>

Abel Upgrade Modification Environmental Assessment

ENVIRONMENTAL ASSESSMENT

Resource Strategies

DONALDSONCOAL
Part of the Yancoal Australia Group

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1 INTRODUCTION

This document is an Environmental Assessment (EA) for the Abel Upgrade Modification (the Modification), which is a modification of Project Approval 05_0136 for upgrades to underground mining operations at the Abel Underground Mine.

Approval for the Modification will be sought under section 75W of the New South Wales (NSW) *Environmental Planning and Assessment Act, 1979* (EP&A Act).

This EA has been prepared to meet the Director-General's Environmental Assessment Requirements (DGRs) issued on 21 February 2012 under section 75W(3) of the EP&A Act (Attachment 1).

1.1 OVERVIEW – ABEL UNDERGROUND MINE

The Abel Underground Mine is an underground coal mining operation located approximately 23 kilometres (km) north-west of the Port of Newcastle, NSW in the Newcastle Coalfield. The Abel Underground Mine area is within the Cessnock, Maitland and Newcastle Local Government Areas (LGAs) (Figure 1).

The Abel Underground Mine is owned and operated by Donaldson Coal Pty Limited (Donaldson Coal), a wholly owned subsidiary of Yancoal Australia Limited.

Project Approval 05_0136 for the Abel Underground Mine was granted on 7 June 2007 by the then NSW Minister for Planning pursuant to section 79J of the EP&A Act. A copy of Project Approval 05_0136 is provided as Attachment 2.

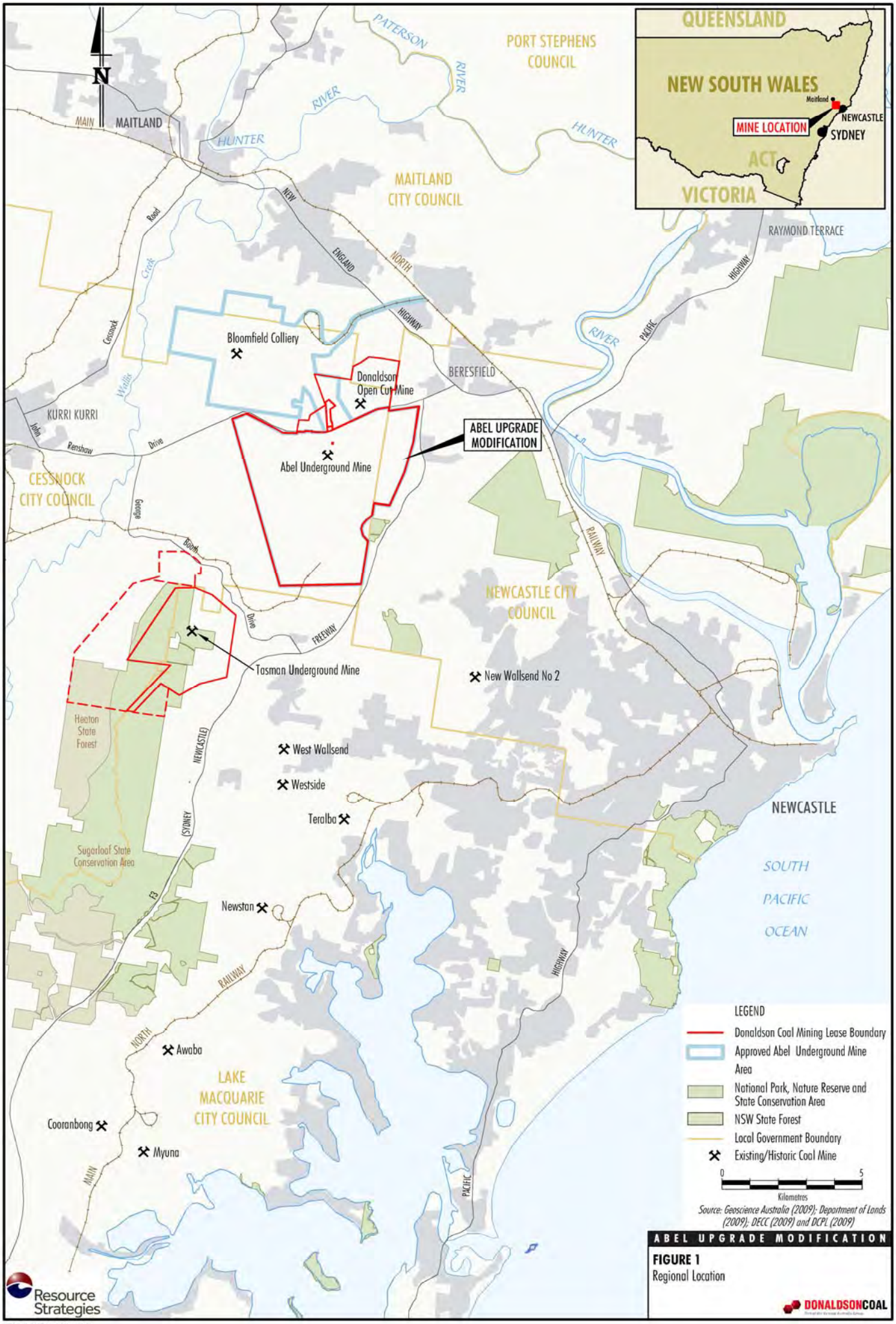
In accordance with Project Approval 05_0136, the Abel Underground Mine is approved to extract up to 4.5 million tonnes per annum (Mtpa) run-of-mine (ROM) coal, over a mine life of approximately 21 years (i.e. until 31 December 2028).

Project Approval 05_0136 also covers the operation of the Bloomfield Coal Handling and Preparation Plant (CHPP), which is approved to process up to 6.5 Mtpa ROM coal from the Abel Underground Mine, Tasman Underground Mine, Bloomfield Colliery and other sources.

The approved operations at the Abel Underground Mine include, but are not limited to:

- Underground mining within Mining Lease (ML) 1618 in the Upper Donaldson Seam and Lower Donaldson Seam, using bord and pillar extraction methods.
- A mine layout developed in accordance with subsidence management commitments.
- Surface infrastructure facilities (e.g. ROM coal stockpiles) within a section of the Donaldson Open Cut Mine void.
- Ventilation shafts required to support underground mining operations.
- Transportation of ROM coal via internal, sealed haul roads to the Bloomfield CHPP.
- The receipt of coal (via internal, sealed haul roads) at the Bloomfield CHPP from various other sources, including the Tasman Underground Mine, Donaldson Open Cut Mine and Bloomfield Colliery.
- Handling, processing and rail loadout of coal at the Bloomfield CHPP and rail loading facility.
- Transportation of product coal to the Port of Newcastle via a privately-owned rail line connecting to the Main North Railway.
- Disposal of fine and coarse reject material from the Bloomfield CHPP at the Bloomfield Colliery.
- An integrated water management system that incorporates aspects of the Abel Underground Mine, Donaldson Open Cut Mine and Bloomfield Colliery water management systems.
- Ongoing surface monitoring, rehabilitation and remediation of subsidence effects.
- Other associated minor infrastructure, plant, equipment and activities.

A general arrangement of the approved mine layout at the Abel Underground Mine is shown on Figure 2. The locations of the Bloomfield CHPP, Tasman Underground Mine, Donaldson Open Cut Mine and Bloomfield Colliery are also shown on Figure 2.



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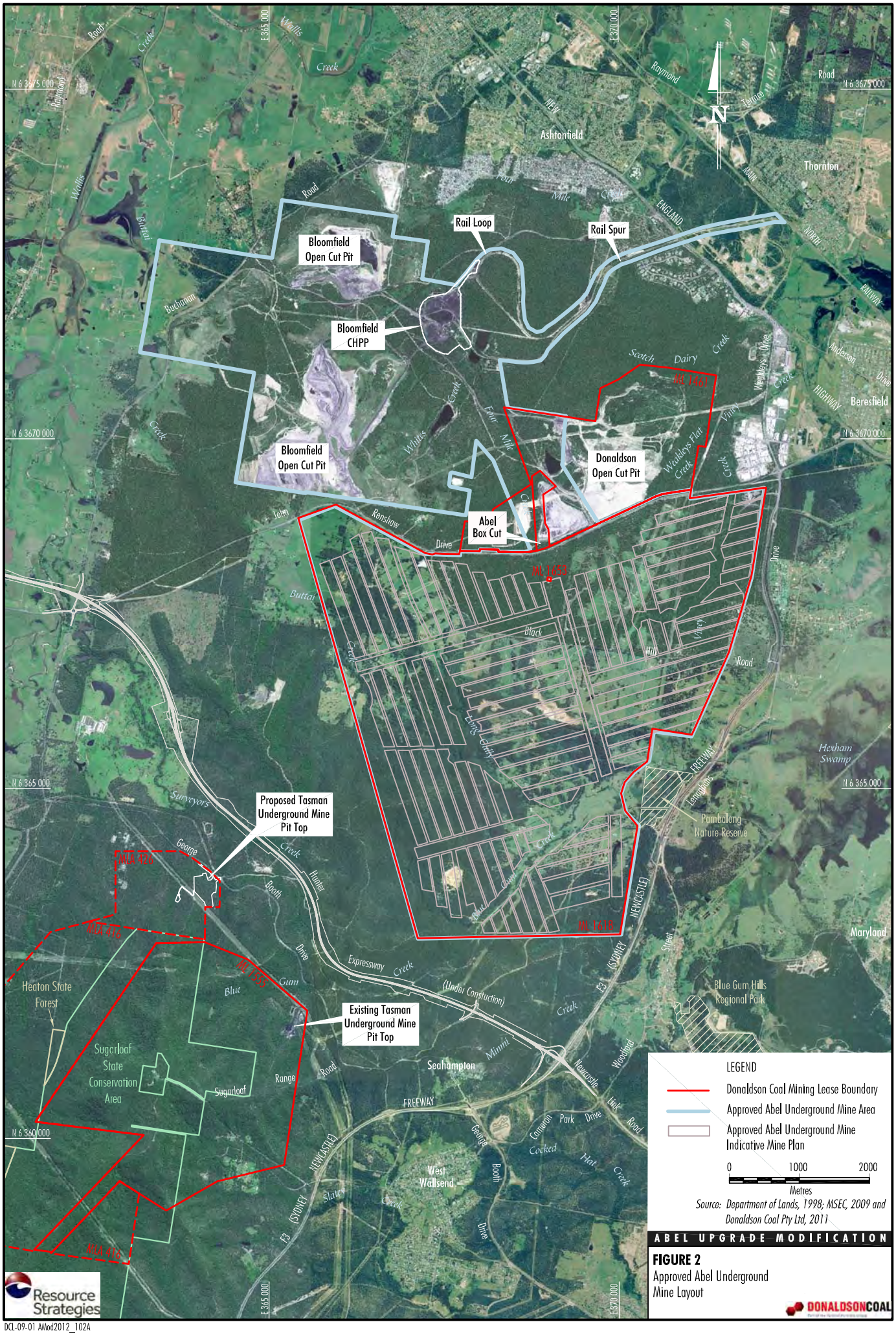

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1.2 OVERVIEW – ABEL UPGRADE MODIFICATION

The proposed Modification to the Abel Underground Mine would involve the continuation of underground mining within the approved area (i.e. ML 1618) and the approved seams (Upper and Lower Donaldson Seams). However, in addition to the approved bord and pillar mining method, it is proposed to also employ a combination of longwall, shortwall and bord and pillar mining. The Modification would also involve an increase in the amount of ROM coal received from the Tasman Underground Mine (per annum and in total) (subject to approval of the Tasman Extension Project [Application Number SSD-4962]).

The key components of the proposed Modification are summarised below:

- The introduction of longwall (i.e. panel widths approximately 230 metres [m]) mining in a section of the Lower Donaldson Seam.
- The introduction of shortwall (i.e. panel widths approximately 120 m) mining in a section of the Upper Donaldson Seam, and a section of the Lower Donaldson Seam.
- The extension of mining, using bord and pillar extraction, in a southern section of the Upper Donaldson Seam that overlies the Lower Donaldson Seam within ML 1618 (referred to as the 'thin seam workings').
- Development of the modified mine layout to meet the existing approved subsidence management commitments.
- An extension of the mine life of approximately two years (i.e. until 31 December 2030).
- Increased annual ROM coal production of up to 6.1 Mtpa.
- An increase in the amount of ROM coal received at the Bloomfield CHPP from the Tasman Underground Mine (per annum and in total).
- Increased internal transport of the ROM coal from the Abel Underground Mine and the Tasman Underground Mine to the Bloomfield CHPP.
- Increased throughput of coal at the Bloomfield CHPP and rail loading facility.
- Modifications and upgrades to the Bloomfield CHPP.
- Increased annual and total quantity of fine and coarse rejects from the Bloomfield CHPP disposed at the Bloomfield Colliery and Donaldson Open Cut void.
- Potential upgrades to the integrated water management system of the Abel Underground Mine, Donaldson Open Cut Mine and Bloomfield Colliery.
- Construction and use of an additional downcast ventilation shaft.
- Development and use of in seam gas drainage infrastructure.
- Other associated minor infrastructure, plant, equipment and activities.

1.3 CONSULTATION FOR THE MODIFICATION

State Government Agencies

Donaldson Coal continues to consult with relevant State Government agencies on a regular basis in relation to the current mining operations in the Newcastle Coalfield and the Abel Underground Mine.

Department of Planning and Infrastructure

Donaldson Coal consults regularly with the NSW Department of Planning and Infrastructure (DP&I) regarding existing operations at the Abel Underground Mine and Donaldson Coal's other operations.

Donaldson Coal has discussed the Modification with the DP&I during the assessment process for the Modification and the preparation of this EA.

A request for DGRs and supporting Project Description and Preliminary Environmental Assessment were lodged with the DP&I in December 2011. DGRs were signed by a delegate of the Director-General of the DP&I on 21 February 2012.

Office of Environment and Heritage and Environment Protection Authority

The NSW Office of Environment and Heritage (OEH) and the NSW Environment Protection Authority (EPA) provided comments and specific input to the Modification DGRs in a letter dated February 2012.

A meeting was held with representatives of the OEH and EPA on 2 February 2012 to provide an overview of the Modification, the proposed subsidence controls and the environmental studies.

A further meeting was held with representatives of the OEH on 11 October 2012 to provide draft results of the specialists studies prepared for the Modification EA.

Briefing material providing draft results of the specialists studies prepared for the Modification EA was also provided to the EPA in October 2012.

Division of Resources and Energy (within Department of Trade, Investment, Regional Infrastructure and Services)

The NSW Division of Resources and Energy (DRE) within the Department of Trade, Investment, Regional Infrastructure and Services provided comments and specific input to the Modification DGRs in a letter dated February 2012.

A briefing on the Modification was provided to representatives of the DRE on 16 August 2012, including information on geology, resource recovery, subsidence management and other environmental areas.

NSW Office of Water

The NSW Office of Water (NOW) provided comments and specific input to the Modification DGRs in a letter dated February 2012.

A meeting was held with representatives of NOW on 15 February 2012 to provide a briefing on the Modification and the progress of the groundwater assessment.

Other State Government Agencies

In addition to the above consultation, information on the Modification has been provided to the following State Government agencies:

- NSW Roads and Maritime Services (RMS);
- NSW Department of Primary Industries (Agriculture and Fisheries);
- NSW Department of Primary Industries, Catchment and Lands (Crown Lands Division);
- Heritage Branch of the OEH;
- NSW Mine Subsidence Board (MSB);
- NSW Health; and
- Hunter-Central Rivers Catchment Management Authority.

NSW Health responded in a letter dated 12 October 2012, and requested that the Modification EA consider potential vibration issues. Potential vibration impacts associated with the Modification are described and assessed in Appendix D.

The RMS also responded in a letter dated 21 November 2012, and requested that all additional construction and operational traffic generated by the Modification be outlined. This information is provided in Appendix G.

Local Government Agencies

The Abel Underground Mine is located within the Cessnock, Maitland and Newcastle LGAs. Donaldson Coal provided a copy of the Modification Description and Preliminary Environmental Assessment to the Cessnock City Council, Maitland City Council and Newcastle City Council in December 2011.

The Newcastle City Council and Maitland City Council provided input to the DGRs in February 2012.

Local Community and Affected Landowners

The Abel Underground Mine Community Consultative Committee (CCC) has been established and operates in accordance with the Project Approval 05_0136. The CCC provides a mechanism for ongoing communication between Donaldson Coal and the local community. Consultation regarding the mining design process and Modification was undertaken in August 2011, October 2011, November 2011, February 2012 and May 2012.

During preparation of this EA, Donaldson Coal produced community information leaflets outlining information on the Modification. These were distributed to the local community in November 2011 and February 2013.

Copies of the community information leaflets are provided in Attachment 4.

Community information sessions were held on the afternoon and evening of 6 December 2011 and the evening of 7 December 2011 to allow members of the local community with an interest in the Modification to have one-on-one discussions with Donaldson Coal representatives and a subsidence specialist. Twenty-seven members of the local community attended the community information sessions.

Additional community information sessions are planned for 26 and 27 February 2013 and notification has been provided through the community information sheets (Attachment 4). The sessions will afford the opportunity for the community to learn about the results of the specialist studies for the EA.

Aboriginal Stakeholders

Comprehensive consultation with Aboriginal stakeholders was conducted in accordance with the *Interim Community Consultation Requirements for Applicants* (NSW Department of Environment and Conservation [DEC], 2004) as part of the Aboriginal Heritage Assessment prepared for the *Abel Underground Mine – Part 3A Environmental Assessment* (Part 3A EA) (Donaldson Coal, 2006). Thirteen Aboriginal organisations registered an interest during this assessment.

As a condition of the Project Approval 05_0136, an Aboriginal Heritage Management Plan (AHMP) (Donaldson Coal, 2007) was prepared and approved by the NSW Department of Planning (DoP) (now the DP&I) in February 2008.

Consultation for the Modification was undertaken consistent with the approved AHMP. The consultation with registered Aboriginal stakeholders identified in the approved AHMP included review of a proposed methodology of work for the Modification, participation in targeted field surveys and review of the draft Aboriginal Cultural Heritage Assessment for the Modification.

Further detail on consultation with Aboriginal stakeholders conducted for the Modification is provided in Appendix F.

Infrastructure Owners

There are a range of developments and infrastructure items within or in the vicinity of ML 1618 that could be potentially affected by mine subsidence from the Abel Underground Mine.

Donaldson Coal has established dialogue with the relevant infrastructure owners and service providers within previous and current mining areas at the Abel Underground Mine.

Separate to the regular meetings held with infrastructure owners as part of the existing operations, Donaldson Coal has consulted with the following to present an overview of the Modification and provide an opportunity to discuss any future potential issues or concerns:

- Daracon (operator of the Stockrington Quarry);
- Woodbury's Haulage and Earthmoving (operator of the Black Hill Quarry);
- Ausgrid;
- TransGrid; and
- Telstra.

Rail and Downstream Coal Operators

Donaldson Coal has consulted with the Australian Rail Track Corporation (ARTC), Hunter Valley Coal Chain Co-ordinator (HVCCC), Newcastle Port Corporation and RailCorp regarding an increase in rail movements dispatched from the Bloomfield rail loop as a result of the Modification.

The ARTC, in correspondence to Donaldson Coal dated 12 July 2012, has indicated sufficient rail capacity would be available to accommodate the peak required rail movements, subject to demonstration of sufficient network exit capability.

It should be noted that Donaldson Coal's existing port allocations are sufficient for the increased rate of coal production associated with the Modification. On this basis, Donaldson Coal would have sufficient network exit capability for the peak rail demand for the Modification.

Donaldson Coal has commenced negotiations with the ARTC to secure the required rail demand for the Modification. One of the triggers for the finalisation of the renewed agreement with the ARTC would be approval of the Modification (if granted).

The Newcastle Port Corporation was also satisfied that there would be no adverse impacts on other coal chain users, as the additional train movements would be subject to contractual arrangements with ARTC and modelling of coal chain capacity by the HVCCC.

Bloomfield Collieries Pty Limited

Donaldson Coal continues to operate in a co-operative manner with the Bloomfield Colliery operations. Donaldson Coal is undertaking ongoing consultation with the Bloomfield Collieries Pty Limited regarding this Modification.

Commercial arrangements exist between Donaldson Coal and Bloomfield Collieries Pty Limited for the handling and processing of ROM coal at the Bloomfield CHPP and loading of trains for transport to customers. These commercial arrangements would be revised as necessary following approval of the Modification.

1.4 STRUCTURE OF THIS DOCUMENT

This EA comprises a main text component and supporting studies. An overview of the main text sections is presented below:

Section 1	Provides an overview of the Abel Underground Mine, the Modification and the consultation undertaken in relation to the Modification.
Section 2	Provides a description of the existing Abel Underground Mine.
Section 3	Provides a description of the Modification.
Section 4	Provides an environmental assessment of the Modification and describes how the existing Donaldson Coal environmental management systems and measures are available to manage and monitor any potential impacts.
Section 5	Describes the general statutory context of the proposed Modification and identifies any Project Approval conditions or site management documents that would require revision in support of the Modification.
Section 6	Provides a summary of management and monitoring measures for the Modification.
Section 7	Provides a summary of the conclusions of the EA.
Section 8	References.

Attachments 1 to 4 and Appendices A to J provide supporting information as follows:

Attachment 1	Director-General's Environmental Assessment Requirements.
Attachment 2	Abel Underground Mine Consolidated Project Approval.
Attachment 3	Existing Subsidence Commitments.
Attachment 4	Community Information Leaflet.
Attachment 5	Peer Review Letter.
Appendix A	Subsidence Assessment.
Appendix B	Groundwater Assessment.
Appendix C	Site Water Balance and Surface Water Impact Assessment Review.
Appendix D	Noise and Vibration Impact Assessment.
Appendix E	Air Quality and Greenhouse Gas Assessment.
Appendix F	Aboriginal Cultural Heritage Report.
Appendix G	Road Transport Review.
Appendix H	Socio-Economic Assessment.
Appendix I	Ecology Review.
Appendix J	Environmental Risk Assessment.

2 EXISTING ABEL UNDERGROUND MINE

The following sub-sections provide a summary of the approved operations at the Abel Underground Mine.

A general arrangement of the approved mine layout at the Abel Underground Mine is shown on Figure 2. The locations of the Bloomfield CHPP, Tasman Underground Mine, Donaldson Open Cut Mine and Bloomfield Colliery are also shown on Figure 2.

2.1 APPROVALS HISTORY

The potential environmental impacts of the existing Abel Underground Mine were assessed in the Part 3A EA.

Project Approval 05_0136 for the Abel Underground Mine was granted on 7 June 2007 by the then NSW Minister for Planning pursuant to section 79J of the EP&A Act. A copy of Project Approval 05_0136 is provided as Attachment 2.

The Abel Underground Mine Project Approval 05_0136 was modified in June 2010 (05_0136 MOD 1) and May 2011 (05_0136 MOD 2) for the construction and installation of a downcast ventilation shaft and an upcast ventilation shaft, respectively.

The Subsidence Management Plan (SMP) for Area 1 of the Abel Underground Mine (Donaldson Coal, 2009) was approved in May 2010. The SMP for Area 2 of the Abel Underground Mine (Donaldson Coal, 2011) was approved in December 2011.

2.2 MINE STAGES AND SEQUENCING

Works Completed

Stage 1 of the construction of the Abel Underground Mine commenced in March 2008, including (Figure 3):

- construction of workshops, offices, bathhouse and car parking facilities which are separated from the operating Donaldson Open Cut Mine;
- excavation of a box cut for the mine entries which occurred as part of the Donaldson Open Cut Mine activities;
- construction of a ROM stackout conveyor with a stockpile capacity of approximately 10,000 tonne (t) capacity located within the box cut;
- development of three underground roadways under John Renshaw Drive off the Donaldson Open Cut highwall; and
- installation of a ventilation fan within the box cut.

Underground mining commenced at the Abel Underground Mine in May 2008 and pillar extraction (i.e. secondary workings) commenced in July 2010.

A downcast ventilation fan was commissioned in 2011. The ventilation fan within the box cut portal was relocated to the new upcast ventilation shaft and installed with an additional ventilation fan in 2012.

Approved Works not Commenced

Donaldson Coal has approval to construct the following additional infrastructure for the Abel Underground Mine (Stage 2 of construction):

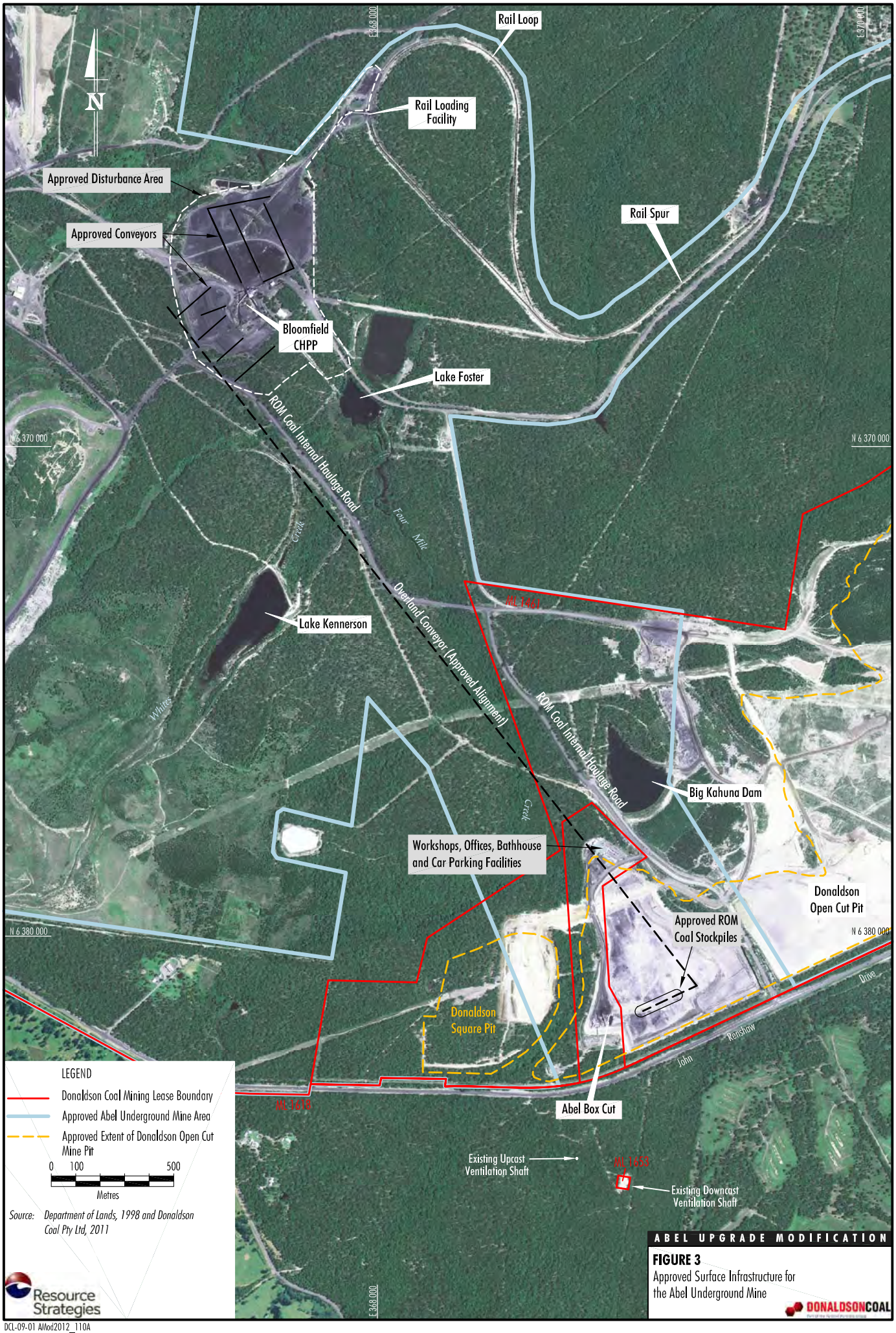
- a higher capacity stackout conveyor and larger ROM coal stockpile in the open cut void; and
- workshops, storage areas, offices, bathhouse and car parking facilities closer to the Abel Underground Mine portals.

The Abel Underground Mine also includes approval to construct and operate an overland conveyor from the ROM coal stockpile to the Bloomfield CHPP to replace truck haulage (Figure 3), as financial circumstances permit.

Additional clearance at the Bloomfield CHPP was also approved to extend the area of ROM and product coal stockpiles, as well as to allow upgrades to ROM coal and product coal conveyor systems (Figure 3).

2.3 MINING METHOD

The approved Abel Underground Mine is a bord and pillar mining operation, with approval to mine within ML 1618 in the Upper Donaldson Seam and Lower Donaldson Seam.



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The underground mining area, within which coal will be extracted, extends southwards from John Renshaw Drive towards George Booth Drive. It is bounded on the eastern side by the F3 Freeway and on the western side by a geological feature in the vicinity of Buttai Creek. Access to the underground reserves is from the Donaldson Open Cut highwall north of John Renshaw Drive.

The Part 3A EA for the Abel Underground Mine included an indicative mine plan that could be modified as part of the SMP process to cater for changing surface and mining conditions that could occur after commencement of mining. The approved indicative mine plan for the Abel Underground Mine is shown on Figure 4.

Bord and pillar mining involves the extraction of coal using first workings from a network of underground roadways (known as panels) followed by the extraction of a portion of the remaining coal (secondary extraction).

The bord and pillar mining method involves the following four stages:

- *Formation of Main Roadways (first workings)* – coal is extracted to create stable and non-subsiding main roadways to provide access to groups of mining panels. Generally this is a four or five heading layout with roadways for ventilation, coal conveyors and access for employees and materials.
- *Formation of Panels (first workings)* – from the main roadways, panels approximately 160 m wide are developed to a logical boundary such as the limit of a conveyor, a geological anomaly, the mine boundary or a depth of cover constraint. Individual panels are separated by a barrier pillar that is left intact.
- *Extraction of Panels (secondary extraction)* – from the panel boundary and retreating back to the main roadways, coal pillars that were formed during panel development are removed, known as 'pillar extraction'. It is during this stage that the level of extraction can be adjusted to manage impacts to surface features. This part of the mining process causes the roof to collapse or 'goaf', which is the mechanism that creates subsidence.
- *Extraction of Main Roadway Pillars (secondary extraction)* – as a group of panels is completed, if the main roadways that serviced them have no long-term use, the coal pillars may be removed.

Secondary extraction from the remaining pillars of coal would be conducted using a combination of partial and total extraction.

Partial extraction involves the removal of coal either in the form of partial removal of the remaining coal pillars or the removal of alternate pillars. Total pillar extraction is an extension of partial extraction where as much coal as can be safely and economically mined is removed from each panel.

Design for Subsidence Outcomes

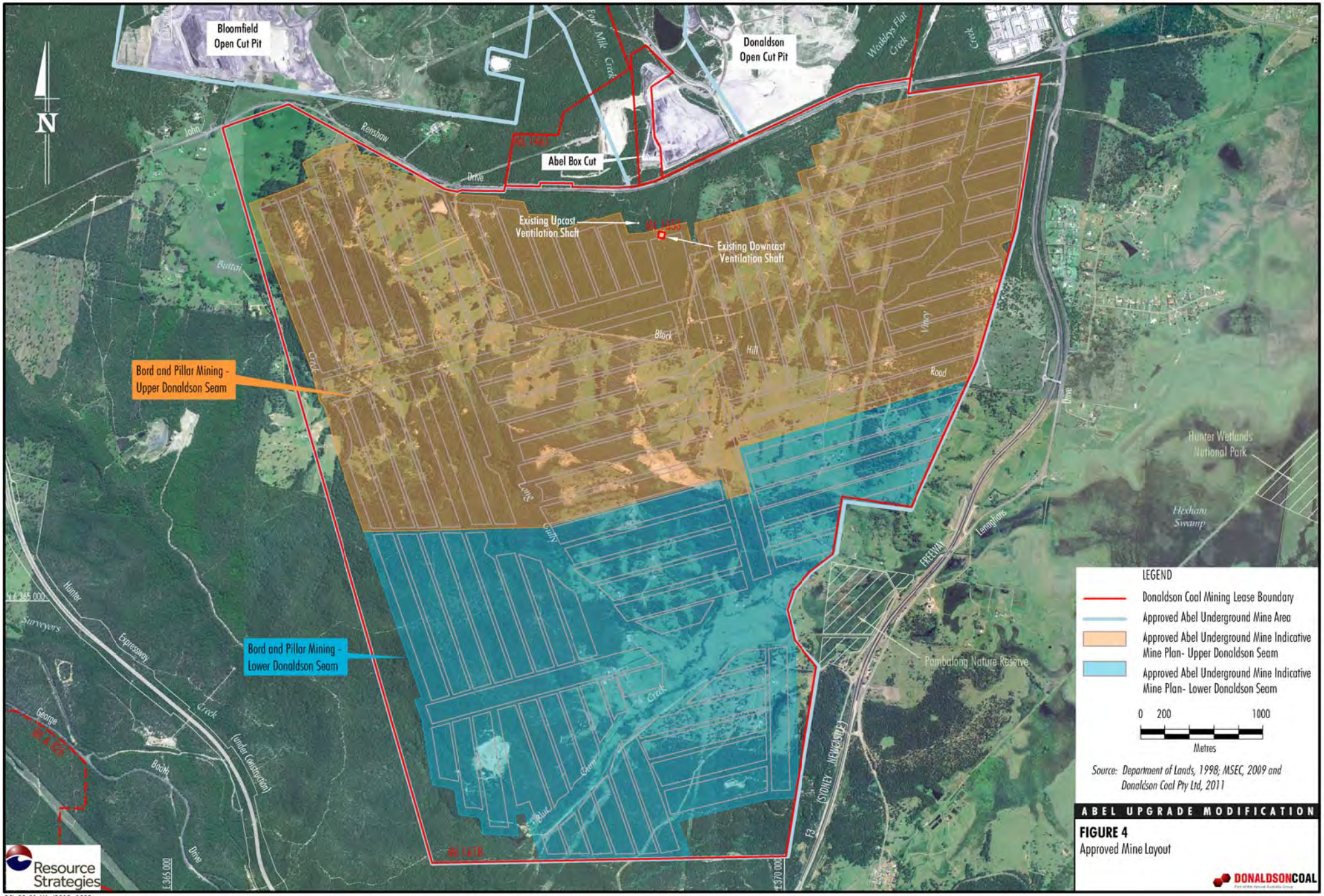
A number of commitments were developed as part of the Part 3A EA. These are included in Donaldson Coal's Statement of Commitments (Appendix 3 of Attachment 2) to protect identified surface features from subsidence impacts, or reduce it to specified manageable levels.

Project Approval 05_0136 (Attachment 2) strengthened these subsidence commitments by including 'subsidence impact limits', specifically:

- The Abel Underground Mine does not result in any subsidence impacts on:
  - Pambalong Nature Reserve; and
  - the surface of the F3 Freeway.
- Mining is limited to first workings beneath, and designed to ensure that mining causes no subsidence impacts requiring mitigation works on:
  - principal residences and other specified structures (without the approval of the relevant landowner);
  - Black Hill Public School;
  - Black Hill Church and cemetery;
  - Schedule 2 streams (i.e. 3rd order and above streams);
  - rainforest areas; and
  - Blue Gum Creek alluvium.
- Not more than 60 percent (%) of coal seam is to be extracted from beneath identified cliff areas.

Prior to the commencement of mining in particular areas, detailed SMPs are prepared to demonstrate that mining achieves the subsidence outcomes listed above.

Donaldson Coal's Statement of Commitments for the Abel Underground Mine (Appendix 3 of Attachment 2) also details additional subsidence commitments for identified surface features, including stakeholder consultation, the preparation of management plans and studies, ongoing monitoring and rehabilitation.



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2.4 MINING EQUIPMENT

Mining equipment at the Abel Underground Mine includes:

- continuous miners fitted with drill rigs to construct underground roadways;
- continuous miners without drill rigs used for secondary extraction of coal pillars;
- shuttle cars to transport coal to the feeder breaker;
- feeder breakers to size coal discharged from the shuttle cars to 150 millimetres (mm) and feed coal onto the underground conveying system; and
- underground conveying system that feeds coal onto the surface stackout conveyor.

There are currently four continuous miners for development and two continuous miners for secondary extraction at the Abel Underground Mine.

The Abel Underground Mine is also approved to use mobile chain haulage systems as an alternative to shuttle cars and feeder breakers.

The mining method requires the following supporting equipment and infrastructure:

- surface stackout conveyor and stockpile;
- power, water and compressed air distribution systems; and
- diesel equipment (e.g. transporters for people and material).

2.5 SURFACE FACILITIES AND ROM COAL TRANSPORT

The Abel Underground Mine workings are accessed via the mine portals located in the Donaldson Open Cut highwall.

Once ROM coal has been brought to the surface through the mine portals, it is conveyed to the ROM coal stockpile. This stockpile is currently located in the Abel Box Cut, adjacent to the mine portals, but may be later relocated to a larger section of the Donaldson Open Cut void (Section 2.2).

ROM coal is transported by trucks on an internal, sealed haul road approximately 4 km from the ROM coal stockpile to the Bloomfield CHPP. Coal can also be transported by overland conveyor from the ROM coal stockpile to the Bloomfield CHPP should financial circumstances permit. This would replace truck haulage.

At the Bloomfield CHPP, ROM coal is either directly loaded to the feed system, or stored on another ROM coal stockpile prior to being processed.

Other surface facilities include workshops, offices, bathhouse and carparks (Section 2.2).

To the south of John Renshaw Drive, existing surface infrastructure consists of existing upcast and downcast ventilation shafts and associated fans (Section 2.2), and other minor items, such as groundwater monitoring bores. Small scale methane drainage equipment may also be required (for mine safety purposes) for the approved mine plan.

The locations of existing and approved surface infrastructure are shown on Figure 3.

2.6 COAL PROCESSING AND PRODUCT COAL TRANSPORT

The Bloomfield CHPP and rail loading facility is approved to process coal from the Abel Underground Mine, Donaldson Open Cut Mine, Tasman Underground Mine, Bloomfield Colliery and other sources.

The Abel Underground Mine Project Approval 05_0136 approved an increase in the processing limit of the Bloomfield CHPP to 6.5 Mtpa of ROM coal and an increase in the output to 5 Mtpa of product coal. A number of modifications to the Bloomfield CHPP were approved under Project Approval 05_0136, including the expansion of coal stockpile areas and upgrades to ROM coal and product coal conveyor systems.

Following processing at the Bloomfield CHPP, coal is stored in various stockpiles according to its type (e.g. thermal or coking coal). Coal is then transported to the rail loading bin, where it is loaded to waiting trains using the Bloomfield rail loop.

The Bloomfield rail loop and private rail spur connect to the Main North Railway (Figure 2). At maximum production, the Part 3A EA estimated an average of three to six trains per day would use the Bloomfield rail loop and spur.

2.7 COARSE REJECT AND TAILINGS MANAGEMENT

During the coal washing process, waste coal material is produced in solid and more liquid (slurry) form. The solid material is termed ‘coarse reject’. The slurry material, a mixture of fine waste and water, is termed ‘tailings’. The percentage of coarse rejects and fine tailings varies depending on the source of the coal and the mining method.

Coarse rejects from the Bloomfield CHPP are mixed with overburden material and disposed of at the overburden emplacement dumps at the Bloomfield Colliery. This process assists in filling voids in preparation for surface rehabilitation.

Disposal of tailings from the Bloomfield CHPP is approved in the following areas of the Bloomfield Colliery:

- former underground workings at the Bloomfield Colliery (Big Ben Seam workings) (used for tailings disposal during the period 2003 to 2007);
- U Cut North tailings dam (a former open cut pit in the north of the Bloomfield Colliery site) (currently used for tailings disposal);
- U Cut South void;
- S Cut North void (Creek Cut void); and
- S Cut South void.

Reject fines settle out of the tailings slurry, gradually filling the void, while the decant water is returned to the Bloomfield CHPP for re-use in processing.

2.8 WATER MANAGEMENT

On-site water management is conducted in accordance with the following principles:

- separation of clean and dirty water;
- minimisation of demand for fresh water supply by recycling water collected on the site;
- storage of recycled water on-site to reduce water consumption during operation of the proposed development;
- management and control of stormwater flows;
- minimisation of sediment generation, soil erosion and transport off-site; and
- discharge from licensed discharged points in accordance with licence conditions.

In accordance with the Project Approval 05_0136, an integrated water management system exists between the Abel Underground Mine, Donaldson Open Cut Mine and Bloomfield Colliery.

Excess water from the Abel Underground Mine is directed to the Donaldson Open Cut Mine main water storage dam (Big Kahuna). Surface runoff and groundwater seepage reporting to the Donaldson Open Cut Mine pit is also directed to the Big Kahuna.

Water stored in the Big Kahuna is used for dust suppression.

Water supply for underground operating purposes is also sourced from the Hunter Water Corporation.

Excess water in the Big Kahuna is transferred to Lake Foster, which is a supply point for water for the Bloomfield CHPP. Alternative water supply for the Bloomfield CHPP is sourced from groundwater sources within the Bloomfield Colliery mining area (Consolidated Coal Lease [CCL] 761).

Donaldson Coal's Environment Protection Licence (EPL) No. 11080 includes licensed discharge to Four Mile Creek from the Big Kahuna. The Bloomfield Colliery EPL No. 396 includes licensed discharge to Four Mile Creek downstream of Lake Foster.

2.9 WORKFORCE AND HOURS OF OPERATION

The existing mining operations at the Abel Underground Mine have an operational workforce of approximately 275 personnel (fulltime equivalent, excluding service providers and general management). At full production, the Abel Underground Mine is approved to employ up to approximately 375 people.

In addition, approximately 28 personnel are currently employed at the Bloomfield CHPP by Bloomfield Collieries Pty Limited.

The Abel Underground Mine, the Bloomfield CHPP and the rail loading facility are approved to operate 24 hours per day, seven days per week.

The current shift arrangements at the Abel Underground Mine have start and finishing times generally as follows:

- day shift – 6.30 am to 4.30 pm;
- afternoon shift – 2.30 pm to 10.30 pm; and
- night shift – 9.30 pm to 7.30 am.

2.10 WASTE MANAGEMENT

The key waste streams from the Abel Underground Mine comprise:

- coarse reject and tailings (Section 2.7);
- sewage and effluent;
- recyclable and non-recyclable general wastes; and

- other wastes from mining and workshop activities (e.g. waste oils, scrap metal, broken or superseded equipment and used tyres).

Donaldson Coal applies general waste minimisation principles (i.e. reduce, re-use and recycle where practicable) to minimise the quantity of wastes that require off-site disposal. No on-site rubbish disposal or landfill is undertaken.

All recyclable and non-recyclable general domestic waste (i.e. putrescible or non-putrescible General Solid Waste[1]) is stored temporarily on-site prior to collection on a regular basis by a licensed waste contractor.

Other waste types likely to be produced over the life of the approved Abel Underground Mine include those listed in Table 1.

Where licensed contractors handle waste, those contractors are required to comply with their own EPA licence agreements.

2.11 INTERACTION WITH EXISTING MINING OPERATIONS

2.11.1 Bloomfield Coal Handling and Preparation Plant

Project Approval 05_0136 for the Abel Underground Mine covers the operation of the Bloomfield CHPP (Figure 2), which is approved to process up to 6.5 Mtpa ROM coal from the Abel Underground Mine, Tasman Underground Mine, Bloomfield Colliery and other sources.

2.11.2 Bloomfield Colliery

The Bloomfield Colliery, located immediately to the north-west of ML 1618 within CCL 761, is owned and operated by Bloomfield Collieries Pty Limited. In accordance with its Project Approval (07_0087), the Bloomfield Colliery is approved to produce up to 1.3 Mtpa until 31 December 2021.

ROM coal from the Bloomfield Colliery is transported to the Bloomfield CHPP for processing and rail loadout.

All fine and coarse rejects from the Bloomfield CHPP are transported back to the Bloomfield Colliery for disposal in former underground workings and open cut voids in accordance with Abel Underground Mine Project Approval 05_0136. In addition, elements of the Bloomfield Colliery water management system are integrated with the Abel Underground Mine water management system (Section 2.8).

Rehabilitation of disposal locations is undertaken in accordance with the Bloomfield Mine Operations Plan, which is required as a condition of the Bloomfield mining lease.

2.11.3 Tasman Underground Mine

The Tasman Underground Mine, located to the south-west of the Abel Underground Mine (Figure 1), was approved in 2004 (DA 274-9-2002) to produce a maximum of 975,000 t per annum ROM coal. ROM coal from the Tasman Underground Mine is transported via public roads to the Abel Underground Mine, where it is transported via internal roads to the Bloomfield CHPP for processing and rail loadout.

Donaldson Coal is currently seeking approval for the Tasman Extension Project (Application No. SSD-4962), which would increase ROM coal production at the Tasman Underground Mine to up to 1.5 Mtpa.

2.11.4 Donaldson Open Cut Mine

The Donaldson Open Cut Mine operates in accordance with Development Consent DA 98/01173 and 118/698/22 (File No. N97/00147), and is approved to operate until 31 December 2013.

The Donaldson Open Cut Mine is located immediately to the north of ML 1618 within ML 1461 (Figure 2), and is owned and operated by Donaldson Coal. Aspects of the Abel Underground Mine that are located within ML 1461 (e.g. surface infrastructure facilities and part of the internal haul road) are operated and approved in accordance with the Abel Underground Mine Project Approval 05_0136.

In addition, elements of the Donaldson Open Cut Mine water management system are integrated with the Abel Underground Mine water management system (Section 2.8).

[1] Described or pre-classified waste in *Waste Classification Guidelines Part 1: Classifying Waste* (NSW Department of Environment, Climate Change and Water [DECCW], 2009a).

Table 1
Other Wastes Likely to be Generated by the Abel Underground Mine

Example of Waste	Indicative Waste Type[1]	Management Method
Tyres	Special	Temporary storage on-site prior to removal from site by appropriately licensed contractor
Used oils/hydrocarbons	Liquid	
Explosives, lead acid batteries, containers that have not been cleaned and have contained dangerous goods	Hazardous	
Building and demolition wastes	General Solid Waste (non-putrescible)	
Glass, plastic, rubber, plasterboard, ceramics, bricks, metal, paper, cardboard, etc.		
Workshop wastes (i.e. drained oil filters and rags and oil-absorbent materials that only contain non-volatile petroleum hydrocarbons and do not contain free liquids)		

[1] Indicative only – described or pre-classified wastes in *Waste Classification Guidelines Part 1: Classifying Waste* (DECCW, 2009a).

2.12 DECOMMISSIONING AND REHABILITATION

Rehabilitation and the proposed site decommissioning are described in the approved Rehabilitation Management Plan under the *Donaldson Open Cut and Abel Underground Coal Mines Landscape Management Plan*.

Rehabilitation and decommissioning of the Abel Underground Mine would include the following domains:

- Abel Box Cut final void and surface facilities, including:
  - the Abel Box Cut void;
  - surface infrastructure, stockpiles and portals;
  - overland conveyor; and
  - Tasman Underground Mine haulage and workforce entrance road.
- Mine subsidence areas.
- Ventilation shafts.
- Bloomfield Colliery (aspects under Project Approval 05_0136).

Decommissioning of the Abel Underground Mine will require the sealing of the mine portals and the removal of surface infrastructure, including workshops, offices, bathhouse, car parking facilities, ROM coal stockpile infrastructure, conveyors and water management structures. Some roads and water management structures may remain if required for future land uses, as determined by planning processes developed closer to the time of closure.

The ground surface will then be reshaped to form a stable surface with embankments at a maximum of 10 degrees (°). Surface water management structures such as contour banks, drains and settlement ponds required to provide permanent, long-term stable water flow and storage will be constructed. Open areas will be rock raked and ripped, in particular where roads and hardstand areas have compacted the existing ground. Soil will then be spread over the site and seeded with tree seed including a cover crop to minimise soil erosion.

Rehabilitation at the upcast and downcast ventilation shaft sites at the end of the mine life will involve the removal of infrastructure, sealing of the shafts and rehabilitation of the disturbed areas (i.e. re-profiling, topsoiling and revegetation).

Remediation of subsidence impacts is undertaken in accordance with the Trigger Action Response Plans (TARPs) outlined in the SMPs prepared for the underground mining areas.

Rehabilitation methods for natural features may include actions such as grouting surface cracks in watercourses, dam walls, roads or general areas including grazing paddocks. This will require topsoil to be stripped, the surface re-graded, the filling of cracks with a self cementing material such as sand, cement or bentonite grout, prior to the surface being re-graded, compacted and topsoil replaced.

Dewatered tailings disposal areas are covered with soil, shaped and seeded for tree cover in accordance with the Bloomfield Colliery Landscape Management Plan and Rehabilitation Management Plan.

2.13 ENVIRONMENTAL MANAGEMENT AND MONITORING

Environmental management plans and monitoring programs have been developed and are implemented for the Abel Underground Mine in accordance with Project Approval 05_0136, including:

- SMPs.
- Environmental Management Strategy.
- Environmental Monitoring Program.
- Water Management Plan, including:
  - Site Water Balance;
  - Erosion and Sediment Control Plan;
  - Surface Water Monitoring Program;
  - Groundwater Monitoring Program; and
  - Disposal of Tailings and Coarse Rejects.
- Landscape Management Plan, including:
  - Rehabilitation Management Plan;
  - Final Void Management Plan; and
  - Mine Closure Plan.
- AHMP.
- Noise Monitoring Program.
- Air Quality Monitoring Program.
- Energy Savings Action Plan.

Copies of the current management plans and monitoring programs are available on the Donaldson Coal website (http://www.doncoal.com.au).

2.14 COMMUNITY CONTRIBUTIONS

Donaldson Coal plays an active role in local communities through financial contributions to facilities, including the Donaldson Job Creation Trust, the Donaldson Community Welfare Trust and the Donaldson Conservation Trust. Donaldson Coal would continue to provide funding contributions to community programs and groups during the life of the Abel Underground Mine.

Donaldson Job Creation Trust

The Donaldson Job Creation Trust was established to assist the local community achieve its goals by providing training opportunities and experience. Since 2001, the Donaldson Job Creation Trust has allocated $1 million (M) to job training and education.

Donaldson Community Welfare Trust

The Donaldson Community Welfare Trust is a charitable trust which contributes approximately $250,000 over 5 years towards supporting the local community within the Abel and Tasman Underground Mine areas. The objective of the trust is to promote the education needs, community works or other activities of benefit to the local community, such as the “News in Education” program.

The Donaldson Coal Community Welfare Trust allocates funding every six months, with a minimum of $10,000 dedicated to educational projects linked to Black Hill Public School each round. An additional $15,000 is made available for other projects of benefit to the community within the Abel and Tasman Underground Mine areas. In addition to funding for the Black Hill Public School, the Donaldson Coal Community Welfare Trust has recently provided $12,000 in funding for the restoration of the historical cemetery at Black Hill and $30,000 for the Benwerrin Rural Fire Brigade Station.

Donaldson Conservation Trust

The Donaldson Conservation Trust has allocated $1M over 10 years to local environmental conservation.

The Donaldson Conservation Trust has been set up specifically to fund environmental education, research, environmental management works or activities within State Conservation Area lands or other environmentally valuable lands that lie within or above Donaldson Coal’s mining leases, exploration licences or other land owned by the company.

2.15 COMPLAINTS AND COMPLIANCE

An Independent Environmental Audit was conducted for the Abel Underground Mine in November 2011 (Trevor Brown & Associates, 2011) in accordance with the requirements of Project Approval 05_0136.

The Independent Environmental Audit of the Project Approval conditions for the Abel Underground Mine confirmed a high degree of compliance and did not identify any non-compliance with Project Approval 05_0136 or Statement of Commitments for the activities undertaken during the 2008 to 2011 period (Trevor Brown & Associates, 2011). As discussed in Section 2.2, construction activities and underground mining at the Abel Underground Mine commenced in 2008.

There has been only one complaint in relation to the Abel Underground Mine, which related to night lighting in 2008. Lighting equipment was subsequently modified to direct light away from sensitive receptors.

3 ABEL UPGRADE MODIFICATION

3.1 MODIFICATION OVERVIEW

In addition to approved bord and pillar mining, the Modification would involve a combination of longwall, shortwall and bord and pillar mining within the approved mining area (ML 1618) and approved seams (Upper Donaldson and Lower Donaldson Seams). The thin seam workings would involve additional mining, using bord and pillar extraction, in a southern section of the Upper Donaldson Seam that overlies the Lower Donaldson Seam within ML 1618.

An additional downcast ventilation shaft would be required to support the longwall mining in the Lower Donaldson Seam.

There would be no change to the existing subsidence management commitments (Section 2.3) for the Modification. As such, changes to the approved mine plan (e.g. the introduction of longwall/shortwall mining) would only occur where it can be demonstrated that the existing subsidence management commitments can be achieved.

The changes to the method of mining would increase the efficiency of coal recovery within the existing approved mining area. This would result in an increase in the amount of ROM coal required to be transported to, and processed at, the Bloomfield CHPP and rail loading facility.

ROM coal from the Abel Underground Mine would continue to be transported to the Bloomfield CHPP via haul trucks on internal sealed roads. Alternatively, the approved overland conveyor (Section 2.5) would be constructed and used to transport ROM coal, should financial circumstances permit.

Modifications and upgrades to the Bloomfield CHPP would be necessary to accommodate the peak increase in processing requirements associated with the Modification and the Tasman Extension Project.

Table 2 provides a comparative summary of the currently approved Abel Underground Mine and the proposed modified Abel Underground Mine (as a result of the Modification).

Figure 5 presents the additional surface infrastructure proposed as part of the Modification. Figures 6 to 8 present the modified mining layout and additional downcast ventilation shaft proposed as part of the Modification.

3.2 CONSTRUCTION AND DEVELOPMENT ACTIVITIES

The Modification would involve upgrades to underground mining equipment, construction of additional ventilation infrastructure and augmentation of materials handling and the Bloomfield CHPP infrastructure.

The construction and development activities proposed as part of the Modification are described in the sub-sections below.

3.2.1 Underground Mining Equipment

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

Longwall and shortwall machines and associated equipment (e.g. coal shearers, hydraulic supports and conveyors) would be transported underground in pieces for assembly underground.

3.2.2 Ventilation Infrastructure

An additional downcast ventilation shaft (Figure 6) and ancillary infrastructure would be constructed as a component of the Modification to ensure adequate ventilation of the underground workings.

Construction of the downcast ventilation shaft would likely occur in 2016 or 2017.

Construction of the new downcast ventilation shaft site would involve:

- grading and levelling of existing bush tracks;
- development of a 5.5 m diameter, 250 m deep, concrete or steel lined shaft;
- installation of appropriate security (i.e. fencing) to prevent unauthorised access to the shaft site; and
- other associated activities.

Access to the site would be via existing fire trails.

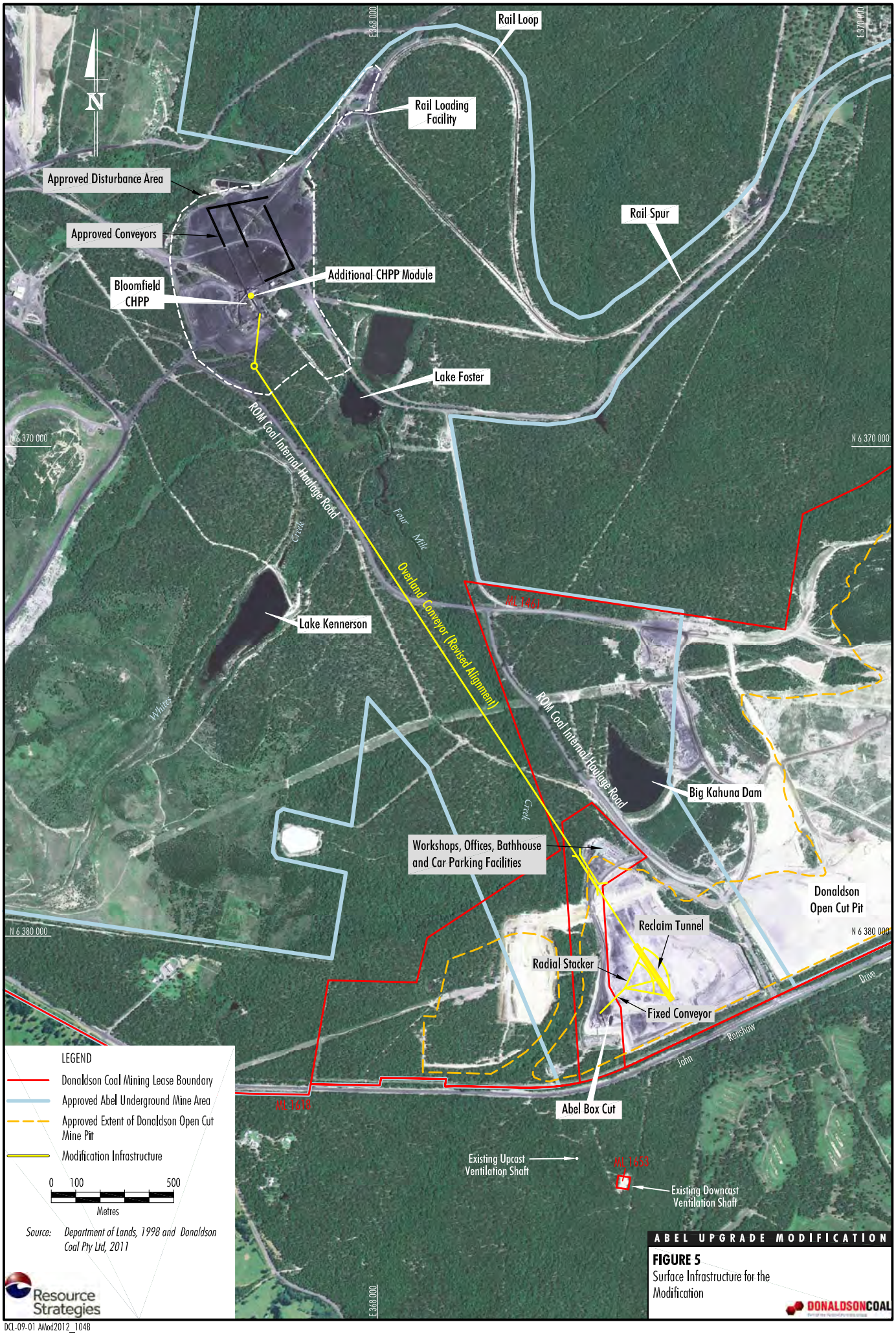
Table 2
Overview of the Approved Abel Underground Mine and the Abel Upgrade Modification

Development Component	Approved Abel Underground Mine	Modified Abel Underground Mine
Mining area	Mining within ML 1618.	No change.
Coal seams mined	Upper Donaldson Seam and Lower Donaldson Seam.	No change. Additional mining, using bord and pillar methods, in a southern section of the Upper Donaldson Seam that overlies the Lower Donaldson Seam within ML 1618 (i.e. the thin seam workings).
Mining method	Bord and pillar mining, including first workings (formation of main roadways and mining panels) and secondary workings (extraction of mining panel pillars and main roadway pillars, with void width of up to 160 m).	Introduction of longwall mining (nominally 230 m wide void) and shortwall mining (nominally 120 m wide void) in some areas within ML 1618. Continuation of bord and pillar mining in all other areas.
Subsidence commitments and management	Mining limited to first workings beneath, and designed to ensure that mining causes no subsidence impacts requiring mitigation works on: • principal residences and other specified structures (without the approval of the relevant landowner); • Black Hill Public School; • Black Hill Church and cemetery; • Schedule 2 streams (i.e. 3rd order and above streams); • Blue Gum Creek alluvium; and • rainforest areas. Not more than 60% of coal seam is extracted beneath identified cliff areas. Monitoring and management strategies for dams and other surface structures (e.g. quarries).	No change.
Mine life	Mining operations approved until 31 December 2028.	Mining operations approved until 31 December 2030.
Total ROM coal	Total ROM coal production of up to approximately 55 million tonnes (Mt) over the life of the mine.	Total ROM coal production of up to approximately 65 Mt over the life of the mine.
Annual ROM coal production	ROM coal production of up to approximately 4.5 Mtpa.	ROM coal production of up to approximately 6.1 Mtpa.
Surface infrastructure area and mine entry	Surface facilities (e.g. conveyor and ROM coal stockpile) located within a section of the Donaldson Open Cut Mine void. Construction and use of an overland conveyor should financial circumstances permit.	No change. No change.
ROM coal haulage	ROM coal transported to the Bloomfield CHPP via a 4 km sealed, internal haul road.	Increased haulage movements, or the use of the approved overland conveyor, should financial circumstances permit.
Bloomfield CHPP	ROM coal from the Abel Underground Mine, Donaldson Open Cut Mine, Tasman Underground Mine, Bloomfield Colliery and other sources processed at the Bloomfield CHPP. Processing of up to 6.5 Mtpa ROM coal.	No change. Increased processing of up to approximately 8.5 Mtpa ROM coal. Modifications and upgrades to the Bloomfield CHPP to accommodate increased processing requirements.

Table 2 (Continued)
Overview of the Approved Abel Underground Mine and the Abel Upgrade Modification

Development Component	Approved Abel Underground Mine	Modified Abel Underground Mine
Product coal transportation	Transportation of product coal from the Bloomfield CHPP to the Port of Newcastle via a private rail loop and spur which connects to the Main North Railway. Up to 5 Mtpa product coal transported from the site via the private rail loop and spur.	No change. Up to 6.5 Mtpa product coal transported from the site via the private rail loop and spur.
Management of rejects from the Bloomfield CHPP	Coarse reject material co-disposed at the Bloomfield Colliery. Tailings disposed in former underground workings and voids located at the Bloomfield Colliery.	No change. No change. Additional storage location for tailings in the Donaldson Square Pit, and alterations to existing storage at the Bloomfield Colliery if required. Increased coarse rejects and storage associated with increased coal processing at the Bloomfield CHPP.
Water management	On-site water management conducted in accordance with the following principles: • separation of clean and dirty water; • minimisation of demand for fresh water supply by recycling water collected on the site; • storage of recycled water on-site to reduce water consumption during operation of the proposed development; • management and control of stormwater flows; • minimisation of sediment generation, soil erosion and transport off-site; and • discharge from licensed discharged points in accordance with licence conditions.	No change to water management principles. Augmentation to water storages, including use of the Donaldson Square Pit and installation and use of water treatment facilities (including Reverse Osmosis [RO]), if required.
Mine ventilation and gas drainage	The Abel Underground Mine uses both an upcast and a downcast ventilation shaft. In-seam gas drainage and small scale methane drainage equipment at the surface if required.	Construction and use of an additional downcast ventilation shaft above the main headings in the Lower Donaldson Seam. No change.
Hours of operation	Abel Underground Mine, Bloomfield CHPP and the rail loading facility operate 24 hours per day, 7 days per week.	No change.
Operational workforce	Up to approximately 375 employees at the Abel Underground Mine operations at peak production. Approximately 28 employees at the Bloomfield CHPP.	Approximately 25 additional operational employees for the Abel Underground Mine operations at peak production (i.e. total of 400). Approximately 23 additional employees at the Bloomfield CHPP at peak production (i.e. total of 51).
Rail movements	An average of three to six rail movements* per day.	A peak of 12 rail movements* per day.

* Rail movements include the arrivals and dispatches of trains (i.e. one dispatch is equivalent to two rail movements).



ABEL UPGRADE MODIFICATION

FIGURE 5
Surface Infrastructure for the Modification

DONALDSONCOAL

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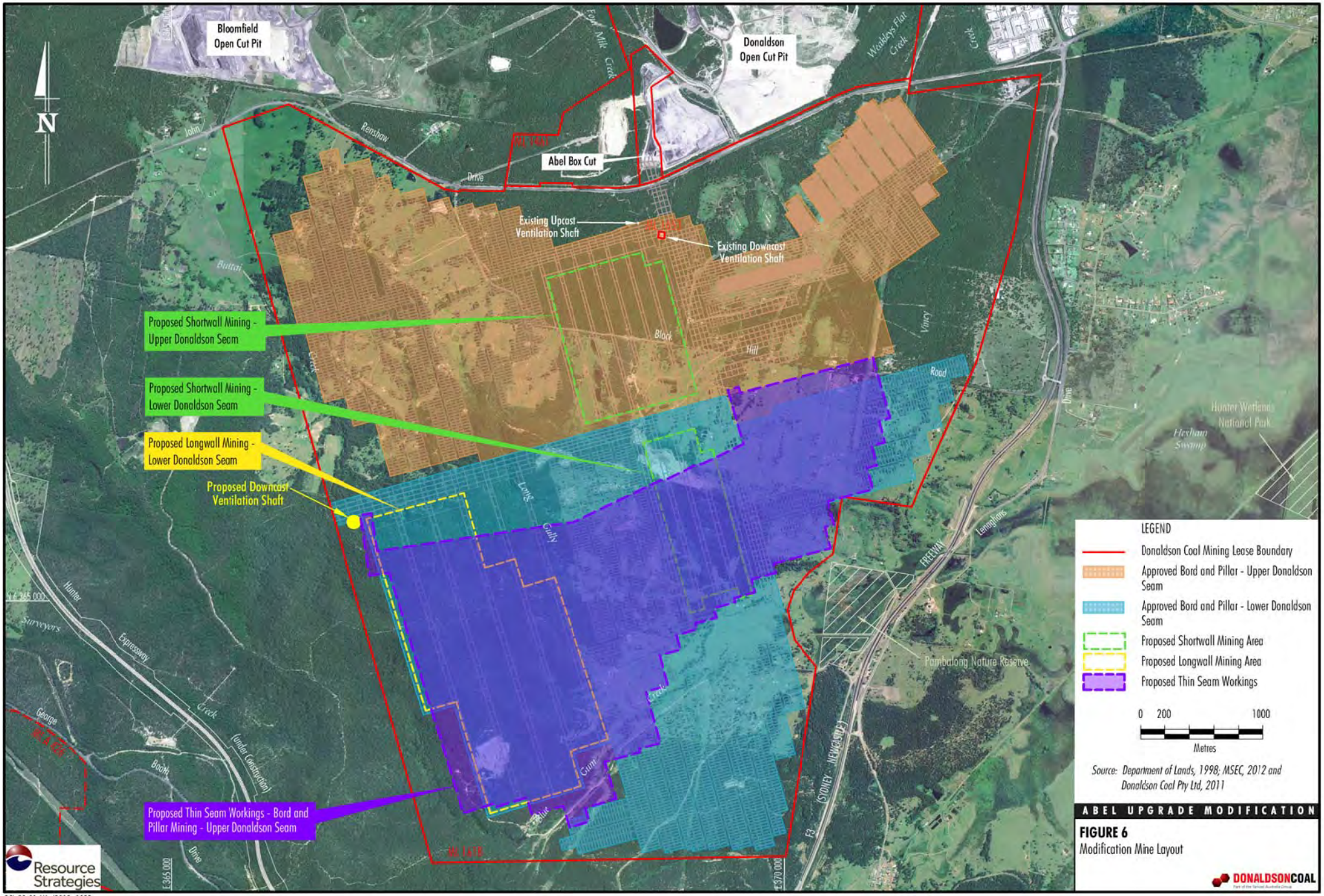
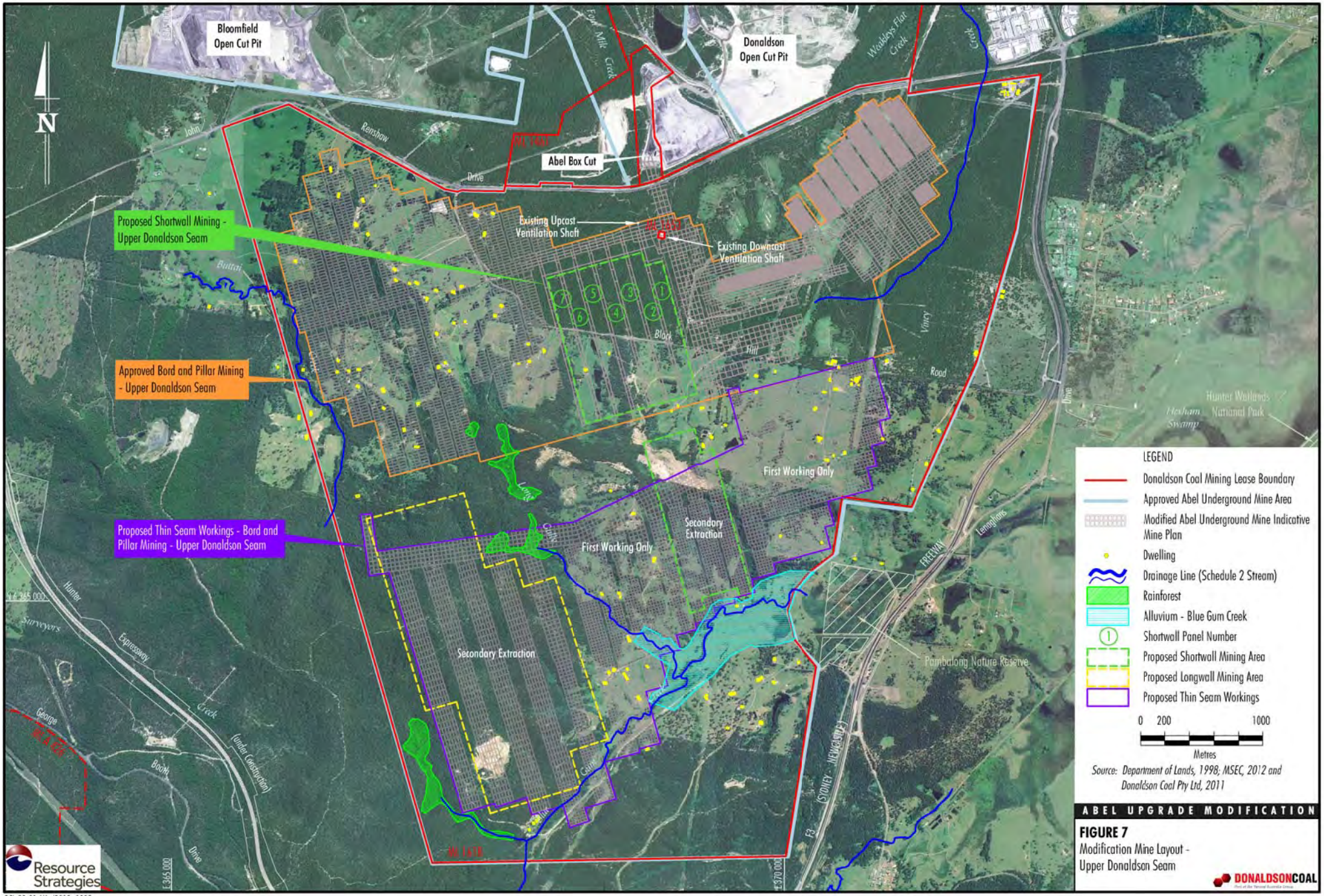

Bloomfield Open Cut Pit
Donaldson Open Cut Pit
Abel Box Cut
Existing Upcast Ventilation Shaft
Existing Downcast Ventilation Shaft
Proposed Shortwall Mining - Upper Donaldson Seam
Proposed Shortwall Mining - Lower Donaldson Seam
Proposed Longwall Mining - Lower Donaldson Seam
Proposed Downcast Ventilation Shaft
Proposed Thin Seam Workings - Bord and Pillar Mining - Upper Donaldson Seam
N
Resource Strategies
LEGEND
Donaldson Coal Mining Lease Boundary
Approved Bord and Pillar - Upper Donaldson Seam
Approved Bord and Pillar - Lower Donaldson Seam
Proposed Shortwall Mining Area
Proposed Longwall Mining Area
Proposed Thin Seam Workings
0 200 1000
Metres
Source: Department of Lands, 1998; MSEC, 2012 and Donaldson Coal Pty Ltd, 2011
ABEL UPGRADE MODIFICATION
FIGURE 6
Modification Mine Layout
DONALDSONCOAL
DCL-09-01 AMod2012_103E



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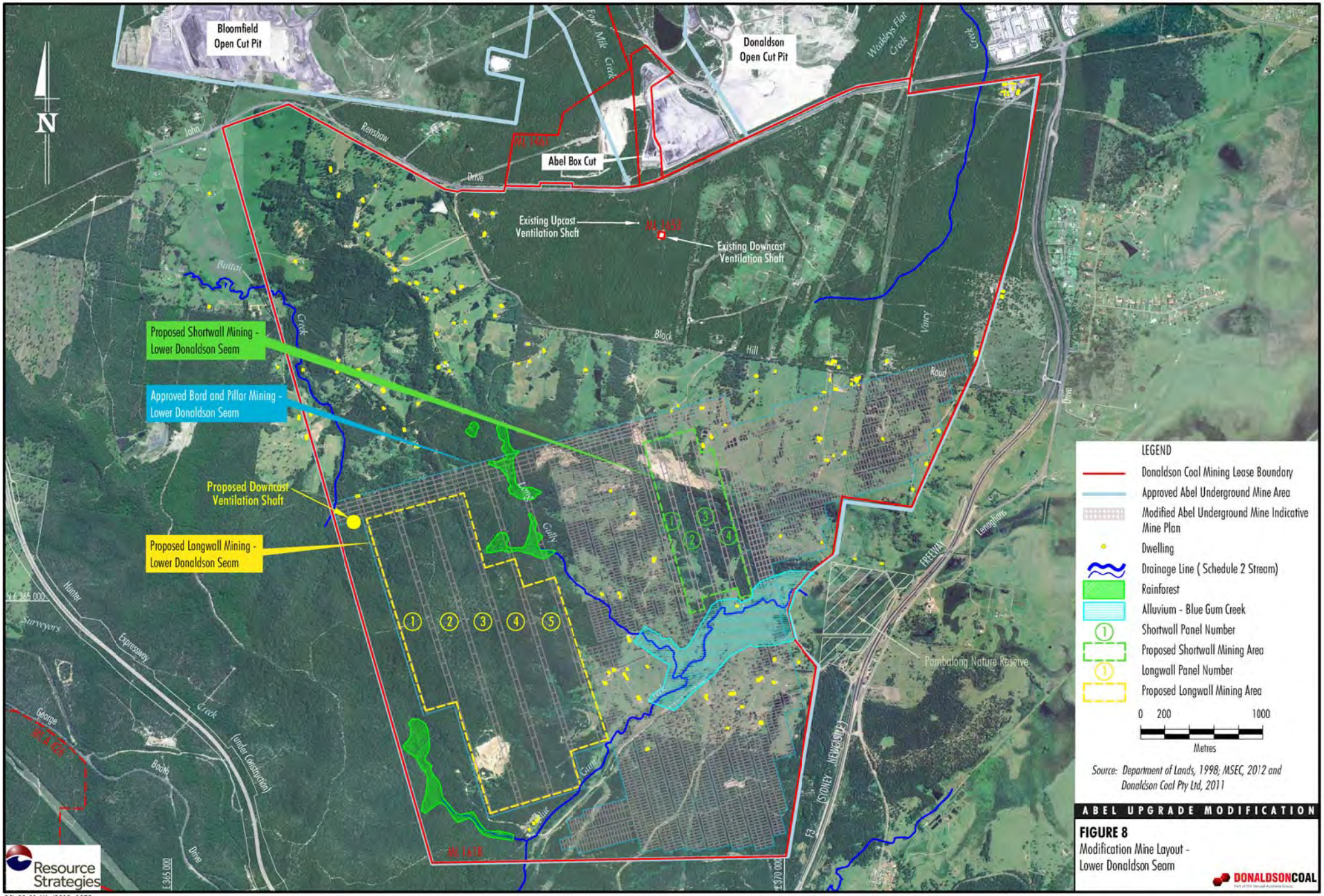

Bloomfield Open Cut Pit
Donaldson Open Cut Pit
Abel Box Cut
Existing Upcast Ventilation Shaft
Existing Downcast Ventilation Shaft
Proposed Shortwall Mining - Lower Donaldson Seam
Approved Bord and Pillar Mining - Lower Donaldson Seam
Proposed Downcast Ventilation Shaft
Proposed Longwall Mining - Lower Donaldson Seam
Pambalong Nature Reserve
N
LEGEND
Donaldson Coal Mining Lease Boundary
Approved Abel Underground Mine Area
Modified Abel Underground Mine Indicative Mine Plan
Dwelling
Drainage Line (Schedule 2 Stream)
Rainforest
Alluvium - Blue Gum Creek
Shortwall Panel Number
Proposed Shortwall Mining Area
Longwall Panel Number
Proposed Longwall Mining Area
0 200 1000
Metres
Source: Department of Lands, 1998; MSEC, 2012 and Donaldson Coal Pty Ltd, 2011
ABEL UPGRADE MODIFICATION
FIGURE 8
Modification Mine Layout - Lower Donaldson Seam
DONALDSONCOAL
Resource Strategies
DCL-09-01 AMod2012_107C

The shaft would be constructed using the 'raise bore' method, which uses a raise bore machine, consistent with the construction method used for the existing upcast and downcast ventilation shafts. A pilot hole would be drilled from the surface with the remainder of the shaft excavated from the bottom upwards. Using this method, material from the excavation would be removed from the bottom of the shaft via the existing underground system, surfacing at the existing portal.

Drilling of the shaft would occur 24 hours per day, seven days per week, while the remainder of construction activities (e.g. vegetation clearance and installation of surface infrastructure) would generally be limited to daytime hours (i.e. 7.00 am to 6.00 pm).

The construction period is expected to be approximately 12 weeks. There would be approximately five fulltime jobs associated with construction of the downcast ventilation shaft.

Plate 1 shows the existing downcast ventilation shaft at the Abel Underground Mine that was commissioned in 2011.

Plate 1: Existing Downcast Ventilation Shaft at the Abel Underground Mine

3.2.3 Overland Conveyor and other ROM Coal Handling Infrastructure

Under the existing Project Approval 05_0136, Donaldson Coal has approval for the construction and use of the overland conveyor and other ROM coal handling infrastructure (i.e. a larger ROM coal stockpile in the Donaldson Open Cut Mine void) (Section 2.2).

A minor change in the overland conveyor alignment is proposed, to reflect the outcomes of additional engineering design work conducted for the overland conveyor and Bloomfield CHPP since the Project Approval 05_0136 was granted.

Figure 3 shows the existing alignment of the approved overland conveyors. Figure 5 shows the proposed minor modification to this alignment.

3.2.4 Bloomfield CHPP

The increase in ROM coal production at the Abel and Tasman Underground Mines (i.e. due to the Modification and Tasman Extension Project) would result in an increase in the amount of coal being processed at the Bloomfield CHPP.

The increase in ROM coal production at the Abel and Tasman Underground Mines (i.e. due to the Modification and Tasman Extension Project) would result in an increase in the amount of coal being processed at the Bloomfield CHPP.

Two stages of upgrades to the Bloomfield CHPP would be required to meet the peak expected ROM coal processing rate of 8.5 Mtpa.

The first stage of upgrades to the Bloomfield CHPP were described in the Part 3A EA and are already approved, but have not been implemented. These include upgrades to the fines circuit in the existing Bloomfield CHPP (e.g. upgrades to pumps, sumps and flotation cells to improve performance) as well as upgrades to the product coal stacker and reclaim conveyors.

The second stage of upgrades would involve the installation of a second CHPP module and associated feed and product conveyor systems. The second CHPP module would be located adjacent to the existing CHPP module (Figure 5).

The nature and extent of the upgrades and modifications to the Bloomfield CHPP would be subject to further engineering design.

The completion of mining at the Donaldson Open Cut Mine would change the types of coal (i.e. coal seams) processed at the Bloomfield CHPP. As such, minor reconfigurations of the ROM coal stockpiles at the Bloomfield CHPP would be required following completion of mining at the Donaldson Open Cut Mine.

All proposed modifications and upgrades to the Bloomfield CHPP would be contained within the existing approved disturbance area (Figure 5).

Construction activities would involve levelling of the area required for the new CHPP module, and installation of the module. The expected plant required for the construction of the new CHPP module is described in Appendix D.

Construction works would be conducted during standard construction hours (7.00 am to 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays).

Approximately 25 construction employees would be required for the proposed upgrades to the Bloomfield CHPP.

3.3 OPERATIONS

3.3.1 Mining Method

Mining Area

The proposed Modification to the Abel Underground Mine would involve the continuation of underground mining within the approved area (ML 1618) and the approved seams (the Upper and Lower Donaldson Seams) using a combination of longwall, shortwall and bord and pillar mining.

The mine layout for the Modification is shown on Figure 6.

The changes in the mine plan for the Modification have been developed in order to maintain the existing subsidence commitments (Section 2.3).

Longwall and Shortwall Mining

General Description

Donaldson Coal proposes to extract coal using shortwalls in the Upper and Lower Donaldson Seams and using longwalls in the Lower Donaldson Seam.

Longwall/shortwall mining would involve coal being removed by a shearer, which cuts the coal from the coal face on each pass as it traverses the width of the shortwall or longwall.

The roof at the coal face would be supported by a series of hydraulic roof supports, which temporarily hold up the roof strata, and provide a secure working space at the coal face.

The coal would then be transported by a face conveyor belt which is located behind and beneath the shearer. As the coal is removed from each section of the coal face, the hydraulic supports are stepped forward, and the coal face progresses (retreats) along the length of the shortwall or longwall.

The strata directly behind the hydraulic supports, immediately above the coal seam, collapses into the void that is left as the coal face retreats. The collapsed zone comprises loose blocks and can contain large voids.

Immediately above the collapsed zone, the strata remains relatively intact and bends into the void, resulting in new vertical factures, the opening of existing vertical fractures and bed separation. The amount of strata sagging, fracturing and bed separation reduces towards the surface.

A generic cross-section through the immediate roof strata and along the length of a typical longwall, at the coal face, is shown in Plate 2.

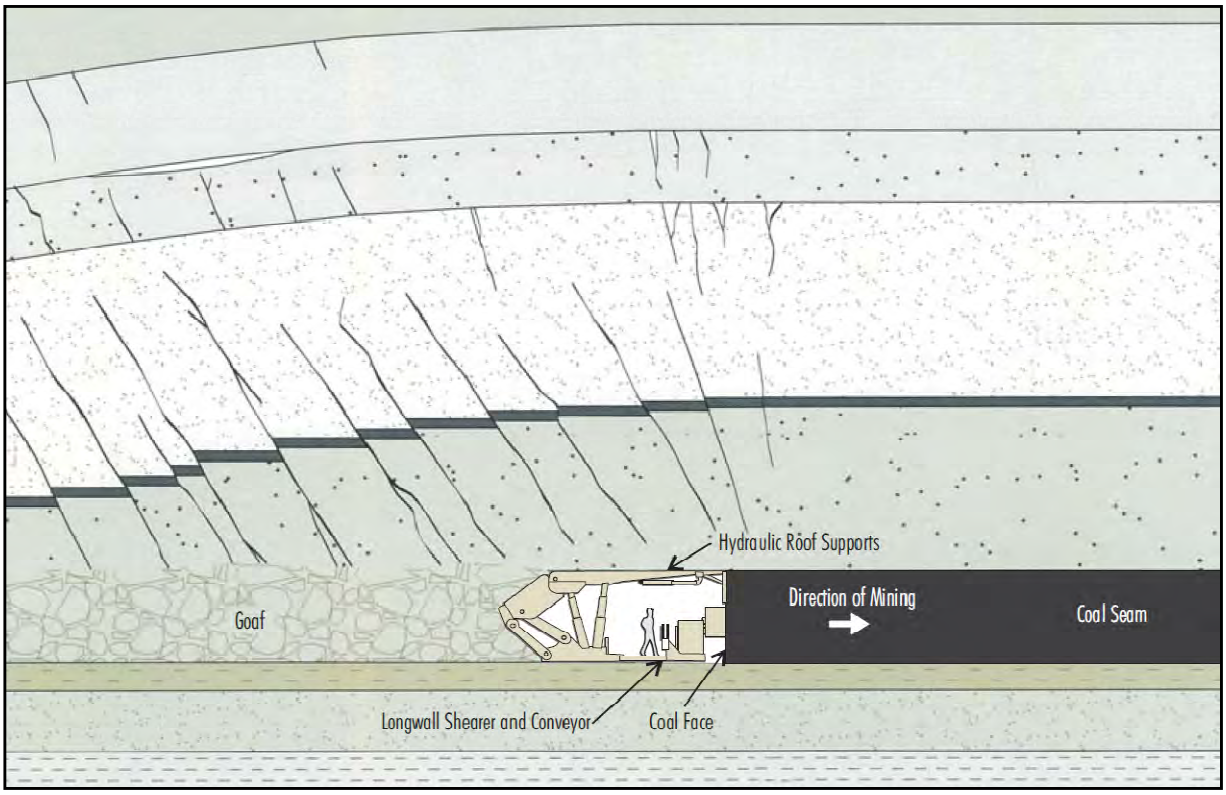
Shortwall Mining – Upper Donaldson Seam

Seven shortwall panels are proposed to be extracted in the centre of the area approved to be mined using bord and pillar extraction in the Upper Donaldson Seam (Figure 7). Table 3 provides a summary of the geometry of the Upper Donaldson Seam shortwall panels.

The depth of cover above the shortwall mining area proposed in the Upper Donaldson Seam increases from approximately 50 m in the northern section to approximately 200 m in the southern section. Drawing MSEC492-07 in Appendix A to the EA shows detailed depth of cover contours for the Upper Donaldson Seam.

The southern sections of Shortwall Panels 5 to 7 are shown to lie beneath a principal residence (Figure 7). In accordance with existing subsidence commitments (Section 2.3) for the Abel Underground Mine, shortwall mining would only be conducted under a principal residence with the approval of the relevant landowner.

Should an agreement not be reached, the length of Shortwall Panels 5 to 7 would be reduced to approximately 800 m.



Source: After Appendix A.

Plate 2: Generic Cross-Section – Longwall Mining

Table 3
Geometry of Shortwall and Longwall Panels in the Upper and Lower Donaldson Seams

Seam	Panels	Overall Void Length Including First Workings (m)	Overall Void Width Including First Workings (m)	Overall Solid Pillar Width (m)
Upper Donaldson	Shortwalls 1 to 7	1,130 to 1,250	120	20
Lower Donaldson	Longwalls 1 to 5	1,420 to 2,470	180* to 230	30 to 35
	Shortwalls 1 to 4	1,170 to 1,360	20	25

Source: After Appendix A.

* The width of Longwall Panel 3 would be narrowed to 180 m at the northern end to meet the existing subsidence commitment within the adjacent rainforest area.

Longwall and Shortwall Mining – Lower Donaldson Seam

Five longwall mining panels and four shortwall mining panels are proposed to be extracted in the area approved to be mined using bord and pillar extraction in the Lower Donaldson Seam (Figure 8). Table 3 provides a summary of the geometry of the Lower Donaldson Seam longwall and shortwall panels.

The depth of cover above the longwall mining area proposed in the Lower Donaldson Seam ranges from approximately 190 to 370 m. The depth of cover above the shortwall mining area proposed in the Lower Donaldson Seam ranges from approximately 150 to 300 m. Drawing MSEC492-10 in Appendix A to the EA shows detailed depth of cover contours for the Lower Donaldson Seam.

Sections of the proposed longwall and shortwall panels are located beneath the proposed thin seam workings in the Upper Donaldson Seam and/or historic workings in the overlying Borehole Seam.

The interburden thickness contours between the Upper and Lower Donaldson Seams is approximately 20 m (Appendix A). The interburden thickness between the historic workings and the Lower Donaldson Seam is approximately 225 m.

The Stockrington Quarry overlies the proposed longwall mining area in the Lower Donaldson Seam. The depth of cover above the longwall mining area in this location is approximately 320 m.

The southern sections of Longwall Panels 1 and 5, and the northern sections of Longwall Panels 4 and 5, would be shortened to meet existing subsidence commitments (Section 2.3) within the adjacent rainforest area, Long Gully and alluvium associated with Blue Gum Creek (Figure 8).

In addition, the width of Longwall Panel 3 would be narrowed to 180 m at the northern end to meet the existing subsidence commitment within the adjacent rainforest area.

The northern section of Shortwall Panel 4 has been shortened to avoid a principal residence (Figure 8), in accordance with the existing subsidence commitment for principal residences (Section 2.3).

The downcast ventilation shaft would be required in the main heading associated with the longwall panels at the approximate location shown on Figure 8.

Subsidence Effects

The types of subsidence effects (e.g. tilt, curvature and tensile strain) associated with longwall and shortwall mining would be the same as those associated with bord and pillar extraction (with potential differences in magnitude).

A detailed description of subsidence effects is provided in Appendix A.

Potential subsidence impacts and consequences associated the changes in mining methods associated with the Modification are provided in Section 4.2 and Appendix A.

Thin Seam Workings – Upper Donaldson Seam

The thin seam workings would involve the extension of mining, using bord and pillar extraction, in a southern section of the Upper Donaldson Seam that overlies the Lower Donaldson Seam within ML 1618 (Figure 7). In the areas where the thin seam workings would occur, the thickness of the Upper Donaldson Seam varies between 1.3 and 2.3 m (Appendix A).

The depth of cover above the proposed thin seam workings in the Upper Donaldson Seam increases from approximately 125 m in the north-eastern corner to approximately 350 m in the western section. Drawing MSEC492-07 in Appendix A to the EA shows detailed depth of cover contours for the Upper Donaldson Seam.

Secondary extraction would occur in sections of the thin seam workings overlying the longwall and shortwall panels in the Lower Donaldson Seam (Figure 8). In all other areas, the thin seam workings would involve first workings only.

Other Mining Areas

Bord and pillar extraction would continue at the Abel Underground Mine in all currently approved areas outside of the longwalls, shortwalls and thin seam workings areas, in accordance with existing Project Approval 05_0136 and relevant SMPs/Extraction Plans.

Gas Drainage

In-seam gas drainage equipment would be utilised, as required, during operations. As described in the Part 3A EA, small scale methane drainage equipment may also be required for mine safety purposes.

3.3.2 Mine Schedule

An indicative mine schedule for the Modification is shown in Table 4.

The indicative mine schedule for the Modification is based on:

- shortwall mining in the Upper Donaldson Seam from approximately 2014 to 2015;
- shortwall mining in the Lower Donaldson Seam from approximately 2016 to 2018;
- longwall mining in the Lower Donaldson Seam from approximately 2018 to 2021; and
- thin seam workings in the Upper Donaldson Seam from approximately 2013 to 2026, with mining (e.g. in each panel) to occur prior to mining in the directly underlying areas of the Lower Donaldson Seam.

Table 4
Indicative Mine Schedule

Year (ending 30 June)	ROM Coal Project (ktpa)				
	Modification (Abel Underground Mine)	Tasman Extension Project	Donaldson Open Cut Mine	Bloomfield Colliery*	Total (Processed at Bloomfield CHPP)
2013	2,726	275	900	1,300	*5,201*
2014	4,513	578	-	1,300	*6,391*
2015	6,125	951	-	1,300	*8,376*
2016	6,065	1,155	-	1,300	*8,520*
2017	5,410	1,428	-	1,300	*8,138*
2018	5,646	1,428	-	1,300	*8,374*
2019	5,732	1,428	-	1,300	*8,460*
2020	5,383	1,500	-	1,300	*8,183*
2021	4,258	1,500	-	1,300	*7,058*
2022	3,572	1,500	-	1,300	*6,372*
2023	3,584	1,500	-	-	*5,084*
2024	1,665	1,428	-	-	*3,093*
2025	1,492	1,428	-	-	*2,920*
2026	1,039	1,428	-	-	*2,467*
2027	1,095	1,017	-	-	*2,112*
2028	1,942	464	-	-	*2,406*
2029	851	462	-	-	*1,313*
2030	-	241	-	-	*241*

* Assumed to be the maximum approved production rate for the Bloomfield Colliery.
ktpa = kilotonnes per annum.

Notwithstanding the above, the introduction of shortwall and longwall mining, and the thin seam workings, would only occur at the election of Donaldson Coal, and would be triggered by approval of relevant Extraction Plans. Should Donaldson Coal elect not to introduce shortwall and longwall mining, the right to use bord and pillar extraction methods within the currently approved mining area would be retained (i.e. in accordance with the conditions of Project Approval 05_0136 and relevant SMPs/Extractions Plans).

3.3.3 Surface Facilities and ROM Coal Transport

The increased efficiency of longwall and shortwall mining, and the additional coal recovered from the Upper Donaldson Seam, would result in an increase in annual ROM coal production to approximately 6.1 Mtpa (i.e. 6,125 kilotonnes [kt]) (Table 4). As such, there would be an associated increase in ROM coal handling, transport and processing.

The existing ROM coal handling surface infrastructure at the Abel Box Cut (i.e. stackout conveyor and ROM coal stockpile) would continue to be used for the Modification. ROM coal would be loaded from the ROM coal stockpile to haul trucks using a front end loader and transported to the Bloomfield CHPP via the existing sealed internal haul road.

Alternatively, the approved overland conveyor would be constructed and used to transport ROM coal to the Bloomfield CHPP. In this case, the ROM coal handling facilities at the Abel Box Cut would also be upgraded. A higher capacity radial stackout conveyor would transport ROM coal to a larger ROM coal stockpile within the open cut void (Figure 5). ROM coal would be reclaimed for transport on the overland conveyor.

Subject to approval of the Tasman Extension Project, there would also be an increase in the approved amount of ROM coal received at the Abel Underground Mine from the Tasman Underground Mine (i.e. an increase from 975 to 1,500 ktpa). ROM coal from the Tasman Underground Mine would continue to be transported in on-highway haul trucks (i.e. B-doubles) from the Abel Underground Mine entrance to the Bloomfield CHPP via sealed internal roads.

At the Bloomfield CHPP, ROM coal would continue to be either directly loaded to the Bloomfield CHPP feed conveyor system, or stockpiled and loaded to the Bloomfield CHPP feed conveyor system using a dozer, for processing.

3.3.4 Coal Processing and Rail Loading Facility

ROM coal from the Abel Underground Mine, Tasman Underground Mine, Bloomfield Colliery and Donaldson Open Cut Mine would continue to be processed at the Bloomfield CHPP at the indicative rates shown in Table 4.

The processing rate at the Bloomfield CHPP would increase above the currently approved rate of 6.5 Mtpa to a maximum of approximately 8.5 Mtpa. This is due to increases in ROM coal production associated with the Modification and the Tasman Extension Project.

The Bloomfield CHPP is currently approved to process ROM coal from sources other than those described above on a campaign basis when required (e.g. from other Bloomfield operations). This would continue as required for the Modification, however, the maximum processing rate would not exceed 8.5 Mtpa.

The upgrades and modifications to the Bloomfield CHPP required to enable the increased ROM coal processing rate are described in Section 3.2.4.

Product coal from the Bloomfield CHPP would be loaded to product stockpiles, before being transported via conveyor to the rail loading facility (Figure 5).

3.3.5 Product Coal Transport

Product coal from the Bloomfield CHPP would continue to be transported from the site by rail via the Bloomfield rail loop and private rail spur, which connects to the Main North Railway Line (Figure 2).

The rate of product coal transported via the Bloomfield rail loop and private rail spur would increase above the currently approved rate of 5 Mtpa to a maximum of approximately 6.5 Mtpa.

The Abel EA estimated an average of 3 to 6 rail movements per day on the Bloomfield rail loop would be required for the transportation of product coal from the Bloomfield CHPP, based on the expected total annual maximum production of 5 Mtpa of product coal. The Abel EA did not specify the peak rail movements required to transport 5 Mtpa of product coal. However, it can be inferred that the peak movements would be materially greater than the average of 3 to 6 rail movements. For the maximum coal production rate for the Modification (i.e. 6.5 Mtpa product coal) a peak of 12 rail movements on the Bloomfield rail loop would be required.

3.3.6 Coarse Reject and Tailings Disposal Strategy

There would be an increase in the quantity of coarse rejects and tailings (i.e. fine rejects) produced at the Bloomfield CHPP due to the increase in ROM coal production associated with the Modification and Tasman Extension Project.

However, there would be no change required for the management of coarse rejects for the Modification. Coarse rejects from the Bloomfield CHPP would continue to be mixed with overburden material and disposed of under advancing overburden emplacement dumps at the Bloomfield Colliery.

Tailings would be disposed at existing approved (Section 2.7) and new storage facilities (i.e. the Donaldson Square Pit) for the Modification (Figure 9). In addition, alterations to the U Cut South void may be required to increase its storage capacity (Figure 9).

A tailings balance was conducted by Evans and Peck (2012) as part of the Site Water Balance for the Modification. It indicated there would be sufficient storage capacity for all tailings from the Bloomfield CHPP, as shown in Table 5.
Tailings would be transferred as slurry to storages via pipelines according to the following nominal progression:

1. Bloomfield U Cut North tailings dam (currently used for tailings disposal).
2. Bloomfield U Cut South void.
3. Donaldson Square Pit void.
4. Bloomfield S Cut South void.
5. Bloomfield S Cut North void (Creek Cut void).

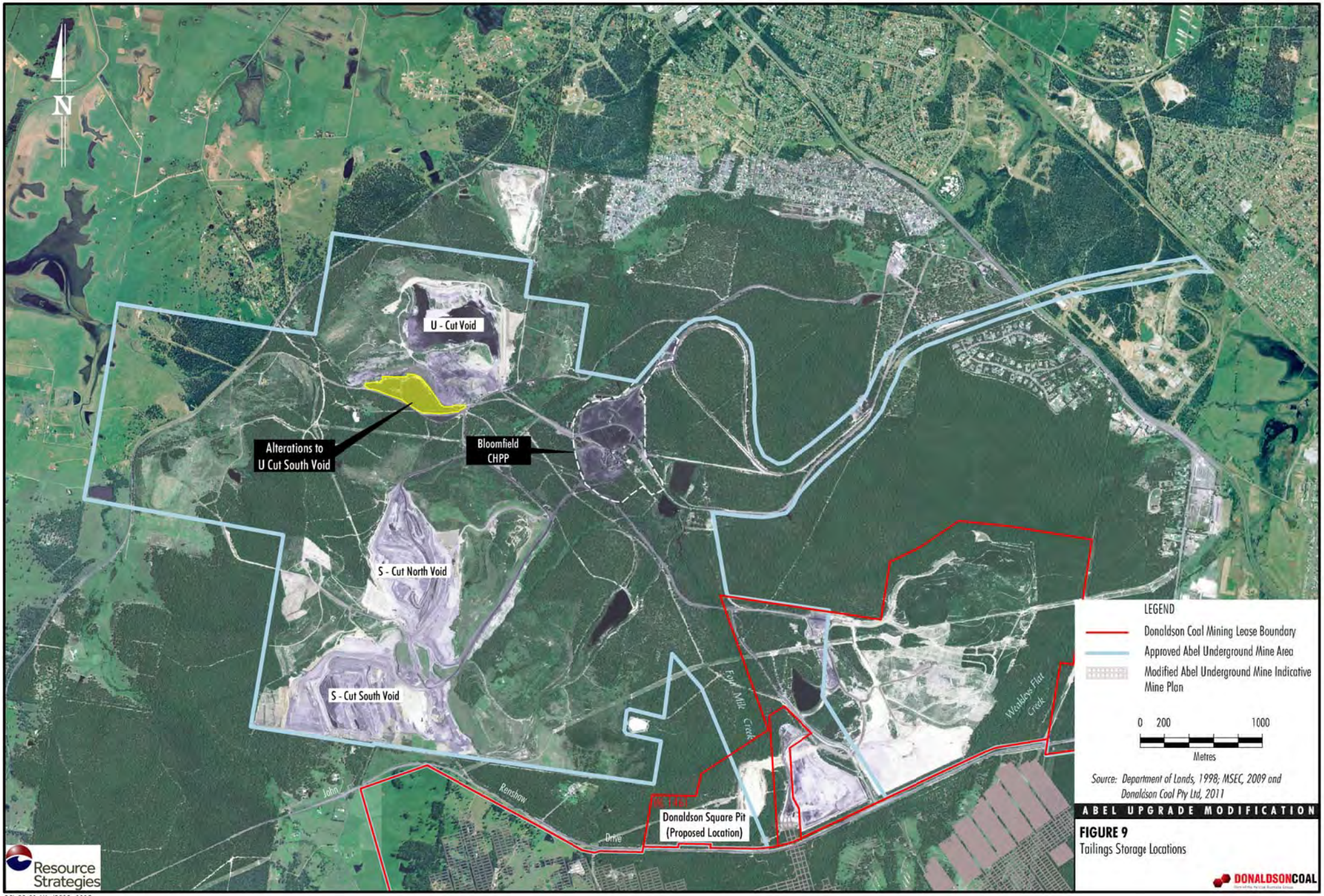


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Table 5
Estimated Capacities of Tailings Storages

Tailings Storage*	Estimated Capacity (ML)
Bloomfield U Cut North tailings dam (currently used for tailings disposal)	2,300
Bloomfield U Cut South void	1,200
Donaldson Square Pit void	2,900
Bloomfield S Cut South void	10,000
Bloomfield S Cut North void (Creek Cut void)	>10,000
Total Storage Capacity	*>26,400*
Total Tailings Production from Bloomfield CHPP (ML)	*16,000*

Source: After Appendix C.
* Refer to Figure 9.
ML = megalitres.

The timing of the transfer of tailings to the storages would be dependent on the rate of reject material production, the capacity of the facility and the availability of new storages.

The use of the Donaldson Square Pit void for the life of the approved Abel Underground Mine for the storage of reject material from the Bloomfield CHPP is consistent with the approved Closure and Decommissioning Strategy for the Donaldson Open Cut Mine detailed in the *Donaldson Open Cut and Abel Underground Coal Mines Landscape Management Plan*.

3.3.7 Water Management

The existing water management principles for the Abel Underground Mine (Section 2.8) would be maintained for the Modification.

A site water balance was conducted by Evans and Peck (2012) for the Modification and is included in Appendix C. It indicated additional storage capacity may be required during the life of the Modification to accommodate predicted increases in groundwater inflows for peak ROM coal production rates (Appendix C).

As such, augmentations to the water management system for the Abel Underground Mine would be implemented as required to ensure no discharge outside of the limits specified in EPL No. 11080 occurs.

Groundwater inflows would be transferred directly to the Donaldson Square Pit to enable the separation of groundwater inflows and surface runoff in the Big Kahuna Dam. If required, an RO plant would be used to treat groundwater inflows to a quality suitable for discharge (in accordance with the limits specified in EPL No. 11080) or transfer to the Bloomfield Colliery (as per existing approved arrangements).

Storage of groundwater inflows would be integrated with the tailings disposal strategy (Section 3.3.6). This may include the transfer of groundwater inflows from the Abel Underground Mine to S Cut South and S Cut North voids when they become available.

The site water balance indicated that, in addition to the augmentations described above, a maximum annual contingency storage of approximately 400 ML may be required. As such, Donaldson Coal would modify existing storages as required. This may involve:

- increasing the capacity of the Donaldson Square Pit within the approved disturbance area (estimated to increase its storage capacity by up to 1,200 ML [Appendix C]); and/or
- creating additional storage capacity in the existing sump located in the Abel Box Cut 'West Pit' area (e.g. by creating an embankment within the approved disturbance area).

Detailed design, to the satisfaction of the DP&I and EPA, would be conducted for any alterations made to existing storages.

The site water balance for the Abel Underground Mine would be reviewed on at least a six-monthly basis to determine in advance if augmentations to the existing water management system are required based on actual groundwater inflows, tailings production rates and the available capacity of existing storages.

Should an RO plant be required, brine waste product would be stored in the Donaldson Square Pit (Appendix C).

Donaldson Coal is also investigating the use of a pipeline to the Hunter River as an alternative water management option. However, this would be the subject of a separate assessment and approval process and does not form part of this Modification.

3.3.8 Hours of Operation and Operational Workforce

The Abel Underground Mine, the Bloomfield CHPP and the rail loading facility are approved to operate 24 hours per day, seven days per week (Section 2.9).

There would be no change to the approved operating hours due to the Modification.

The existing shift hours for mining operations at the Abel Underground Mine (Section 2.9) would be maintained for the Modification (subject to minor variations to start and finishing times due to operational requirements).

An additional 25 operational employees would be required at the Abel Underground Mine operations as a result of the Modification (total of 400 at peak production).

The Bloomfield CHPP currently operates five and a half days per week. The Bloomfield CHPP would operate 24 hours per day, seven days per week to accommodate the increased ROM coal processing rate.

An additional 23 operational employees at the Bloomfield CHPP (total of 51) would be required for the Modification. These additional employees would be employed by Bloomfield Collieries Pty Limited.

3.3.9 Waste Management

No changes to the existing waste management system for the Abel Underground Mine (Section 2.10) would be required for the Modification, with the exception of the management of reject material from the Bloomfield CHPP, which is described in Section 3.3.6.

3.4 DECOMMISSIONING AND REHABILITATION

Existing Approved Abel Underground Mine

Decommissioning and rehabilitation of the existing approved Abel Underground Mine (e.g. Abel Box Cut final void and surface facilities, mine subsidence areas, existing ventilation shafts and aspects of the Bloomfield Colliery [aspects under Project Approval 05_0136]) is described in Section 2.12.

Lower Donaldson Seam Downcast Ventilation Shaft

Decommissioning and rehabilitation of the Lower Donaldson Seam downcast ventilation shaft site at the end of the mine life would be conducted as per the rehabilitation of the existing upcast and downcast ventilation shaft sites (Section 2.12). This will include the removal of infrastructure, sealing of the shafts, re-profiling, topsoiling and revegetation of the disturbed areas.

Donaldson Square Pit

The Donaldson Square Pit would be maintained as a void for the use of tailings and/or water storage for the life of the Abel Underground Mine and Bloomfield CHPP.

The *Donaldson Open Cut and Abel Underground Coal Mines Landscape Management Plan* (including the Mine Closure Plan) would be revised prior to the emplacement of coarse rejects and tailings at the Donaldson Open Cut Mine.

Decommissioning and rehabilitation of the Donaldson Square Pit would be to the satisfaction of the EPA and DP&I.

Should the Donaldson Square Pit have been used for storage of groundwater inflows from the Abel Underground Mine, it would be dewatered, with the water returned to underground workings.

Should the Donaldson Square Pit have been used for the storage of tailings, then the reject material would be capped with approximately 5 m of inert material. Depending on the volume of tailings that may be required to be stored during the mine life, the Donaldson Square Pit would either be returned to an area that would free-drain to the surrounding natural topography (subject to suitable runoff water quality) or maintained as a water storage body, consistent with the description in the *Donaldson Open Cut and Abel Underground Coal Mines Landscape Management Plan*.

3.5 INTERACTION WITH EXISTING AND PROPOSED MINING OPERATIONS

Interactions between the existing Abel Underground Mine and other existing mining operations are described in Section 2.11.

Generally, the interactions between the Abel Underground Mine and other mining operations for the Modification would be similar in nature to existing interactions, with some changes relating to ROM coal production rates and associated processing and waste material production rates.

A summary of the potential changes due to Modification is provided in the following sub-sections.

3.5.1 Bloomfield Coal Handling and Preparation Plant

As part of the Modification, the Bloomfield CHPP and associated handling and rail loading infrastructure would be upgraded to process up to approximately 8.5 Mtpa ROM coal from the Modification, the Tasman Extension Project, the Bloomfield Colliery and other sources (Section 3.1). The increased processing rate, and associated upgrades to the Bloomfield CHPP, would not occur until after the cessation of mining at the Donaldson Open Cut Mine.

3.5.2 Bloomfield Colliery

The Modification would involve increased disposal of coarse rejects and tailings (in total and per annum) at the Bloomfield Colliery associated with the increased processing of ROM coal at the Bloomfield CHPP.

A tailings and coarse reject disposal strategy is provided in Section 3.3.6.

Alterations to the Bloomfield U Cut South void may be required to increase its capacity to store tailings from the Bloomfield CHPP (Section 3.3.6).

Project Approval 05_0136 for the Abel Underground Mine covers the disposal of tailings and coarse rejects material from the Bloomfield CHPP. In addition, the alterations to the Bloomfield U Cut South void are located within the approved Abel Underground Mine area (Figure 9).

As such, this Modification seeks approval for alterations to the Bloomfield U Cut South void, as well the disposal of tailings at this location.

Notwithstanding, rehabilitation of the Bloomfield U Cut South void would be undertaken in accordance with the Bloomfield Mining Operations Plan, as per the rehabilitation requirements for existing approved tailings storage locations at the Bloomfield site.

3.5.3 Tasman Underground Mine and Tasman Extension Project

As part of the Modification, ROM coal from the Tasman Extension Project would be received at the Abel Underground Mine (from John Renshaw Drive), and transported via internal sealed roads to the Bloomfield CHPP for processing and rail loadout.

ROM coal transportation from the Tasman Extension Project to the Abel Underground Mine on public roads was described and assessed in the Tasman Extension Project Environmental Impact Statement (EIS), and does not form part of the Modification.

3.5.4 Donaldson Open Cut Mine

The Donaldson Open Cut Mine is approved to operate until 31 December 2013 (Section 2.11.4).

During the Modification, ROM coal from coal seams at the Donaldson Open Cut Mine would no longer be processed at the Bloomfield CHPP, changing the coal types processed at the Bloomfield CHPP.

Mining at the Donaldson Open Cut Mine currently occurs in an area called the 'Square Pit' located to the west of the Abel Underground Mine Box Cut. Following the completion of mining in the Donaldson Square Pit, reject material from the Bloomfield CHPP and groundwater inflows from the Abel Underground Mine would be stored in the Donaldson Square Pit, if required (Sections 3.3.6 and 3.3.7).

The *Donaldson Open Cut and Abel Underground Coal Mines Landscape Management Plan* would be revised prior to the emplacement of coarse rejects and tailings at the Donaldson Open Cut Mine.

3.6 JUSTIFICATION OF THE ABEL UPGRADE MODIFICATION

The Modification would result in the additional recovery of approximately 10 Mt of coal within the approved mining areas and seams for the Abel Underground Mine. A Benefit Cost Analysis (BCA) indicated the Modification would have incremental (i.e. in comparison to the approved Abel Underground Mine) net production benefits of $265M, with $165M of these net production benefits accruing to Australia (Appendix H).

This increase in the efficiency of coal recovery would result in positive social and economic benefits for the region and NSW (Appendix H).

The Modification would result in additional employees for construction (i.e. a total of approximately 30 additional employees) and operations (i.e. a total of approximately 48 additional employees) at the Abel Underground Mine and Bloomfield CHPP.

The incremental average annual contributions of the Modification to the regional economy over 17 years are estimated to be (Appendix H):

- $81M in annual direct and indirect regional output or business turnover;
- $50M in annual direct and indirect regional value added;
- $5M in annual indirect household income; and
- 64 indirect jobs.

In addition, the incremental average annual contributions of the Modification to the NSW economy over 17 years are estimated to be (Appendix H):

- $95M in annual direct and indirect regional output or business turnover;
- $57M in annual direct and indirect regional value added;
- $10M in annual indirect household income; and
- 112 indirect jobs.

The Modification is justified on the basis that the changes in mining method required to increase the efficiency of coal recovery could be conducted with no change to existing subsidence management commitments and environmental conditions and limits specified in both Project Approval 05_0136 for the Abel Underground Mine and Donaldson Coal's EPLs (11080 and 12856).

The environmental assessment for the Modification is provided in Section 4.

4 ENVIRONMENTAL ASSESSMENT

The following sub-sections present the environmental assessment for the Modification. The assessment was conducted in accordance with the DGRs for the Modification (Attachment 1), consideration of the outcomes of consultation with key stakeholders (Section 1.3) and the results of the Environmental Risk Assessment (ERA) workshop (Section 4.1 and Appendix J).

4.1 IDENTIFICATION OF KEY ISSUES

In accordance with DGRs, an ERA was undertaken to identify key potential environmental issues for further assessment in the EA. The ERA was conducted in July 2012.

With the implementation of proposed risk treatment measures, all of the potential issues were ranked within the “Medium" (i.e. acceptable with controls) or “Low” range by the risk assessment team. The ERA is provided in full as Appendix J.

4.2 SUBSIDENCE

Subsidence is the vertical and horizontal movement of the land surface as a result of the extraction of underlying coal. These land surface movements are generically referred to as subsidence effects. The different subsidence effects are described in detail in Appendix A, including systematic subsidence movements, far-field horizontal movements and sub-surface strata movements.

A detailed Subsidence Assessment was prepared by Mine Subsidence Engineering Consultants (MSEC) (2012) for the Modification and is presented in Appendix A. The Subsidence Assessment:

- focused on areas where subsidence effects have the potential to change due to changes in the method of mining for the Modification (i.e. longwall and shortwall areas);
- identified potential consequences from subsidence to identified natural and built features; and
- demonstrated that the Modification mine layout could be developed to meet existing subsidence management commitments.

4.2.1 Subsidence Impacts Observed at the Existing Abel Underground Mine and Existing Compliance

Subsidence associated with approved mining at the Abel Underground Mine has been monitored in accordance with relevant SMP requirements.

Subsidence monitoring of secondary workings in Panels 1 to 4 of the approved mine layout, as reported in the 2010/2011 Annual Environmental Monitoring Review for the Abel Underground Mine, indicated:

- Subsidence monitoring results (i.e. for subsidence, tilts and strains) were generally consistent with, or less than, predicted levels.
- Surface cracking and minor ponding occurred generally as predicted within vegetated areas and sealed access roads and tracks. Remedial works were carried out in consultation with the landowner.
- Surface cracking on an access track was recorded (200 mm width), which exceeded the 30 to 150 mm widths predicted in the SMP where depths of cover exceed 80 m. Notification, as required by the SMP, was provided. The crack was subsequently remediated.
- Surface cracking in a clay capped area was recorded (375 mm width), which exceeded the 260 mm width predicted in the SMP where depths of cover are less than 80 m.
- Seepage from a connector to a former water supply pipeline was identified and repairs undertaken.
- Apparent sag of power lines between Energy Australia (now Ausgrid) Power Poles 17 and 18 was identified. Energy Australia was notified and the conductors were lifted to reinstate clearance heights.

Predicted crack widths are often exceeded on a small number of occasions (as has been the case with the panels extracted to date at the Abel Underground Mine). These exceedances are generally found to be related to the presence of adverse or anomalous geological or topographical conditions or strain concentration in near surface rock (Ditton Geotechnical Services, 2011).

Surface cracks observed at the Abel Underground Mine have been remediated as described in the Part 3A EA and the SMPs.

There has been no non-compliance with the subsidence impacts limits in Project Approval 05_0136 at the Abel Underground Mine.

4.2.2 Prediction Methodology

MSEC (2012) identified that, in comparison to the existing approved mine layout for the Abel Underground Mine, changes in subsidence effects would be limited to the longwall and shortwall areas of the Modification mine layout.

The Modification mine layout involves the thin seam workings in the Upper Donaldson Seam, however, secondary (i.e. pillar) extraction would only occur in sections of the thin seam workings overlying the longwall and shortwall areas in the Lower Donaldson Seam (Figure 8).

In all other areas, the thin seam workings would involve non-subsiding first workings only (Figure 7). These areas of first workings only overlie areas of bord and pillar mining in the Lower Donaldson Seam. However, MSEC (2012) considers first workings in the thin seam workings would not result in additional subsidence, in comparison to predicted subsidence associated with the approved mine layout.

For areas outside the longwall and shortwall areas, bord and pillar operations would continue, as approved by Project Approval 05_0136 and relevant SMPs/Extraction Plans.

As such, potential subsidence impacts associated with areas where approved bord and pillar mining would continue at the Abel Underground Mine, and the areas of the thin seam workings limited to first workings, did not require further assessment and were not included by MSEC (2102) in the Subsidence Assessment for the Modification.

The areas in which potential impacts to surface features were assessed by MSEC (2012) (i.e. due to subsidence effects from the longwall and shortwall areas) were bounded by (Figure 10):

- the 26.5^{o} angle of draw line from the longwall and shortwall areas; and
- the predicted limit of vertical subsidence, taken as the 20 mm subsidence contour resulting from the extraction of the shortwall and longwall panels and extraction of panels (i.e. areas of secondary extraction) in thin seam workings.

In addition, other areas could experience far-field or valley related movements. The potential subsidence impacts to surface features which are sensitive to such movements were identified and assessed by MSEC (2012).

Subsidence effects associated with the potential reactivation of historic workings in the Borehole Seam are also discussed in Appendix A.

Predictions of systematic subsidence parameters for the Modification were made using the Incremental Profile Method, which includes a database of observed monitoring data, including relevant data for shortwalls and longwalls with similar geometry in the Newcastle Coalfield.

A detailed description of the numerical methodologies used to predict subsidence effects associated with the Modification mine layout is provided in Appendix A.

4.2.3 Prediction of Subsidence Effects

A comparison of conventional subsidence parameters predicted for the approved mine layout and the Modification mine layout is provided in Table 6.

The predicted maximum subsidence for the longwall and shortwall areas is greater than the predicted maximum subsidence for the equivalent areas in the approved mine layout (Table 6).

However, potential consequences of subsidence to natural features and surface infrastructure are generally more dependent on differential subsidence (i.e. tilt, curvature and strain), rather than the magnitude of vertical subsidence (Appendix A).

Predicted maximum tilts and curvatures for the Modification mine layout are similar in magnitude, or less than, those predicted for the approved mine layout (Table 6) (Appendix A).

Continuous sub-surface cracking refers to the extent of fracturing above a total extraction panel that would provide a direct flow-path or hydraulic connection to the workings, if a sub-surface aquifer or coal seam were intersected (Appendix A).

The height of continuous cracking is referred to as the A Horizon.

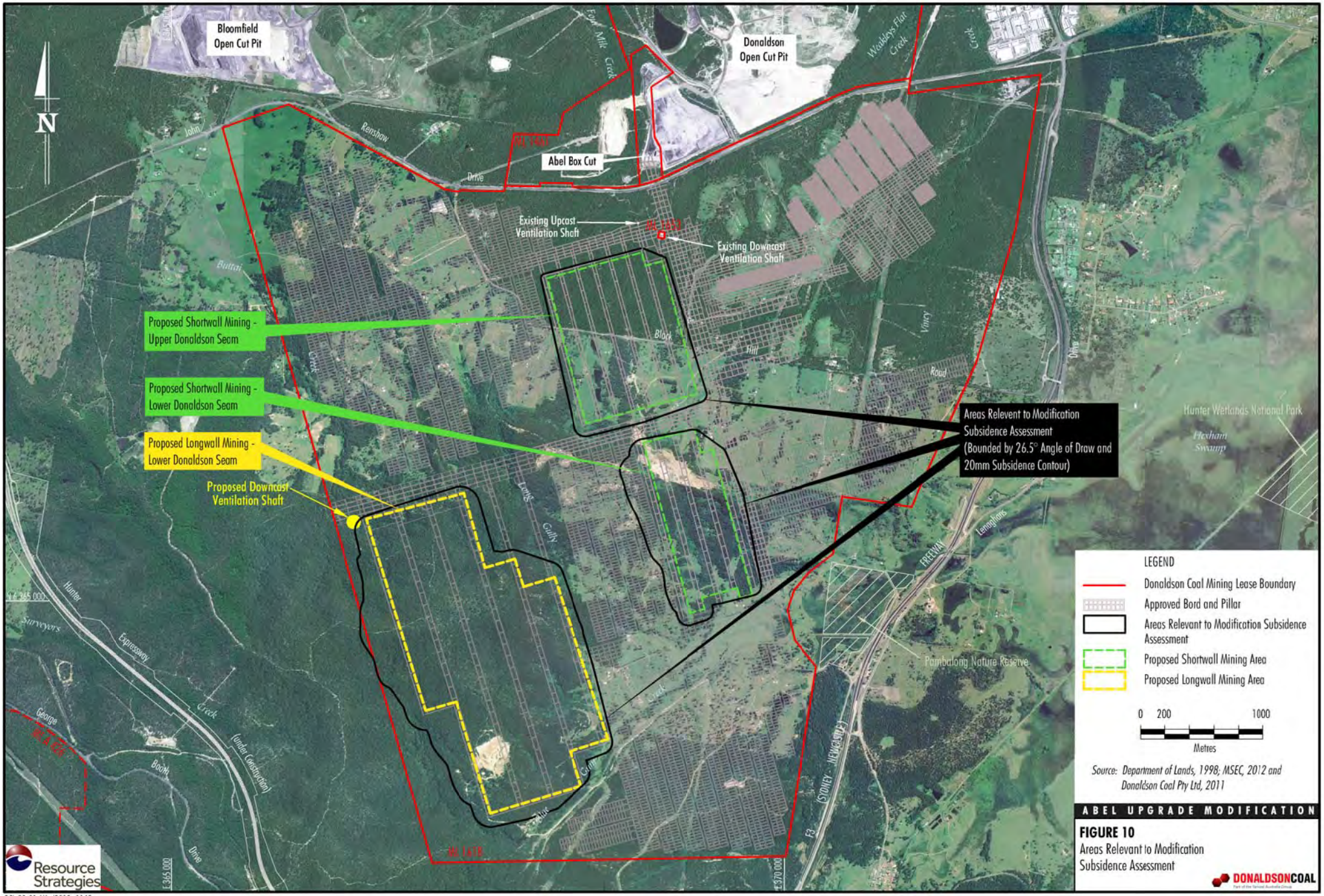

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Table 6
Comparison of Subsidence Predictions – Approved and Modification Mine Layouts

Area of Modification Mine Layout	Comparison with Approved Mine Layout	Maximum Predictions (Total Conventional)				
		Subsidence (mm)	Tilt (mm/m)	Tensile Strain* (mm/m)	Hogging Curvature (km^{-1})	Sagging Curvature (km^{-1})
Upper Donaldson Seam – Shortwalls	Approved - Bord and Pillar (Panels D and H)	1,330	48	32.4	3.24	4.12
	Modification - Shortwalls Panels 1 to 7	1,700	60	25	2.5	2.5
Lower Donaldson Seam – Shortwalls	Approved - Bord and Pillar (Panel M)	1,480^	41	15.4	1.54	1.95
	Modification - Shortwalls Panels 1 to 4	1,700	25	10	1	1.5
Lower Donaldson Seam – Longwalls and overlying thin seam workings	Approved - Bord and Pillar (Panels N, O and P)	990^	17	8.1	0.81	1.02
	Modification - Longwall Panels 1 to 5 and overlying thin seam extraction panels	3,100	30	10	1	1

Source: After Appendix A.

* Predicted strains are 'smooth profile' strains. Appendix A also provides a statistical analysis of predicted strains for the Modification to account for potential variability.

^ Additional subsidence could potentially occur due to undermining of Borehole Seam workings, ranging from 0 to 20% of the Borehole Seam mining height (i.e. up to 600 mm for an assumed mining height of 3 m), or in the extreme event of a total collapse of the marginally stable pillars were to occur, 50% of the Borehole Seam mining height (i.e. 1,500 mm for an assumed mining height of 3 m) (Appendix A).

mm/m = millimetres per metre.

Discontinuous fracturing refers to the extent above a total extraction panel that could experience a general increase in horizontal and vertical permeability within the rock mass, due to bending or curvature deformation of the overburden. This type of fracturing does not provide a direct flow-path or connection to the workings and is more likely to interact with surface cracks or joints (Appendix A).

The height of discontinuous cracking is referred to as the B Horizon.

The estimated heights of continuous and discontinuous fracturing are based on the depth of cover, subsidence and other subsidence effects (e.g. conventional tensile strain). The estimated heights of continuous and discontinuous fracturing for various depths of cover for the longwall and shortwall areas are shown in Table 7.

Continuous cracking is predicted to extend up to the surface where the depths of cover are shallowest above the shortwalls in the Upper Donaldson Seam (Table 7) (Appendix A).

Discontinuous cracking could potentially extend up to the surface above the shortwalls in the Upper Donaldson Seam, as well as above the shortwalls in the Lower Donaldson Seam and the thin seam pillar extraction panels overlying the longwall areas (Table 7) (Appendix A).

4.2.4 Subsidence Impacts

Subsidence impacts are the physical changes to the ground and its surface caused by the subsidence effects described in Section 4.2.3. Potential subsidence impacts associated Modification mine layout would include:

- surface cracking;
- changes in stream bed gradients;
- ponding and changes in stream alignment;
- slope instability and erosion; and
- depressurisation of groundwater aquifers.

MSEC (Appendix A) concludes that predicted maximum tilts and curvatures for the Modification mine layout are similar in magnitude, or less than, those predicted for the approved mine layout, and therefore, potential subsidence impacts associated with the Modification mine layout would be similar in nature to those associated with the approved mine layout.

The Subsidence Assessment includes detailed subsidence predictions and assessment for key natural and built features in the longwall and shortwall areas. Potential consequences of subsidence on key natural and built features are summarised in Section 4.2.5.

Table 7
Estimated Heights of Sub-Surface Cracking

Area of Modification Mine Layout	Depth of Cover (m)	Estimated Height of the A Horizon (m)	Estimated Height of the B Horizon (m)
Upper Donaldson Seam – Shortwalls	50 to 200	41 to 112	50 to 192
Lower Donaldson Seam – Shortwalls	150 to 300	96 to 141	150 to 267
Lower Donaldson Seam – Longwalls	170 to 300	133 to 238	170 to 350

Source: After Appendix A

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4.2.5 Potential Consequences of Subsidence on Key Natural and Built Features

Streams

The underground mining area for the Abel Underground Mine includes ephemeral Schedule 2 (i.e. 3rd order and above) (Table 8) and Schedule 1 (i.e. 1st and 2nd order) streams.

Schedule 2 Streams

Schedule 2 streams within or adjacent to the underground mining area are shown on Figures 7 and 8, and are listed and described in Table 8.

Table 8
Schedule 2 Streams within or Adjacent to the Abel Underground Mining Area

Stream Name	Strahler Stream Order	Description
Blue Gum Creek	3rd and 4th Order	Located to the south of the shortwalls and longwalls in the Lower Donaldson Seam. Not directly mined beneath.*
Long Gully	3rd Order	Located between the shortwalls and longwalls in the Lower Donaldson Seam. Not directly mined beneath.*
Buttai Creek	3rd Order	Located on the western perimeter of the mining lease. Not directly mined beneath.*
Viney Creek	3rd Order	Located east of the shortwalls in the Upper Donaldson Seam. Not directly mined beneath.*

Source: After Appendix A.

* To provide a minimum 40 m barrier between the 20 mm line of subsidence and the bank of the stream.

The existing subsidence management commitment for Schedule 2 streams requires limiting mining operations to first workings only beneath Schedule 2 streams, and ensuring that mining causes no subsidence impacts requiring mitigation works (Section 2.3). This would be achieved by providing a minimum 40 m barrier between the 20 mm line of subsidence and the bank of any Schedule 2 stream.

To maintain the existing subsidence management commitment for Schedule 2 streams, the Modification mine layout has been designed so that longwall and shortwall mining would not occur beneath Schedule 2 streams (Figures 7 and 8) such that the 20 mm line of subsidence would be at least 40 m from the banks of any Schedule 2 streams. There would be no additional potential consequences from subsidence to Schedule 2 streams due the Modification (Appendix A).

Schedule 1 Streams

The approved mine plan included mining directly beneath Schedule 1 streams. Therefore, these streams were predicted to experience the full range of subsidence effects due to the approved mine layout (Appendix A).

Predicted tilts and curvatures associated with the Modification mine layout (i.e. in the longwall and shortwall areas) are similar to, or less than, the predicted tilts and curvatures associated with approved mine layout (Table 6) (Appendix A). Therefore, no additional potential consequences from subsidence to Schedule 1 streams due to the Modification are predicted, in comparison to those associated with the approved mine plan (Appendix A).

Potential consequences from subsidence to Schedule 1 streams would include ponding, flooding, scouring, fracturing, bulking and dilation of bedrock, and diversion of surface water flows. Mitigation measures, management and monitoring relevant to Schedule 1 streams are described in Section 4.2.6 and Attachment 3.

Cliffs, Rock Outcrops and Steep Slopes

Based on the definitions in contemporary project approvals, cliffs, rock outcrops and steep slopes are defined as (Appendix A):

- cliffs – continuous rock faces, having heights greater than 10 m and minimum slopes of 2 to 1 (i.e. greater than 63°);
- rock outcrops – discontinuous rock faces, having heights less than 10 m, or minimum slopes of 2 to 1 (i.e. greater than 63°); and
- steep slopes – areas of land having minimum natural gradients of 1 in 3 (i.e. greater than 18°).

Since the Part 3A EA, additional works have been undertaken to confirm areas of cliffs, rock outcrops and steep slopes, using Light Detection and Ranging (LiDAR) survey data, the orthophotograph of the area and site investigations (i.e. walking cliff areas) (Appendix A). Based on the results of this additional work, areas identified as cliffs, rock outcrops and steep slopes in close proximity to the longwall and shortwall areas are shown on Figure 11.

Cliffs

The existing subsidence management commitment for cliffs requires limiting mining operations such that not more than 60% of coal is extracted beneath identified cliff areas (Section 2.3).

The Modification would involve greater than 60% of coal extraction in the longwall and shortwall areas.

To maintain the existing subsidence management commitment for cliffs, the Modification mine layout has been designed such that there would be no longwall or shortwall mining beneath identified cliff areas (Figure 11).

There would be no additional potential consequences from subsidence to cliffs due to the Modification (Appendix A).

Rock Outcrops and Steep Slopes

Rock outcrops and steep slopes have been identified above the longwall and shortwall areas (Appendix A). Rock outcrops were included in the definition of cliffs in the Part 3A EA, and as such mining was limited to no more than 60% of coal extraction.

The magnitude of the predicted mine subsidence effects for the proposed longwall and shortwall mining areas in the Lower Donaldson Seam may be sufficient to result in some fracturing of the rock outcrops, and where the rock is marginally stable, this could result in some instability (Appendix A).

MSEC (2012) notes that, based on previous experience in the NSW Coalfields, only a small percentage of rock outcrops would potentially be impacted by mining, as rock outcrops are generally discontinuous and have small heights (i.e. in comparison to cliffs).

Subsidence associated with longwall and shortwall mining may result in surface cracks in steep slopes, which could potentially result in soil erosion (Appendix A).

Mitigation measures, management and monitoring relevant to rock outcrops and steep slopes are described in Section 4.2.6 and Attachment 3.

An assessment of potential impacts of slope instability on land resources and visual character is provided in Section 4.3 and 4.11.3.

Blue Gum Creek Alluvium

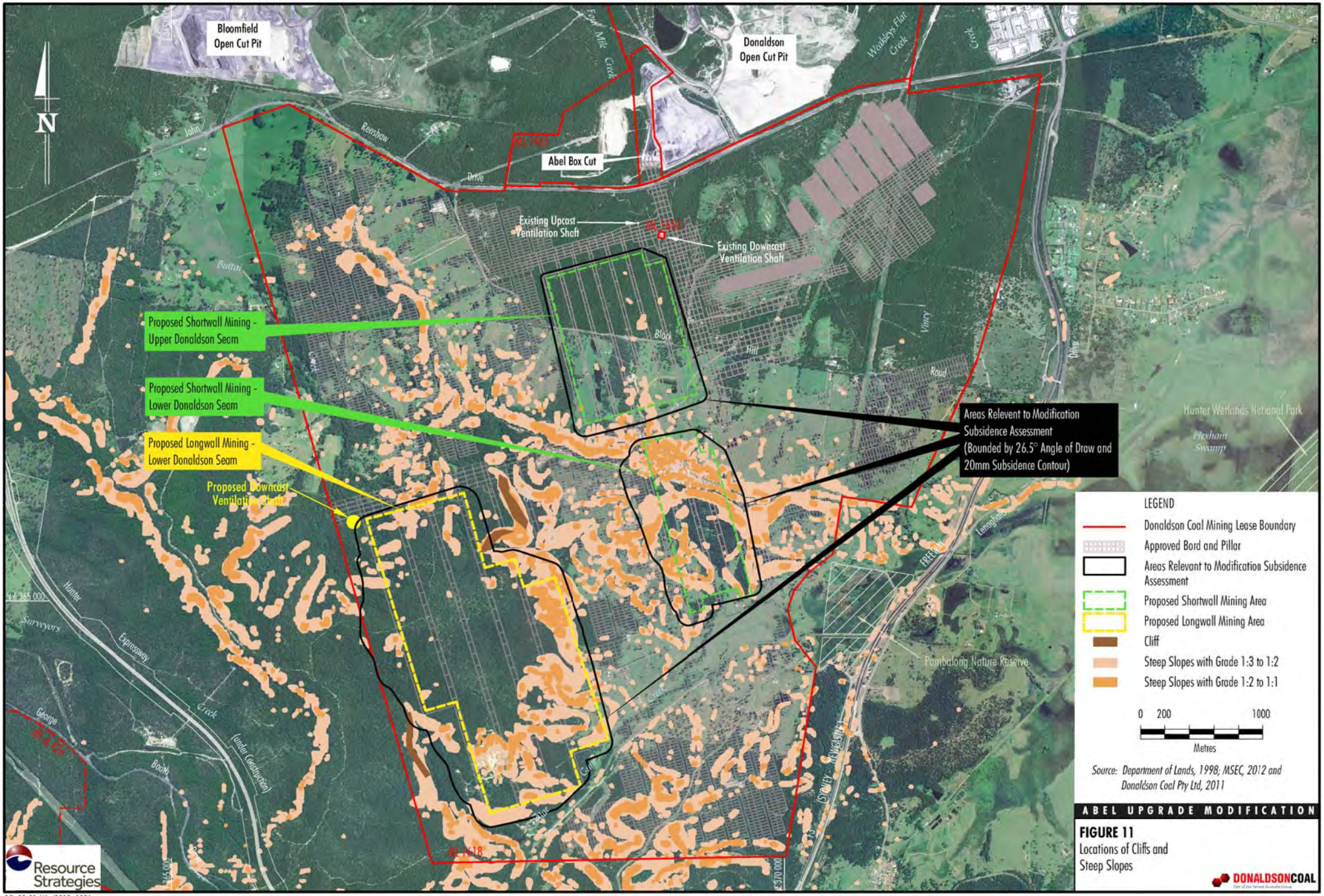
The existing subsidence management commitment for the Blue Gum Creek alluvium requires limiting mining operations to first workings only beneath the Blue Gum Creek alluvium, and ensuring mining causes no subsidence impacts requiring mitigation works (Section 2.3).

To maintain the existing subsidence management commitment for the Blue Gum Creek alluvium, the Modification mine layout has been designed so that longwall and shortwall mining would not occur beneath the Blue Gum Creek alluvium (Figures 7 and 8), such that no more than 20 mm of subsidence would occur within 40 m of the limit of the alluvium boundary.

There would be no additional potential consequences from subsidence to the Blum Gum Creek alluvium due the Modification (Appendix A).

Rainforest Areas

Rainforest communities have been identified along the upper reaches of Long Gully and Blue Gum Creek (Figures 7 and 8).



ABEL UPGRADE MODIFICATION

FIGURE 11
Locations of Cliffs and Steep Slopes

DONALDSONCOAL

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The existing subsidence management commitment for the rainforest areas requires limiting mining operations to first workings only, and ensuring mining causes no subsidence impacts requiring mitigation works (Section 2.3).

To maintain the existing subsidence management commitment for the rainforest areas, the Modification mine layout has been designed so that longwall and shortwall mining would not occur beneath rainforest areas (Figures 7 and 8), such that no more that 20 mm of subsidence would occur within the identified rainforest areas.

There would be no additional consequences from subsidence to the rainforest areas due the Modification (Appendix A).

Pambalong Nature Reserve

The existing subsidence management commitment for the Pambalong Nature Reserve requires that the Abel Underground Mine does not result in subsidence impacts to the Pambalong Nature Reserve.

ML 1618 was designed to avoid the Pambalong Nature Reserve (Figure 6).

No subsidence impacts at the Pamabalong Nature Reserve are predicted (Appendix A).

Aboriginal Heritage

Potential consequences (e.g. cracking) may occur to Aboriginal heritage sites as a result of subsidence associated with the Modification mine layout.

Potential consequences from subsidence for Aboriginal heritage are assessed in Section 4.9 and Appendix F.

Principal Residences, Farm Dams and other Private Structures

A number of privately-owned rural properties overlie the underground mining area at the Abel Underground Mine. These properties contain principal residences, non-residential building structures (e.g. sheds, garages and greenhouses), dams, fences and other improvements.

Principal Residences

The existing subsidence management commitment for principal residences requires limiting mining operations to first workings only, and ensuring mining causes no subsidence impacts requiring mitigation works (Section 2.3 and Box 1). To achieve this, subsidence control zones have been established for all relevant principal residences, based on the 26.5° angle of draw.

Box 1
Subsidence Management Commitment – Principal Residences

Principal Residence*

Subsidence Management Commitments:

- Limit mining operations to first working beneath principal residences (without agreement from the landowner).
- Ensure that mining causes no subsidence impacts that require mitigation works.
- Subsidence control zone around each principal residence based on 26.5° angle of draw.

Modification Mine Layout:

- No longwall or shortwall mining beneath principal residences (without agreement from the landowner).

* Source: Strata Engineering (2006).

To maintain the existing subsidence management commitment for the principal residences, longwall and shortwall mining would not occur within the 26.5° angle of draw at any principal residence without agreement from the relevant landowner.

There would be no additional potential consequences from subsidence to principal residences due the Modification (Appendix A).

Figure 7 shows shortwall mining in the Upper Donaldson Seam beneath principal residences. This would only occur if an agreement is reached with the relevant landowner (Section 3.3.1). If shortwall mining occurs (i.e. with landowner agreement) beneath these residences, curvatures and strains would be expected to result in structural impacts (e.g. cracking in brickwork and plasterboard, or distortion of lightweight claddings and linings) and tilts would be expected to result in significant serviceability issues (e.g. door swings and issues with roof guttering and site drainage) (Appendix A).

If an agreement with the relevant landowner is not reached, Shortwall Panels 4 to 7 in the Upper Donaldson Seam would be shortened to maintain the subsidence control zone around these principal residences (Section 3.3.1).

Farm Dams and other Private Structures

Approximately 33 farm dams are located within or adjacent to the shortwall areas, including approximately 18 located directly above the shortwall panels (Appendix A). In addition, other private structures (e.g. sheds, garages, greenhouses, fences and private driveways/roads) are located within or adjacent to the longwall and shortwall areas.

Predicted subsidence effects for the farm dams and other private structures associated with the Modification mine layout are similar to those predicted for the approved mine layout (Appendix A). On this basis, no additional consequences from subsidence are predicted due the Modification (Appendix A).

Mitigation measures, management and monitoring relevant to farm dams and other private structures are described in Sections 4.2.6 and 4.3.3.

Other Infrastructure

Appendix A provides a detailed description of the potential consequences of subsidence to infrastructure in the underground mining area for the Abel Underground Mine. Infrastructure with more than 20 mm predicted subsidence associated with the proposed longwall and shortwall mining includes the:

- Blackhill, Taylors and Meredith Roads, and other unsealed public roads;
- Ausgrid 132 kilovolt (kV) power line, and the network of 66 kV and low voltage powerlines servicing residential properties;
- Telstra direct buried optical fibre cable and copper telecommunications cables;
- Black Hill Quarry; and
- Stockrington Quarry.

Predicted subsidence effects associated with the Modification mine layout at the locations of these infrastructure are similar to those predicted for the approved mine plan (Appendix A). On this basis, no additional consequences from subsidence are predicted due the Modification (Appendix A).

Mitigation measures, management and monitoring relevant to infrastructure are provided in Section 4.2.6 and Attachment 3.

Negligible subsidence impacts associated with the Modification are predicted for the F3 Freeway, Hunter Expressway (under construction), TransGrid 330 kV transmission line or disused Richmond Vale Railway corridor (Appendix A).

No longwall or shortwall mining is proposed near the Black Hill School, Black Hill Church or Black Hill Cemetery.

4.2.6 Mitigation Measures, Management and Monitoring

MSEC (2012) considers that the Modification mine layout could be developed to meet the existing subsidence management commitments for the Abel Underground Mine (Section 2.3), which have been developed to protect key natural and built surface features.

Where surface features (e.g. steep slopes and public roads) overlie the longwall and shortwall mining areas, predicted subsidence effects are similar to those predicted for the approved mine layout, and as such, no additional consequences of subsidence for these surface features are predicted (Section 4.2.5).

Existing subsidence mitigation measures, management and monitoring commitments for the Abel Underground Mine would continue for the Modification, including:

- monitoring and regular inspections of Schedule 1 streams, with mitigation and remediation works as required (as detailed in the Surface Water Management Plan);
- specific subsidence monitoring plans for each principal residence (unless an alternative agreement with the landowner is reached), and individual assessments to determine tolerable levels for subsidence parameters (i.e. such that no mitigation works are required due to subsidence);

- management, mitigation and monitoring plans for all other surface structures, implemented prior to mining occurring that could result in potential impacts;
- Dam Monitoring and Management Strategies for all dams, implemented prior to mining occurring that could result in potential impacts;
- management plans to ensure the safety and serviceability of public roads, powerlines, gas pipelines;
- subsidence management measures for the Black Hill and Stockrington Quarries developed in consultation with their respective operators;
- TARPs to ensure public and employee safety in the vicinity of cliffs, rock outcrops and steep slopes;
- provision of alternative (and equivalent) water supplies in the event of interruptions to water supplies due to subsidence impacts on dams, water tank pipelines, water mains and irrigation systems; and
- public safety management programs to ensure public safety in any areas that may be affected by subsidence from the Abel Underground Mine.

A complete list of subsidence management commitments is provided in Attachment 3.

Extraction Plans would be prepared prior to the commencement of mining in each area of the Abel Underground Mine to demonstrate that subsidence management commitments can be achieved.

The existing conditions of the historic workings in the Borehole Seam would be investigated further, prior to the commencement of proposed mining in the underlying areas, as part of the Extraction Plan process.

In the event of any mine subsidence damage to any residential structure (improvement), claims are lodged with the MSB. If the claim is accepted, the MSB would offer repair works or financial compensation, in accordance with the NSW *Mine Subsidence Compensation Act, 1961*.

For mine subsidence damage to improvements not compensable under the *Mine Subsidence Compensation Act, 1961*, Donaldson Coal would provide compensation for any 'compensable loss' experienced by landowners due to underground mining operations associated with the Abel Underground Mine, in accordance with the requirements of the NSW *Mining Act, 1992*.

4.3 LAND RESOURCES AND USES

4.3.1 Background and Existing Environment

The Abel Underground Mine area includes (Figure 2):

- the area south of John Renshaw Drive (i.e. the underground mining area); and
- areas north of John Renshaw Drive, containing the Abel Underground Mine surface infrastructure (Section 2.5) and the Bloomfield Colliery.

Property and mining titles within the Abel Underground Mine area are provided in Project Approval 05_0136 (Attachment 2).

The majority of land in the Abel Underground Mine area is owned by Donaldson Coal, Coal and Allied and the Catholic Diocese of Maitland and Newcastle, with various other private landowners to the south of John Renshaw Drive. Private landholdings are generally rural/residential in nature.

The underground mining area south of John Renshaw Drive consists of low, undulating, vegetated hills with some areas cleared for rural/residential properties.

The major topographic feature of the underground mining area is the ridgeline associated with Black Hill, which runs in an east-west direction. Tributaries of Buttai Creek, Viney Creek/Weakleys Flat Creek and Four Mile Creek drain northwards from this ridgeline. Long Gully/Blue Gum Creek drain from the southern side of the ridgeline eastwards towards Pambalong Nature Reserve.

Cliffs, rock outcrops, steep slopes and gullies are located along sections of the ridge and elsewhere within the underground mining area.

The Abel Underground Mine area north of John Renshaw Drive consists of both vegetated areas and areas disturbed for mining activities.

Agriculture Uses and Rural Land Capability

Land used for livestock grazing occurs in some properties overlying the northern and south-eastern sections of the underground mining area. In addition, a commercial orchard is located in the northern section of the underground mining area.

Regional rural land capability mapping (NSW Department of Environment and Climate Change [DECC], 2009a) is available for the underground mining area. Rural land capability is a method of evaluating the quality of rural land. Rural land capability is an eight class classification system based on assessment of biophysical characteristics categorising land in terms of general limitations such as erosion hazard, climate and slope (Emery, 1985).

The following rural land capability classes are mapped within the underground mining area (Figure 12):

- Class II – suitable for regular cultivation.
- Class IV – suitable for grazing with occasional cultivation.
- Class VI – suitable for grazing with no cultivation.
- Class VII – land best protected by green timber.
- Class VIII – areas incapable of sustaining agricultural or pastoral production (e.g. cliffs).

The Abel Underground Mine area does not include any "regionally significant agricultural land" identified in the Lower Hunter Regional Strategy 2006-31 (DoP, 2006).

Longwall and Shortwall Mining Areas

The Modification would potentially result in impacts to land resources and uses in the longwall and shortwall areas, due to changes in subsidence effects, and associated increased potential for subsidence impacts.

The area overlying the shortwalls in the Upper Donaldson Seam is partially cleared and is used for agricultural purposes (i.e. grazing). Based on regional rural land capability mapping (DECC, 2009a) for the underground mining area, the area overlying the shortwalls in the Upper Donaldson Seam contains Class IV, VI and VII land (Figure 12). Surface lithogies in this area are predominately derived from the Tomago Coal Measures (Pl), including the Dempsey, Four Mile Creek and Wallis Creek Formations (Appendix A).

The area overlying the shortwalls in the Lower Donaldson Seam is largely forested, with the Black Hill Quarry located in the northern section. The majority of the area contains Class VI and VII land, with a small area of Class IV land (Figure 12). Surface lithogies are predominantly derived from the Adamstown (Pna), and Lambton (Pnl) subgroups of the Newcastle Coal Measures (Appendix A).

The area overlying the longwalls in the Lower Donaldson Seam is also largely forested, with the Stockrington Quarry located in the southern section. This area contains Class IV, VI and VII land (Figure 12). Surface lithogies are predominantly derived from the Boolaroo (Pnb) and Adamstown (Pna) subgroups of the Newcastle Coal Measures (Appendix A).

In addition to the quarries described above, other surface infrastructure in the longwall and shortwall mining areas includes public roads, power lines, dams and other non-residential structures (Section 4.2.5).

4.3.2 Environmental Review

Landforms

The existing subsidence management commitment for cliffs would be maintained for the Modification (Box 2), and as such, no additional environmental consequences from subsidence are predicted due to the Modification (Section 4.2.5).

Box 2
Subsidence Management Commitment – Cliffs

Cliffs along Upper Reaches of Long Gully*

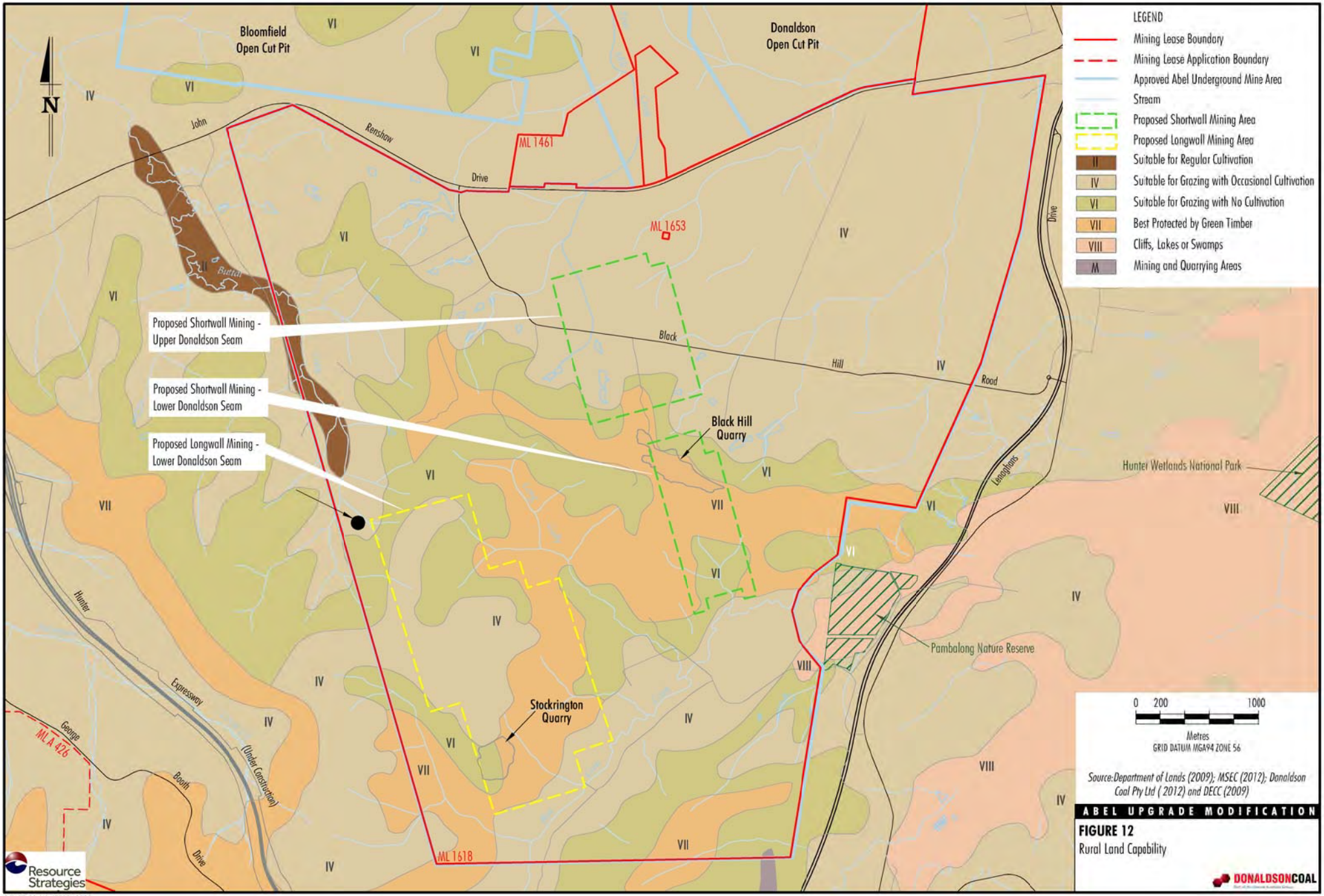
Subsidence Management Commitments:

- Not more than 60% of coal extracted beneath identified cliff areas.

Modification Mine Layout:

- No longwall or shortwall mining beneath identified cliff areas.

* Source: Appendix A.



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Rock outcrops and steep slopes have been identified in the longwall and shortwall areas, and the associated subsidence effects may result in rock fall and slope instability (Section 4.2.5). These are primarily public safety issues (Appendix A). Public safety management measures are described in Section 4.2.6

Soil and Erosion Potential

The Modification may result in increased potential for surface cracking in the longwall and shortwall mining areas (Section 4.2.3), which may lead to soil erosion, particularly on steep slopes.

Measures to mitigate and manage potential impacts to soil resources are described in Section 4.3.3.

Agricultural Land Use

The longwall and shortwall areas contain Class IV, VI and VII land. The commercial orchard in the underground mining area is located outside of the longwall and shortwall areas. On this basis, the longwall and shortwall areas are not considered to contain any highly valuable agricultural lands or resources.

There would be no change to existing subsidence management commitments for the Modification, including those relevant to the management of potential impacts to agricultural land (Section 4.3.3).

Other Land Uses

No additional consequences of subsidence to environmentally significant areas, residences, other private structures and infrastructure are predicted due the Modification, when compared to the approved mine layout (Section 4.2.5). Key subsidence management measures are described in Section 4.2.6.

In the event that subsidence impacts require remediation (e.g. areas of surface cracking), restricted access to these areas may be required while the remediation works take place.

Public safety management plans would be implemented to ensure public safety in any areas that may be affected by subsidence from the Abel Underground Mine (Section 4.2.6).

Bushfire Hazard

The activities associated with the Modification are not expected to increase the potential for bushfires.

Emergency response procedures in the event of bushfire are in place at the Abel Underground Mine, and these procedures would be maintained for the Modification.

Land Contamination

Land contamination could potentially occur at the Abel Underground Mine due to uncontrolled spills, fires and explosions associated with the transport, storage and usage of hydrocarbons and chemicals.

The Modification would involve the continued storage and usage of hydrocarbons and chemicals at the Abel Underground Mine. Mitigation and management measures relevant to land contamination are provided in Section 4.3.3.

Construction of the Downcast Ventilation Shaft and Alterations to Bloomfield U Cut South Void

Construction of the downcast ventilation shaft would require minor clearance (i.e. an area of approximately 0.16 hectares [ha]) of vegetation on land owned by Coal and Allied.

If required, alterations to the Bloomfield U Cut south void to increase tailings storage capacity would involve the clearance of vegetation in a fragmented area between existing disturbed areas associated with the Bloomfield U Cut south void and an internal haulage road.

Potential ecological impacts associated with this clearance are described in Section 4.8, with potential impacts to Aboriginal heritage described in Section 4.9.

4.3.3 Mitigation Measures, Management and Monitoring

Existing mitigation measures, management and monitoring commitments for the Abel Underground Mine would continue for the Modification to manage potential impacts to land resources and uses.

In addition to the subsidence management measures described in Section 4.2.6, the following measures relevant to managing potential impacts to land resources and uses would include:

- remediation (i.e. backfilling or grouting) of surface cracks in creek beds, or other dangerous surface cracks;
- limiting mining beneath the four largest dams on the properties containing the commercial orchard to non-subsiding first workings;

- implementation of a Dam Monitoring and Management Strategy (for all dams), which requires remediation of any dams damaged by subsidence, and the provision of an alternative water supply as required; and
- repair of any damage to fences or irrigation systems.

A complete list of subsidence management commitments is provided in Attachment 3.

In addition, Donaldson Coal would provide compensation for any 'compensable loss' to agricultural land experienced by landowners due to underground mining operations associated with the Abel Underground Mine, in accordance with the requirements of the *Mining Act, 1992*.

Donaldson Coal implements a number of hazard control and mitigation and management measures for the Abel Underground Mine, including those detailed in the Pollution Incident Response Management Protocol.

General measures to reduce the potential for contamination of land include:

- Contractors transporting dangerous goods would be appropriately licensed in accordance with the provisions of the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (National Transport Commission, 2007).
- On-site consumable storage areas would be designed with appropriate bunding and would be operated, where applicable, in compliance with the requirements of Australian Standard 1940:2004 *The Storage and Handling of Flammable and Combustible Liquids*.
- Fuel storage areas would be regularly inspected and maintained.

Investigations would be undertaken at mine closure to identify and remediate any contaminated soil materials in accordance with the requirements of the NSW *Contaminated Land Management Act, 1997*.

4.4 GROUNDWATER

A Groundwater Assessment for the Modification has been prepared by RPS Aquaterra (2012a) and is presented as Appendix B. The Groundwater Assessment was reviewed by Dundon Consulting Pty Ltd (Peter Dundon) and the peer review letter is provided in Attachment 5.

4.4.1 Background and Existing Environment

Peter Dundon and Associates Pty Ltd (PDA) (2006) assessed the potential impacts of the Abel Underground Mine for the Part 3A EA.

Condition 15(a), Schedule 4 of Project Approval 05_0136 for the Abel Underground Mine required further development of the regional and local groundwater model.

In accordance with this condition, Aquaterra (now RPS Aquaterra) developed the Donaldson Regional Groundwater Model (DRGM). Compared to the Abel Underground Mine model, the DGRM incorporated deeper layers and a larger regional extent, including the Bloomfield Colliery operations.

In June 2012, Donaldson Coal lodged the Tasman Extension Project EIS. To assess potential impacts to groundwater associated with the Tasman Extension Project, RPS Aquaterra (2012b) developed the Tasman Extension Project groundwater model, which refined and extended the DRGM.

The groundwater model developed for the Tasman Extension Project formed the basis of the groundwater model used by RPS Aquaterra (2012a) to assess potential impacts to groundwater associated with the Modification and meet the requirements of Condition 15(a), Schedule 4 of Project Approval 05_0136.

Hydrogeological Data

A number of groundwater studies have previously been undertaken by Donaldson Coal, and for other surrounding mining projects, the main studies being:

- groundwater investigations undertaken for the Donaldson Open Cut Coal Mine in 1998 (PPK Environmental and Infrastructure, 1998; Mackie Environmental Research, 1998);
- hydrogeological studies undertaken for the existing Tasman Underground Mine in 2002 (PDA, 2002);
- groundwater investigations undertaken for the Abel Underground Mine in 2006 (PDA, 2006);
- groundwater investigations undertaken for the Bloomfield Colliery in 2008 (Aquaterra, 2008); and
- hydrogeological studies undertaken for the Tasman Extension Project in 2012 (RPS Aquaterra, 2012b).

As part of these studies, numerous groundwater monitoring bores were installed and core samples collected. Many of these groundwater monitoring bores were maintained and form part of an ongoing monitoring network in the Abel Underground Mine region (Appendix B). Previous studies also included hydraulic conductivity testing of core samples from the Abel Underground Mine region (Appendix B).

RPS Aquaterra (2012b) analysed data from the previous studies for the Groundwater Assessment prepared for the Tasman Extension Project EIS, and this data was used in the ongoing development of the groundwater model for the Modification (Appendix B).

Hydrogeological Regime

Two distinct aquifer systems are known to occur within the Abel Underground Mine area (Appendix B):

- fractured rock aquifer systems in the coal measures, with groundwater flow occurring mainly in the coal seams; and
- shallow aquifer systems in the alluvium associated with swamp, floodplain and estuarine sediments along the Wallis Creek and Hunter River systems and their tributaries, with flow patterns similar to surface flows.

Groundwater levels in the alluvium are closely related to topography, with flow patterns broadly similar to the surface flow patterns. Recharge occurs by rainfall infiltration, and flows down gradient towards the local surface drainages.

In the most elevated areas, alluvium is absent, and the regolith is unsaturated. Occasional localised perched groundwater is found in the colluvium and weathered bedrock zone in lower-lying areas along creek lines (Appendix B).

Groundwater levels in the strata of the deeper Permian coal measures have a more regional pattern, and are controlled by topographic elevations in areas where the coal seams outcrop or subcrop and receive recharge, with the discharge zones to the east beneath the Hunter River estuary. Groundwater flows down gradient from the recharge zones towards the discharge areas, with a generally south-easterly flow direction (Appendix B).

There is very little or no vertical flow across the bedding from shallow to deeper strata under natural conditions. Flow is predominantly parallel to the bedding, and occurs mostly within the more permeable coal seams (Appendix B).

Groundwater Quality

Groundwater quality has been monitored at the Abel Underground Mine and Donaldson Open Cut Mine, and elevated salinity is found within much of the Permian coal measures aquifer system, with groundwater salinity ranging from less than around 600 microSiemens per centimetre (µS/cm) electrical conductivity (EC) in the more permeable coal seams to more than 16,000 µS/cm EC within some of the less permeable overburden/interburden units (Appendix B).

Groundwater Monitoring Program

A broad network of groundwater monitoring piezometers has been installed through previous monitoring and investigation programs for the Abel and Tasman Underground Mines, Donaldson Open Cut Mine and Bloomfield Colliery (Figure 13).

Groundwater monitoring for the Abel Underground Mine is conducted in accordance with the existing Groundwater Management Plan (included in the Water Management Plan) for the Abel Underground Mine (Section 2.13).

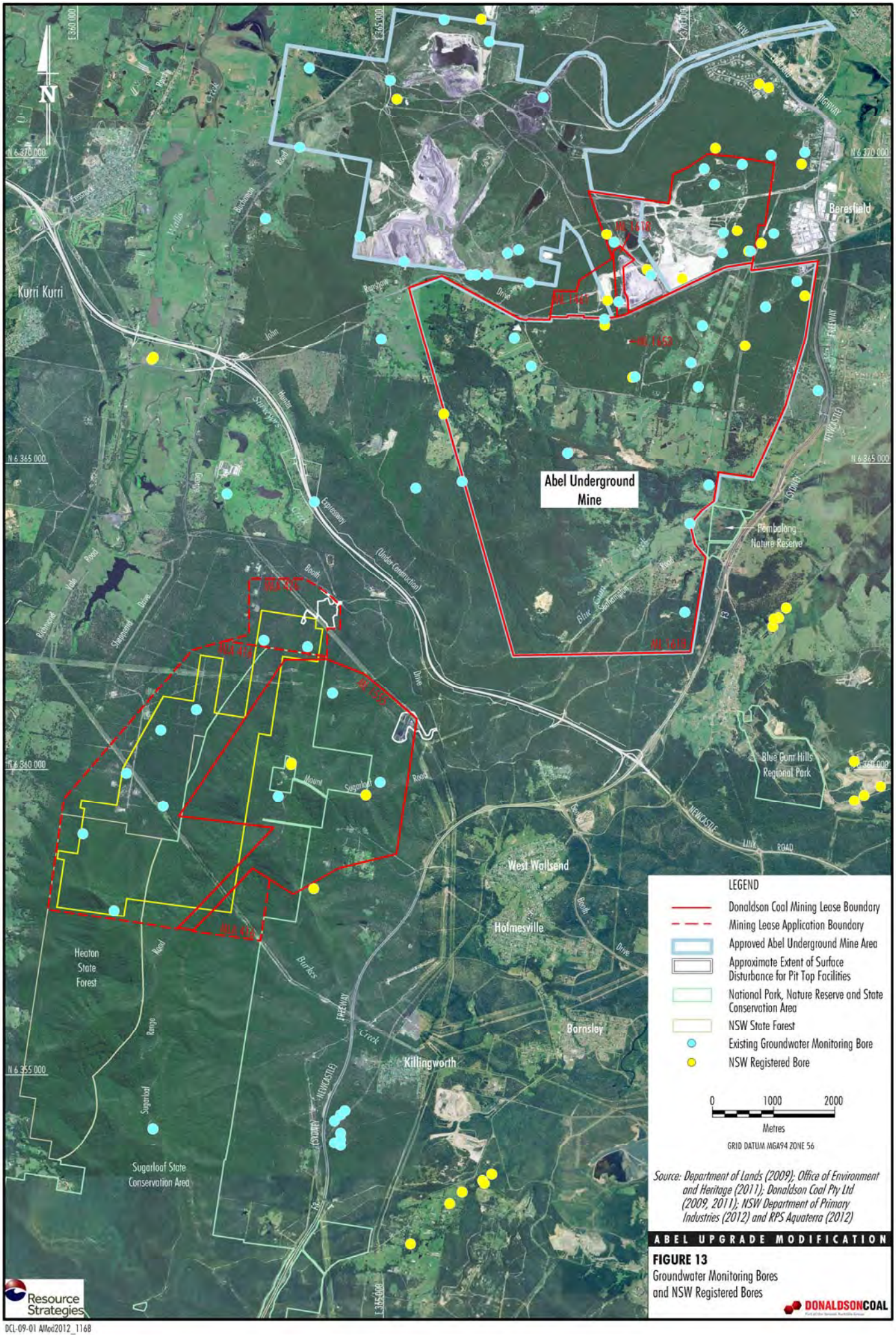
4.4.2 Environmental Review

Groundwater Prediction Methodology

The groundwater model for the Modification (Section 4.4.1) uses the MODFLOW-SURFACT modelling package. This was used to assess potential impacts to groundwater associated with the Modification.

The groundwater model for the Modification was first calibrated against quasi 'steady state' pre-mining conditions, and then subject to a transient calibration to groundwater levels, baseflows and mine inflows from 2006 to 2012. Calibration statistics are provided in Appendix B and comply with relevant groundwater modelling guidelines.

The groundwater model was used to predict the incremental impacts of the Modification mine layout (i.e. additional groundwater impacts compared to the approved impacts associated with approved mine layout). To enable this, the groundwater model was run separately for the approved mine layout and the Modification mine layout. By subtraction, the predicted impacts associated with the Modification in isolation were identified (Appendix B).



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Groundwater Inflows

The groundwater inflows to mining areas are predicted to increase during the Modification, reaching a maximum of 6.3 million litres per day in 2015 (Appendix B). These groundwater inflows are absolute (i.e. as opposed to incremental).

Groundwater inflow volumes would be licensed in accordance with the requirements of the *Water Act, 1912*. Management of groundwater inflows is described in Section 3.3.7.

Potential Impacts

Groundwater Levels – Mining

At the end of mining, the Modification is predicted to result in very limited groundwater drawdown in alluvium in the Abel Underground Mine area compared to the minor drawdown predicted for the approved mine layout. The maximum predicted increase in groundwater drawdown in the alluvium associated with the Modification is predicted to be approximately 1 m. The alluvium is predicted to remain partially saturated (Appendix B).

The Modification mine layout has been designed to maintain the existing subsidence management commitments regarding the alluvium associated with Blue Gum Creek (Box 3) (Section 4.2.5).

Groundwater Level Impacts – Post-Mining

Recovery of groundwater levels was assessed for 100 years following the completion of mining at the Abel Underground Mine (Appendix B).

There is predicted to be an insignificant effect to groundwater levels in the alluvium post-mining (Appendix B)

Stream Baseflows

The Modification mine layout has been designed to maintain the existing subsidence management commitments for the Abel Underground Mine regarding Schedule 2 (i.e. 3rd order and above) streams (Section 4.2.5).

The Modification is predicted to result in very limited (i.e. less than 1 cubic metre per day) incremental changes in stream baseflow to/from all streams in the Abel Underground Mine area compared to the stream baseflow changes predicted for the approved mine layout (Appendix B).

No impacts to stream baseflows due to the Modification are predicted post-mining (Appendix B).

Box 3
Subsidence Management Commitment – Blue Gum Creek Alluvium

Blue Gum Creek*

Subsidence Management Commitments:

- Limit mining operations to first working beneath Blue Gum Creek alluvium.
- Ensure that mining causes no subsidence impacts that require mitigation works.
- A minimum 40 m barrier between the 20 mm line of subsidence and the limit of the alluvium boundary.

Modification Mine Layout:

- No longwall or shortwall mining beneath the Blue Gum Creek alluvium.

* Source: Appendix A.

Groundwater Dependent Ecosystems

The following areas within or adjacent to the Abel Underground Mine area could support Groundwater Dependent Ecosystems (GDEs) (Appendix B) (Figures 7 and 8):

- the rainforest areas (Section 4.2.5) within the Abel Underground Mine area;
- swamps located within the alluvium associated with Long Gully and Blue Gum Creek;
- Pambalong Nature Reserve; and
- Hexham Swamp.

The Modification mine layout has been designed to maintain the existing subsidence management commitments for the Abel Underground Mine regarding rainforest areas, Schedule 2 streams (including Long Gully) and Blue Gum Creek alluvium (Section 4.2.5).

Impacts associated with the Modification on flows and groundwater levels in the alluvium within the Abel Underground Mine area are predicted to be insignificant, both during mining and post-mining (Appendix B).

Consequently, RPS Aquaterra (2012a) considers it highly unlikely the Modification would result in any additional impact on GDEs in comparison to the approved Abel Underground Mine.

Groundwater Users

Figure 13 shows the location of registered groundwater bores.

All non-mine owned registered groundwater bores are located outside the extent of predicted drawdown effects from mining at the Abel Underground Mine, including for the Modification. Therefore, no impacts to groundwater users are predicted (Appendix B).

4.4.3 Mitigation Measures, Management and Monitoring

A Groundwater Monitoring Program is already in place for the Abel Underground Mine, as detailed in the existing Water Management Plan.

The existing monitoring network would be maintained and expanded for the Modification to include (Appendix B):

- Monitoring of the inflow rate and water quality (EC, total dissolved solids [TDS] and pH) of groundwater inflows.
- Regular monthly measurement of groundwater levels/pressures within all vibrating wire piezometers and standpipes.
- Quarterly sampling of all standpipe piezometers, for laboratory analysis of EC, TDS and pH.
- Annual collection of water samples from all standpipe piezometers for laboratory analysis of a broader suite of parameters including physical properties (EC, TDS and pH), major cations and anions, nutrients and dissolved metals.
- Installation of additional multi-level piezometers located:
  - to the north and west of Pambalong Nature Reserve, to provide additional data on groundwater pressures in the intervening strata between the Donaldson seams and the alluvium (supplementing the existing data from piezometers C081A and B and C082);
  - at three sites between the F3 Freeway and the lease boundary, to provide additional data on groundwater pressures in the intervening strata between the Donaldson Seams and the Hexham Swamp alluvium; and
  - near the western and southern boundaries of ML 1618 to provide additional information on groundwater pressures at various depths in this area, and to provide information on the current status of groundwater in the Borehole Seam near the former workings.

The existing Groundwater Monitoring Program would be updated for the Modification.

4.5 SURFACE WATER

A Surface Water Impact Assessment Review has been prepared by Evans and Peck (2012) and is presented as Appendix C to the EA.

4.5.1 Background and Existing Environment

An assessment of potential impacts to surface water features was conducted for the Part 3A EA.

Impacts to streams and catchments associated with the surface infrastructure required for the Abel Underground Mine (Section 2.5) were predicted to be negligible.

In addition, negligible impacts to Schedule 2 (i.e. 3rd order and above) streams were predicted given the subsidence management commitment to limit mining to first workings only (i.e. to ensure mining does not cause subsidence impacts requiring remediation).

As mining would occur beneath Schedule 1 (i.e. 1st and 2nd order) streams, some impacts were predicted, including increased ponding and cracking and minimal changes in bed slope. Monitoring and remediation commitments were outlined in the Part 3A EA to mitigate potential impacts to Schedule 1 streams.

Surface Water Catchments

The underground mining area lies across the headwaters of the following creek systems (Appendix C):

- Four Mile Creek and Viney Creek, which drain in a northerly direction to the Hunter River floodplain to the west of Hexham;
- Blue Gum Creek and its tributary Long Gully, which drain to the Hexham Swamp via the Pambalong Nature Reserve; and
- Buttai Creek, which drains in a north-westerly direction to join Wallis Creek and drain to the Hunter River near Maitland.

Surface Water Monitoring

Surface water monitoring (i.e. flow gauging, water quality monitoring and macroinvertebrate monitoring) for the Abel Underground Mine is currently conducted at a number of sites on Four Mile Creek, Long Gully, Blue Gum Creek, Viney Creek and Buttai Creek, as well as at the Pambalong Nature Reserve.

These monitoring sites form part of a broader network, as detailed in the Abel Underground Coal (Integrated with Donaldson Open Cut, Tasman Underground and Bloomfield Open Cut Coal Mines) Integrated Environmental Monitoring Program.

Surface water monitoring for the Abel Underground Mine is conducted in accordance with the existing Surface Water Monitoring Plan (included in the Water Management Plan) for the Abel Underground Mine (Section 2.13).

Existing Compliance

The Abel Underground Mine currently operates in accordance with the consent conditions relating to surface water in Project Approval 05_0136. In November 2011, an Independent Environmental Audit was conducted by Trevor Brown & Associates (2011) for the Abel Underground Mine. In regard to surface water, the Independent Environmental Audit concluded:

> *The surface water monitoring results have not indicated that the Abel Project has influenced the surface water quality at the locations sampled during the 2008 to 2011 period. The surface water monitoring program appears to be adequate to assess surface water quality in the vicinity of the underground mining activities…*

4.5.2 Environmental Review

Surface Infrastructure

There would be limited additional surface infrastructure required for the Modification, and as such, no additional impacts to surface water are expected.

Notwithstanding, the protocols detailed in the existing Erosion and Sediment Control Plans would be implemented for any additional construction works required for the Modification.

Potential Impacts to Catchments and Streams from Subsidence

Subsidence effects may lead to potential impacts to catchments and streams (e.g. cracking, which could provide a pathway for loss of water from the catchment or creek channels, or changes in pooling, which could lead to a change in the seepage and evaporation loss).

MSEC (2012) concludes that changes in subsidence for the Modification mine layout (i.e. in comparison to predicted subsidence associated with the approved mine layout) would only occur in the longwall and shortwall mining areas.

The existing subsidence management commitments for Schedule 2 streams would be maintained for the Modification (Box 4). As such, there would be no additional impacts to Schedule 2 streams associated with the Modification in comparison to the approved mine layout.

Longwall and shortwall mining would occur beneath Schedule 1 streams. However, the approved mine layout included mining beneath these steams, and as such, the full range of subsidence effects and associated impacts (e.g. cracking) were predicted for the approved mine layout (Appendix A).

Potential consequences from subsidence to Schedule 1 streams would include ponding, flooding, scouring, fracturing, bulking and dilation of bedrock, and diversion of surface water flows.

However, as predicted tilts and curvatures associated with the Modification mine layout are similar to, or less than, those predicted for the approved mine layout, no additional consequences to Schedule 1 streams are predicted (Appendix C).

Box 4
Subsidence Management Commitment – Schedule 2 Streams

Viney Creek – Schedule 2 Stream*

Subsidence Management Commitments:

- Limit mining operations to first working beneath Schedule 2 streams.
- Ensure that mining causes no subsidence impacts that require mitigation works.
- A minimum 40 m barrier between the 20 mm line of subsidence and the bank of any Schedule 2 stream.

Modification Mine Layout:

- No longwall or shortwall mining beneath Schedule 2 streams.

* Source: Appendix A.

Flow Regime

The Modification is predicted to result in very limited (i.e. less than 1 cubic metre per day) incremental changes in baseflow to/from any of the streams in the Abel Underground Mine area compared to the baseflow changes predicted for the approved mine layout (Appendix B).

These changes in baseflow would not lead to any measurable additional change to the flow regime of any of the streams draining from the Abel Underground Mine area (Appendix C).

Water Quality

The surface water management system for the Modification would not require any change to the existing approved licensed discharge limits specified in Donaldson Coal's EPL No. 11080.

On this basis, Evans and Peck (2012) concludes the Modification would not result in additional impacts to surface water quality compared to those approved for the Abel Underground Mine.

4.5.3 Mitigation Measures, Management and Monitoring

Existing mitigation measures, management and monitoring commitments for the Abel Underground Mine relevant to surface water would continue for the Modification.

This includes the monitoring and regular inspections of streams, and their associated catchment land surface, with mitigation and remediation works undertaken as required (as detailed in the existing Water Management Plan).

The site water balance for the Abel Underground Mine would be reviewed on a six-monthly basis to monitor the performance of the water management system based on actual groundwater inflows, tailings production rates and the available capacity of existing storages.

If required, augmentations to the water management system would be implemented to ensure no discharge outside of the limits specified in EPL No. 11080 occurs.

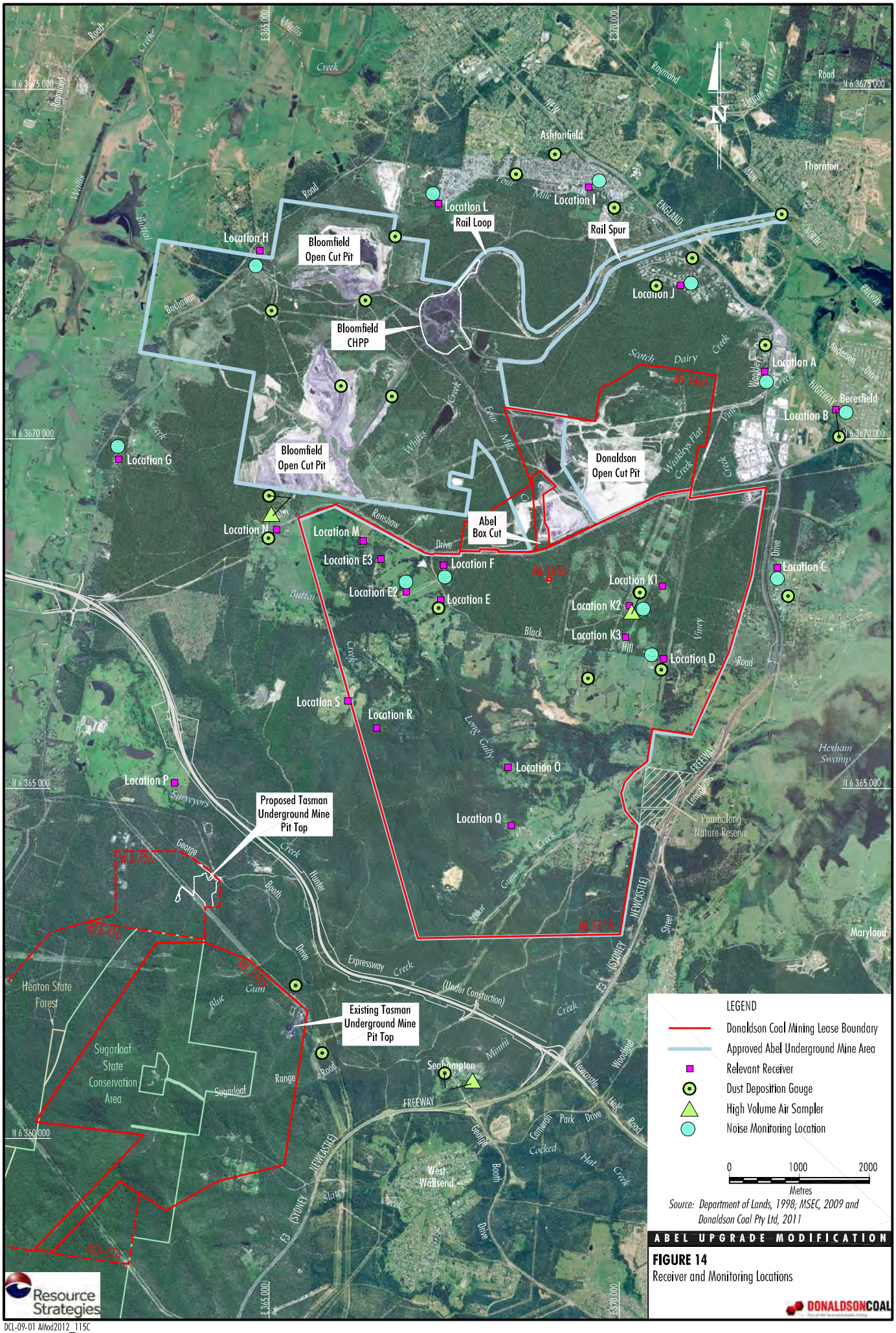
4.6 NOISE AND VIBRATION

A Noise and Blasting Assessment has been prepared for the Modification by SLR Consulting Australia Pty Ltd (SLR Consulting) (2012) and is presented as Appendix D to the EA.

4.6.1 Background and Existing Environment

Heggies Australia Pty Ltd (Heggies) (2006) assessed the potential noise impacts of the Abel Underground Mine for the Part 3A EA. The study assessed potential construction, operational, cumulative and rail transport noise impacts at relevant receiver locations.

Operational noise levels were predicted to meet the Project-specific noise criteria at all receiver locations under prevailing weather conditions with the exception of Location K2 (Figure 14) where an exceedance of 1 A-weighted decibel (dBA) was predicted during prevailing north-west winds. The operational noise limits in Project Approval 05_0136 reflect the results of this operational noise modelling.



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SLR Consulting (2011) conducted an additional noise assessment for the upcast ventilation shaft modification (05_0136 Mod 2) in 2011. The modification (05_0136 Mod 1) for the downcast ventilation shaft did not require a noise assessment as no fan or other machinery is located at the surface, and therefore, no noise is associated with its operation.

Noise Limits

Noise limits at relevant receiver locations for the Abel Underground Mine are detailed in Condition 23, Schedule 4 of Project Approval 05_0136.

Noise Monitoring Program

In accordance with the requirements of Project Approval 05_0136, a Noise Monitoring Program was established for the Abel Underground Mine in 2007, which forms part of the Abel Underground Coal (Integrated with Donaldson Open Cut, Tasman Underground and Bloomfield Open Cut Coal Mines) Integrated Environmental Monitoring Program. This integrated monitoring network consists of attended monitoring at 12 locations representative of the nearest residential areas (Figure 14).

In addition to attended monitoring, unattended noise monitoring occurs at four locations.

Operator-attended noise monitoring has indicated that the existing noise environment is dominated by road noise, including from the following major roads and highways (Appendix D):

- John Renshaw Drive;
- New England Highway;
- F3 Freeway; and
- Weakleys Drive.

Existing Compliance

Abel Underground Mine currently operates in accordance with the consent conditions relating to noise in Project Approval 05_0136. In November 2011, an Independent Environmental Audit was conducted by Trevor Brown & Associates (2011) for the Abel Underground Mine. In regard to noise, the Independent Environmental Audit concluded:

> *Abel Project mine operations are inaudible at the locations nominated in Project Approval Schedule 4 condition 23. The noise survey results therefore indicate that the Abel Project noise contribution to the noise experienced at receivers would not exceed the specified criteria and are therefore in compliance with the Project Approval.*

No complaints relating to noise from the Abel Underground Mine have been received to date.

Existing Noise Controls

Noise controls implemented at the Abel Underground Mine include (Appendix D):

- partial enclosure and noise screening of drives and conveyors at the Bloomfield CHPP;
- surface vehicles equipped with reversing quackers; and
- horizontal discharge of the upcast ventilation shaft, with orientation of the fan directed towards the north-west (i.e. away from the closest residential receivers).

4.6.2 Environmental Review

Summary of Changes Relevant to Noise Impacts

Aspects of the Modification that would potentially result in changes to noise impacts associated with the Abel Underground Mine include (Appendix D):

- increased ROM coal from the Abel Underground Mine and the Tasman Underground Mine transported to the Bloomfield CHPP;
- modifications and upgrades to the Bloomfield CHPP, including an additional CHPP module and associated feed and product conveyor systems;
- increased rail loadout and transport of product coal;
- increased quantity of coarse rejects from the Bloomfield CHPP transported to the Bloomfield Colliery for disposal; and
- construction of the downcast ventilation shaft.

The cessation of mining at the Donaldson Open Cut Mine would also reduce potential noise impacts in the Abel Underground Mine area.

Noise Impact Assessment

SLR Consulting (2012) modelled the following operational scenarios to assess potential noise impacts from the Modification:

- Scenario 1 - total operational noise emissions, with ROM coal from the Abel Underground Mine and the Tasman Underground Mine transported via trucks to the Bloomfield CHPP.

- Scenario 2 - total operational emissions, with ROM coal from the Abel Underground Mine transported via the overland conveyor, and ROM coal from the Tasman Underground Mine transported via trucks, to the Bloomfield CHPP.

Sound power levels (SWLs) of the plant were based on those modelled by SLR Consulting (2006), with changes made to reflect the Modification and the mitigation measures implemented at the Abel Underground Mine (Section 4.6.1).

The noise modelling involved an iterative review of potential noise mitigation measures. As a result of this review, the following at-source operational noise controls would be adopted (Appendix D):

- the additional CHPP module would be mitigated such that SWLs would be equal to (or less) than that of the existing module; and
- the additional breaker at the Bloomfield CHPP would be mitigated such that SWL would be at or below the existing breaker.

Potential Impacts

Operational Noise

With the adoption of the noise mitigation measures listed above, it was predicted that operational noise would not exceed the operational noise limits specified in Project Approval 05_0136 at any relevant receiver location for either Scenario 1 or Scenario 2 (Appendix D).

Tabulated results for each receiver for day, evening and night periods under calm and prevailing meteorological conditions (including F class temperature inversions during the night) are provided in Appendix D.

Cumulative Noise

Existing and proposed mining operations in the vicinity of the Abel Underground Mine include the Bloomfield Colliery, Donaldson Open Cut Mine and the Tasman Underground Mine.

Given the distance that separates the Tasman and Abel Underground Mines (approximately 7.5 km), cumulative noise impacts from these mines are expected to be negligible (Appendix D).

The cumulative impacts of the Modification and the Bloomfield Colliery are predicted to comply with the relevant amenity criteria set in accordance with the NSW *Industrial Noise Policy* (EPA, 2000) at all relevant receiver locations (Appendix D).

The Donaldson Open Cut Mine is scheduled to cease operations at the end of 2013 (i.e. prior to the commencement of operational changes associated with the Modification).

Construction Noise

The construction activities associated with the Modification are described in Section 3.2.

No exceedances of the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) construction noise goals were predicted at any relevant receiver location for the construction activities associated with the modifications and upgrades to the Bloomfield CHPP.

In addition, no exceedances of the ICNG construction noise goals or operational noise limits were predicted at any relevant receiver location when construction activities for the modifications and upgrades to the Bloomfield CHPP and approved overland conveyor were considered cumulatively with operational noise (Appendix D).

Construction of the downcast ventilation shaft would involve 24 hour per day 'raise bore' drilling operations in a fully enclosed acoustic shed (Section 3.2.2). In addition, construction activities would involve the clearance and minor earthworks, which would occur during the daytime only (Section 3.2.2).

No exceedances of the ICNG construction noise goals during the evening or night periods (i.e. 6.00 pm to 7.00 am) were predicted at any relevant receiver location for the drilling operations (Appendix D).

However, construction activities are predicted to exceed the ICNG noise goals during the daytime (i.e. 7.00 am to 6.00 pm) at the closest two receiver locations (R and S [Figure 14]) (Appendix D). Construction noise levels are predicted to be below the ICNG highly affected noise level of 75 dBA at all receiver locations. Construction noise associated with the downcast ventilation shaft would be managed through the implementation of the following mitigation methods:

- full enclosure of drilling activities in a temporary acoustic shed (Plate 3);
- construction workers to undergo briefings in regard to using equipment in ways that minimise noise; and
- ensure that equipment is appropriately maintained and turned off when not in use.

Note: The temporary acoustic shed used for the construction of the proposed downcast ventilation shaft would be fully enclosed on all sides.

Plate 3: Temporary Acoustic Shed (used during Drilling of the Existing Downcast Ventilation Shaft)

In addition, Donaldson Coal would consult with potentially affected landowners, notifying them of the timing and duration of construction activities at least six months prior to commencement (expected in 2015).

There would be no noise impacts associated with the operation of the downcast ventilation shaft, as there would be no fan or other machinery at the surface.

Rail Noise

Peak daily rail movements would increase up to 12 daily rail movements (six dispatches) per day on the Bloomfield rail loop during the life of the Modification (Section 3.3.5). Noise associated with peak daily rail movements has been conservatively compared to noise associated with approved average daily movements (i.e. an average of three to six rail movements per day) (Appendix D).

The increase in rail traffic on the Bloomfield rail loop is predicted to increase the existing daytime equivalent continuous noise level ($L_{Aeq[15\ hour]}$) and existing night $L_{Aeq(9\ hour)}$ rail noise level by less than 0.1 dBA. This increase is negligible and such an increase would not be discernible by receivers near the rail line (Appendix D).

4.6.3 Mitigation Measures, Management and Monitoring

In addition to the mitigation measures currently implemented at the Abel Underground Mine (Section 4.6.1), the mitigation measures identified as part of the noise assessment (Section 4.6.2) would be implemented for the Modification.

The existing Noise Monitoring Program currently includes monitoring at all relevant receiver locations and would be maintained for the Modification. Given there would be no change in the location of operational noise sources and no additional operational impacts are predicted, the existing Noise Monitoring Program is considered by SLR Consulting (2012) to be suitable for the Modification.

4.7 AIR QUALITY

An Air Quality and Greenhouse Gas Assessment has been prepared for the Modification by Todoroski Air Sciences and is presented as Appendix E to the EA.

4.7.1 Background and Existing Environment

The potential air quality impacts of the Abel Underground Mine were assessed in the Part 3A EA by Holmes Air Sciences (Holmes Air Sciences, 2006). The assessment accounted for potential Modification-only impacts, and the potential cumulative impacts of the Modification with other mining operations and non-mining background sources. It was predicted operations at the Abel Underground Mine would comply with relevant air quality criteria at all relevant receiver locations.

Air Quality Criteria

Concentrations of Suspended Particulate Matter

Surface handling activities associated with the existing Abel Underground Mine (and Bloomfield CHPP) have the potential to generate particulate matter (i.e. dust) in the form of:

- Total suspended particulate (TSP) matter, which refers to all suspended particles in the air and are typically less than 30 to 50 micrometres (µm) in aerodynamic diameter.
- Particulate matter with an equivalent aerodynamic diameter of 10 µm or less (PM_{10}) (a subset of TSP).
- Particulate matter with an equivalent aerodynamic diameter of 2.5 µm or less ($PM_{2.5}$) (a subset of TSP and PM_{10}).

Impact assessment criteria for concentrations of PM_{10} and TSP are specified in Condition 25, Schedule 4 of Project Approval 05_0136. These criteria are consistent with those specified in the *Approved Methods for the Modelling Assessment of Air Pollutants* (Approved Methods).

The Approved Methods do not specify criteria for $PM_{2.5}$. However, the DGRs for the Modification require the assessment of $PM_{2.5}$. As such, Todoroski Air Sciences (2012) has assessed potential impacts associated with $PM_{2.5}$ emissions against the advisory standards specified in the *National Environment Protection (Ambient Air Quality) Measure* (Ambient Air-NEPM).

Relevant health based air quality criteria, as specified in the Approved Methods (DEC, 2005a) and Ambient Air-NEPM, are provided in Table 9.

Table 9
OEH Criteria and Ambient Air-NEPM Advisory Standards for Particulate Matter Concentrations

Pollutant	Averaging Period	Criteria ($\mu g/m^3$)
TSP	Annual mean	90
PM_{10}	24 hour maximum	50
	Annual mean	30
$PM_{2.5}$*	24 hour maximum	25
	Annual mean	8

Source: After Appendix E.

* Advisory Standard.

$\mu g/m^3$ = micrograms per cubic metre.

Dust Deposition

Particulate matter has the potential to cause nuisance (amenity) effects when it is deposited on surfaces. The amenity criteria for the maximum increase in dust deposition and maximum total dust deposition, as specified by the Approved Methods (DEC, 2005a) and consistent with the air quality impact criteria specified in Project Approval 05_0136, are provided in Table 10.

Table 10
OEH Criteria for Dust (Insoluble Solids) Deposition

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level (g/m^2/month)	Maximum Total Deposited Dust Level (g/m^2/month)
Deposited Dust	Annual	2	4

Source: After Appendix E.

g/m^2/month = grams per square metre per month.

Other Legislative Considerations

Protection of the Environment Operations Act, 1997

Donaldson Coal's EPLs 11080 and 12856, issued under Chapter 3 of the NSW *Protection of the Environment Operations Act, 1997*, specify air quality monitoring requirements.
In addition, the *Protection of the Environment Operations (Clean Air) Regulation, 2010* prescribes requirements for domestic solid fuel heaters, control of burning, motor vehicle emissions and industrial emissions (e.g. Volatile Organic Carbons). Motor vehicle emissions would be addressed by regular maintenance of all vehicles at the Abel Underground Mine, as per Donaldson Coal's existing EPL requirements.

Action for Air

In 1998, the NSW Government implemented the *Action for Air,* a 25 year air quality management plan for Sydney, Wollongong and the Lower Hunter. The aims of the *Action for Air* include meeting the national air quality standards for six pollutants (i.e. PM_{10}, carbon monoxide, nitrogen dioxide, sulphur dioxide, lead and ozone) identified in the Ambient Air-NEPM.

The main pollutant relevant to the Modification is PM_{10}. The Modification generally addresses the aims of the *Action for Air* by quantitatively assessing potential impacts against the 24 hour PM_{10} criterion in Table 9, which is consistent with the standard in the Ambient Air-NEPM.

Air Quality Monitoring Program

In accordance with the requirements of Project Approval 05_0136, an Air Quality Monitoring Program for the Abel Underground Mine was established in 2007, which forms part of the Abel Underground Coal (Integrated with Donaldson Open Cut, Tasman Underground and Bloomfield Open Cut Coal Mines) Integrated Environmental Monitoring Program.

The integrated monitoring network includes high volume air samplers and dust deposition gauges. The locations of air quality monitoring sites are shown on Figure 14.

Existing Compliance

Abel Underground Mine currently operates in accordance with consent conditions relating to air quality described in Project Approval 05_0136. In November 2011, an Independent Environmental Audit was conducted by Trevor Brown & Associates for the Abel Underground Mine. In regard to air quality, the Independent Environmental Audit concluded:

> *The dust monitoring results for 2008 to 2011 have demonstrated compliance with the air quality criteria in Project Approval Schedule 4 condition 25 for dust deposition, TSP and PM_{10} …*
>
> *...*
>
> *… The Air Quality Monitoring Program and management of operations in relation to dust generation are considered to be adequate for the management for air quality in the vicinity of the Abel Project.*

Existing Air Quality Environment

Air quality monitoring data is provided in Appendix E. This air quality monitoring data has been used to assess the potential impacts of the Modification cumulatively with background sources (Section 4.7.2).

Existing Air Quality Management Measures

The following air quality mitigation and management measures are currently implemented at the Abel Underground Mine:

- access roads and storage areas are sealed (i.e. to minimise dust generation);
- a dedicated water truck is used on disturbed and unpaved areas, and the internal sealed haul route to the Bloomfield CHPP;
- water sprays are used on coal stockpiles;
- daily site inspections are conducted by the Environmental Manager to check the implementation and effectiveness of dust management at the site operations; and
- all mobile equipment is maintained in good working order to reduce exhaust fumes.

4.7.2 Environmental Review

Summary of Changes Due to the Modification

Aspects of the Modification that would potentially result in changes to air quality impacts associated with the Abel Underground Mine include:

- increased ROM coal from the Abel Underground Mine and the Tasman Underground Mine transported to the Bloomfield CHPP;
- modifications and upgrades to the Bloomfield CHPP, including an additional CHPP module and associated feed and product conveyor systems;
- increased rail loadout and transport of product coal; and
- increased quantity of coarse rejects from the Bloomfield CHPP transported to the Bloomfield Colliery for disposal.

Air Quality Assessment

Potential air quality impacts associated with the Modification were assessed for the year representing maximum ROM coal production and processing at the Bloomfield CHPP.

Two operational scenarios (at maximum ROM coal production) were considered (Appendix E):

- Scenario 1 (hauling scenario) – continued transport of ROM coal from the Abel Underground Mine to the Bloomfield CHPP by haul truck along internal, sealed roads.
- Scenario 2 (conveyor scenario) – transportation of ROM coal from the Abel Underground Mine to the Bloomfield CHPP via the approved overland conveyor would replace the haul trucks.

Potential impacts were predicted using air dispersion modelling, using the CALPUFF model (Appendix E).

The Air Pollution Model (TAPM) and CALMET models were used to generate the meteorological modelling input for the air dispersion model (Appendix E).

Potential Impacts

Modification Only

No exceedances of relevant OEH air quality criteria for PM_{10} (annual and 24-hour average), TSP and dust deposition were predicted at any of the relevant receiver location due to the operation Abel Underground Mine, inclusive of the activities associated with the Modification (Appendix E)

No exceedances of the advisory standards for $PM_{2.5}$ were predicted at any relevant receiver location (Appendix E).

Tabulated results for each receiver location, as well as contour diagrams, are provided in Appendix E.

Cumulative

The cumulative operations of the Modification, Bloomfield Colliery and other background sources were not predicted to result in exceedances of the OEH annual average criteria for PM_{10}, TSP or dust deposition at any relevant receiver location (Appendix E).

Potential impacts associated with the Bloomfield Colliery were included in the dispersion modelling, based on the emissions inventory for the Bloomfield Colliery presented in PAEHolmes (2010) (Appendix E).

Contributions from other background sources were estimated based on the results of air quality monitoring data (Appendix E). The monitored levels include the contributions of existing mining operations at the Abel Underground Mine, Bloomfield Colliery and Donaldson Open Cut Mine.

As such, this would potentially result in some double counting of cumulative impacts, as the contributions from existing operations Abel Underground Mine and Bloomfield Colliery were also modelled, and the Donaldson Open Cut Mine would cease operations prior the operational changes to the Abel Underground Mine associated with the Modification.

It was predicted that the Modification could successfully operate without resulting in any additional exceedances of the OEH 24 hour average PM_{10} criterion at any relevant receiver location (i.e. non-mining background sources may still result in exceedances) (Appendix E).

Tabulated results for each receiver location are provided in Appendix E.

Rail Transport

Product coal from the Bloomfield CHPP would be transported via rail to the Port of Newcastle and other customers. During the transport of product coal, there is the potential for the generation of coal dust emissions.

Site specific product coal testing was conducted for the Modification to determine the relative dustiness of the product coal produced at the Bloomfield CHPP.

Based on the site specific product coal testing, and the results of other studies conducted to assess potential air quality impacts from coal transport by trains, Todoroski Air Sciences (2012) concluded there was no potential for the Modification to result in adverse health impacts due to coal dust emissions from trains inside or outside of the rail corridor when assessed against relevant air quality criteria. In addition, there would be no potential for the Modification to result in adverse impacts to amenity outside the rail corridor when assessed against dust deposition guideline levels (Appendix E).

Construction

No impacts to air quality associated with construction activities for the Modification are predicted (Appendix E).

4.7.3 Mitigation Measures, Management and Monitoring

Existing mitigation and monitoring measures implemented at the Abel Underground Mine would be maintained and are considered by Todoroski Air Sciences (2012) to be suitable for the management of potential air quality impacts for the Modification.

4.8 ECOLOGY

A review of potential ecological impacts associated with the Modification was conducted by Hunter Eco (2012) and is presented as Appendix I to the EA.

4.8.1 Background

An assessment of potential ecological impacts was included in the Part 3A EA. Flora and fauna investigations were conducted within the underground mining area, Abel Underground Mine surface facilities area and at the Bloomfield CHPP.

The ecological investigation predicted no impacts on threatened species or threatened ecological communities (TECs) associated with the construction and operation of the Abel Underground Mine, including the use and expansion of the Bloomfield CHPP.

4.8.2 Environmental Review

Summary of Changes Due to the Modification

Hunter Eco (2012) identified the following aspects of the Modification would have the potential to result in additional ecological impacts (Appendix I):

- construction of the downcast ventilation shaft;
- the revised alignment of the approved conveyor route; and
- changes in the mining method in the longwall and shortwall mining areas.

In addition, alterations to the Bloomfield U Cut South void (if required) would result in the clearance of additional vegetation.

Figure 15 indicates where potential ecological impacts associated with the Modification may occur.

Potential Impacts

An investigation of the construction of the downcast ventilation shaft site was conducted by Hunter Eco (2012) in August 2012.

Construction of the downcast ventilation shaft would result in the clearance of approximately 0.16 ha (i.e. an area approximately 40 by 40 m) of vegetation typical of the *Hunter Valley Moist Forest* community, which does not fit the description of any TEC (Appendix I).

No threatened flora species and no trees with habitat hollows were identified during the site investigation (Appendix I).

The revised alignment of the approved overland conveyor would result in slightly less clearing of endangered ecological communities (EECs) (i.e. *Lower Hunter Spotted Gum – Ironbark Forest* EEC), and slightly more clearing of communities which are not TECs (i.e. *Hunter Valley Moist Forest* and *Coastal Plains Smooth-barked Apple Woodland*) in comparison to the clearing approved for the existing approved alignment of the overland conveyor (Appendix I).

The potential impact on habitat of the revised conveyor route would not be significantly different to that of the currently approved route (Appendix I).

The Modification mine layout has been designed to maintain existing subsidence management commitments for key natural surface features, including rainforest areas (Box 5), Schedule 2 streams, the Blue Gum Creek alluvium and cliffs (Section 4.2.5).

Box 5
Subsidence Management Commitment – Rainforest Areas

Rainforest Area*

Subsidence Management Commitments:

- Limit mining operations to first working beneath rainforest areas.
- Ensure that mining causes no subsidence impacts that require mitigation works.
- 20 mm line of subsidence set back from the rainforest protection zone.

Modification Mine Layout:

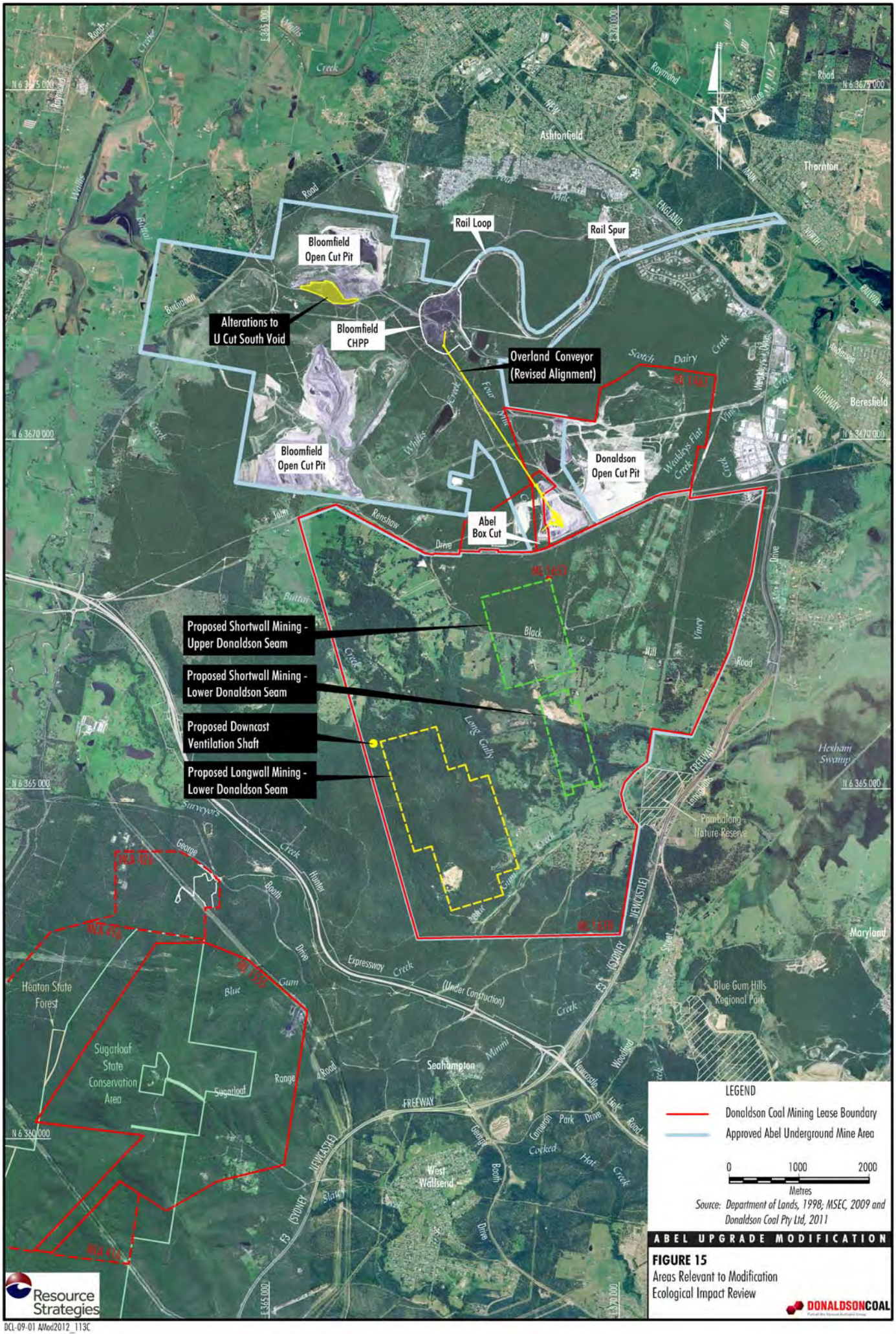
- No longwall or shortwall mining beneath rainforest areas.

* Source: Appendix A.

Native vegetation overlies sections of the longwall and shortwall mining area. However, predicted subsidence effects associated with the Modification mine layout are similar to those predicted for the approved mine layout (Appendix A).

As such, the Modification would not result in additional impacts to surface habitat in comparison to the approved mine layout (Appendix I).

Hunter Eco (2012) concluded the potential ecological impacts associated with the construction of the downcast ventilation shaft, revised alignment of the overland conveyor route and changes in mining method in the longwall and shortwall mining areas, would be essentially the same as the approved impacts described in the Part 3A EA.



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If required, the alterations to the Bloomfield U Cut South void would result in the clearance of approximately 11.1 ha of a fragmented vegetation community identified as *Hunter Valley Moist Forest* and *Coastal Plains Smooth-barked Apple Woodland* (Bloomfield Collieries Pty Limited, 2008), which is not a TEC.

This fragmented vegetation community is bounded to the north by the existing disturbance associated with the Bloomfield U Cut South void, and bounded to the south by an existing haulage route.

Mitigation measures, management and monitoring for ecological impacts are described in Section 4.8.3.

4.8.3 Mitigation Measures, Management and Monitoring

Existing flora and fauna mitigation and management commitments would be maintained for the Modification.

The potential impacts of the Abel Underground Mine on flora and fauna are currently managed by the implementation of the following management plans:

- Abel Flora and Fauna Management Plan;
- Donaldson Coal Bushland Conservation Area Management Plan; and
- *Donaldson Open Cut and Abel Underground Coal Mines Landscape Management Plan* (including Rehabilitation Management Plan).

Potential impacts of the Modification on flora and fauna and their habitats would be managed by the continued implementation of the above management protocols, plans and programs.

The Abel Flora and Fauna Management Plan establishes a Vegetation Clearance Protocol to minimise the impact of clearance activities on flora and fauna. Procedures have been put in place for delineating areas requiring clearing, conducting pre-clearance surveys, and identification and clearance of potential habitat trees.

Marked habitat trees would be observed at dusk and into dark by an experienced fauna ecologist prior to clearing to determine whether any fauna are using the hollows; particularly bats.

Any trees found to have bats using hollows would be soft-felled in the evening after the bats have left the hollows provided the weather is not particularly cold. For all other trees an experienced fauna ecologist would be in attendance during clearing to care for any fauna disturbed during the process.

4.8.4 Biodiversity Offset

Project Approval 05_0136 contains an existing condition (Condition 17 of Schedule 4) requiring a biodiversity offset of at least 20 ha for the 12.3 ha of approved vegetation clearance described in the Part 3A EA. This clearance has not yet occurred, and therefore, the offset has not been established.

The Modification would potentially result in total additional vegetation clearance of 11.3 ha associated with the construction of the downcast ventilation shaft, the revised overland conveyor alignment and the alterations to the Bloomfield U Cut South void. The vegetation to potentially be cleared would not include any TECs (Section 4.8.2).

Consistent with the existing biodiversity offset requirement, a biodiversity offset (of like for like vegetation with a ratio of 2:1) would be established as compensatory habitat for any additional clearance required for the Modification to maintain or improve biodiversity values in the medium to long-term.

The selection of suitable bushland for the compensatory habitat would be to the satisfaction of DP&I, in consideration of the OEH's *Principles for the use of Biodiversity Offsets in NSW* and the Offsetting Principles outlined in the *Lower Hunter Regional Conservation Plan* (DECCW, 2009b).

The biodiversity offset land would be secured, as required, prior the commencement of any phase of additional clearance associated with the Modification.

4.9 ABORIGINAL HERITAGE

An Aboriginal Cultural Heritage Assessment for the Modification was prepared by South East Archaeology Pty Ltd (South East Archaeology) (2012) and is presented as Appendix F to the EA.

4.9.1 Background

An Aboriginal Cultural Heritage Assessment was prepared for the Part 3A EA by South East Archaeology (2006). It was prepared with reference to the draft *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005b), and involved a review of previous studies, searches of relevant heritage registers, consultation with the Aboriginal community in accordance with the *Interim Community Consultation Requirements for Applicants* (DEC, 2004) and inspection of the underground mining area.

Aboriginal Heritage Sites

A total of 61 Aboriginal heritage sites and two potential archaeological deposits (PADs) have been identified within the Abel Underground Mine area to date, comprising of:

- artefact scatters;
- grinding grooves;
- scarred trees; and
- a rock shelter.

Aboriginal Cultural Heritage Management

As a condition of the Project Approval 05_0136 for the Abel Underground Mine, an AHMP (Donaldson Coal, 2007) was prepared in consultation with relevant Aboriginal Stakeholders and approved by the DoP (now the DP&I) in February 2008. Management of Aboriginal cultural heritage at the Abel Underground Mine is conducted in accordance with the approved AHMP.

The AHMP includes procedures for archaeological investigations, including Aboriginal stakeholder involvement and consultation. Consequently, the Aboriginal Cultural Heritage Assessment for the Modification was undertaken in accordance with the approved AHMP.

4.9.2 Environmental Review

The purpose of the Aboriginal Cultural Heritage Assessment was to assess potential impacts on Aboriginal heritage in areas where changes to the method of mining are proposed as part of the Modification (i.e. longwall and shortwall mining areas).

Consultation

Consultation for the Modification was undertaken consistent with the approved AHMP. The AHMP specifies the involvement of the Awabakal Local Aboriginal Land Council (LALC) and Mindaribba LALC in Aboriginal heritage matters at the Abel Underground Mine. In addition to the two LALCs, the 13 Aboriginal stakeholders who registered as part of the Part 3A EA were also invited to be involved in the consultation process for the Modification.

The consultation for the Modification included involvement in the review of the methodology, participation in field surveys and review of the draft Aboriginal Cultural Heritage Assessment for the Modification.

Survey Design

The field survey targeted areas more likely to contain features with potential susceptibility to subsidence movements (e.g. rock formations and major drainage lines) within the longwall and shortwall areas. The existing AHMP requires a systematic survey of all areas to be undermined prior to the commencement of mining, and as such, further field surveys would occur prior to the commencement of longwall or shortwall mining.

Archaeological Findings

Of the 61 sites within the Abel Underground Mine area 15 Aboriginal heritage sites and one PAD were identified within, or in close proximity to, the longwall and shortwall areas, including (Figure 16) (Appendix F):

- seven grinding groove sites;
- six artefact sites;
- two possible scarred trees; and
- one PAD within a rock shelter.

Detailed descriptions of these sites are provided in Appendix F.

Archaeological and Cultural Heritage Values

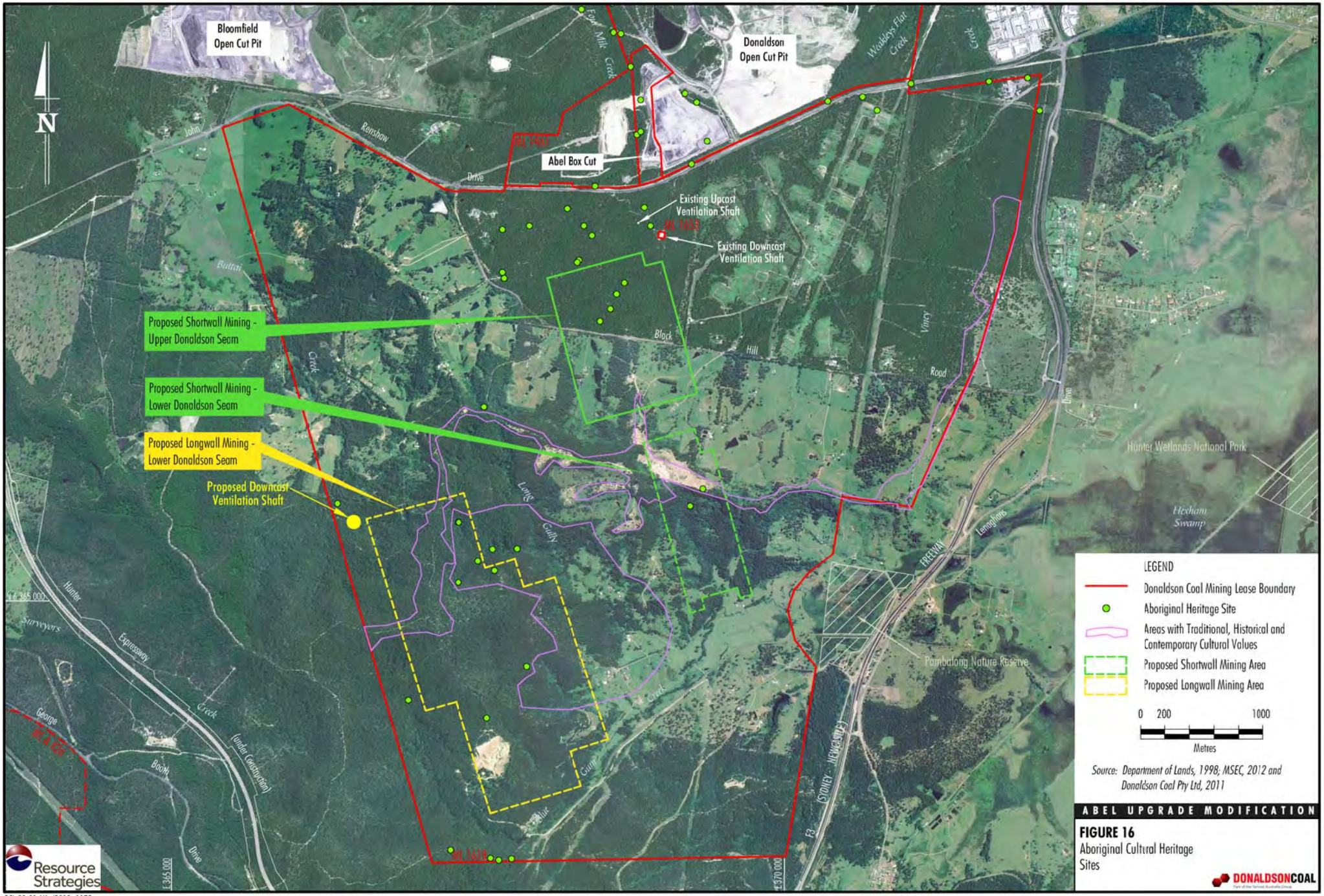
The significance of Aboriginal heritage was assessed using the relevant aspects of the International Council on Monuments and Sites Australia (1999) *Burra Charter*. This included an assessment of the scientific (archaeological) values and the cultural values.

The six artefact sites, the two possible scarred trees, rock shelter with a PAD and three grinding groove sites (AMB1/A, AMC2/C and AMC16/A) were assessed as having low scientific significance within a local context.

Four grinding groove sites (AMC2/A, AMC10/A, Abel 1 and Abel 2) were assessed as having a low to moderate scientific significance within a local context.

In addition to the above, traditional, historical and contemporary cultural values and associations have been identified by the registered Aboriginal stakeholders (and are also known through ethnohistorical evidence) within the Modification area and surrounds (Figure 16). These do not necessarily involve Aboriginal objects or physical evidence and include (Appendix F):

- the Black Hill locality (including the Modification area) as a cultural landscape;


Bloomfield Open Cut Pit
Donaldson Open Cut Pit
Abel Box Cut
Existing Upcast Ventilation Shaft
Existing Downcast Ventilation Shaft
Proposed Shortwall Mining - Upper Donaldson Seam
Proposed Shortwall Mining - Lower Donaldson Seam
Proposed Longwall Mining - Lower Donaldson Seam
Proposed Downcast Ventilation Shaft
Hunter Wetlands National Park
Heshiam Swamp
Paimbalong Nature Reserve
Resource Strategies
LEGEND
Donaldson Coal Mining Lease Boundary
Aboriginal Heritage Site
Areas with Traditional, Historical and Contemporary Cultural Values
Proposed Shortwall Mining Area
Proposed Longwall Mining Area
0 200 1000
Metres
Source: Department of Lands, 1998; MSEC, 2012 and Donaldson Coal Pty Ltd, 2011
ABEL UPGRADE MODIFICATION
FIGURE 16
Aboriginal Cultural Heritage Sites
DONALDSONCOAL
DCL-09-01 AMod2012_117C

- the Black Hill Spur Aboriginal pathway; and
- 'The Doghole', a historically documented initiation/ceremonial site.

Potential Impacts

Changes in potential impacts to Aboriginal heritage associated with the Modification would be due to:

- changes in predicted subsidence effects as a result of changes to the mining method (i.e. from bord and pillar to longwall and shortwall mining); and
- direct disturbance as a result of the construction of the downcast ventilation shaft, minor adjustments to the approved overland conveyor alignment and, if required, alterations to the Bloomfield U Cut South void.

Subsidence Impacts

Potential consequences of subsidence to Aboriginal heritage are summarised below and described further in Appendices A and F.

Open artefact sites are not particularly susceptible to subsidence impacts (Appendices A and F). Any effects to open artefacts sites due to subsidence are likely to be short-term, minimal and confined to the sediments within the site context rather than directly on the actual artefacts (Appendix F).

Impacts to trees as a result of subsidence are rare and usually occur only when there are very shallow depths of cover or very steeply sloping terrain. Given these conditions are not present in relation to the two possible scarred trees in the Modification area, it is considered unlikely they would be impacted by subsidence (Appendices A and F).

The likelihood of potential impacts to the rockshelter with PAD (AMC2/B) as a result of subsidence is assessed as unlikely given the freestanding nature of the large boulder in which it is located (Appendix F).

Subsidence impacts on grinding groove sites have been defined in terms of cracking potential. Fracturing (cracking) of bedrock has been observed elsewhere where tensile strains are greater than 0.5 mm/m or compressive strains are greater than 2 mm/m (Appendix A). The assessed likelihood of potential impacts to grinding groove sites is summarised in Table 11.

Table 11
Potential Impacts to Grinding Groove Sites in the Longwall and Shortwall Areas

Likelihood of Perceptible Impacts	Local Archaeological Significance	Grinding Groove Sites
Possible (10-50%)	Low to Moderate	Abel 2, AMC2/A
	Low	AMB1/A, AMC16/A
Unlikely (5-10%)	Low to Moderate	Abel 1, AMC10/A
	Low	AMC2/C

Source: After Appendix F.

The likelihood of potential impacts to three grinding groove sites (Abel 1, AMC10/A and AMC2/C) is assessed as unlikely (5-10% chance) given maximum predicted strains at these sites are less than 0.3 mm/m. Maximum predicted strains at the other four grinding groove sites (Abel 2, AMC2/A, AMB1/A and AMC16/A) range from 0.5 mm/m to 4.5 mm/m. MSEC (2012) concluded there is a possible (10-50%) chance cracking could occur at these sites.

These potential impacts were described in the draft Aboriginal Cultural Heritage Assessment, which was reviewed by the relevant Aboriginal stakeholders.

Direct Disturbance

The downcast ventilation shaft and overland conveyor would be located to avoid impacts to Aboriginal heritage.

If the alterations to the Bloomfield U Cut South void are required, surveys would be conducted with Aboriginal stakeholders prior to any additional surface disturbance in this area (Figure 15) in accordance with the protocols described in the AHMP.

The AHMP would be updated in consultation with relevant Aboriginal stakeholders to include the proposed clearance area. Additional disturbance for the alterations to the Bloomfield U Cut South void would not occur without approval of the updated AHMP by the DP&I.

4.9.3 Mitigation Measures, Management and Monitoring

Management of Aboriginal cultural heritage at Abel Underground Mine is conducted in accordance with the approved AHMP (Section 4.9.1). The following measures are detailed in the approved AHMP and would continue to be implemented for the Modification:

- ongoing consultation with the Aboriginal stakeholders;
- staged systematic archaeological surveys of areas proposed to be undermined that have not been subject to previous systematic survey;
- management of the Aboriginal heritage site database; and
- monitoring of Aboriginal heritage sites.

The measures described below are proposed to manage and mitigate potential impacts to rock based Aboriginal heritage sites (i.e. grinding groove and rock shelter sites) associated with the Modification.

These measures have been developed in consultation with the Aboriginal stakeholders and are detailed in the revised AHMP which is provided in Appendix F. The AHMP would be revised further, as required.

Grinding Grooves

The following would be implemented for the mitigation and management of potential impacts to grinding grooves:

- Baseline recording would be undertaken at all grinding groove sites.
- No further action would be undertaken at grinding groove sites assessed as being of low significance.
- For grinding groove sites assessed as being of low to moderate, moderate or high significance, an assessment of potential subsidence impacts will be undertaken by a suitably qualified subsidence expert. Based on the findings of the Subsidence Assessment:
  - No further action would be undertaken at grinding groove sites where subsidence impacts are assessed as unlikely or very unlikely to occur.
  - Further investigation (e.g. residue and use-wear analysis) and monitoring would be undertaken at grinding groove sites where the potential for subsidence impacts is assessed as more than likely to occur.
  - Mitigation measures such slotting of bedrock around the grinding groove site would be considered at grinding groove sites of high significance where potential impacts are assessed as more than likely to occur.

Rock Shelters

The following would be implemented for the mitigation and management of potential impacts to rock shelters:

- Baseline recording would be undertaken at all rock shelter sites.
- No further action would be undertaken at rock shelter sites assessed as being of low significance.
- For rock shelter sites assessed as being of low to moderate, moderate or high significance, an assessment of potential subsidence impacts will be undertaken by a suitably qualified subsidence expert. Based on the findings of the Subsidence Assessment:
  - No further action would be undertaken at rock shelter sites where subsidence impacts are assessed as unlikely or very unlikely to occur.
  - Monitoring would be undertaken at rock shelter sites of low to moderate or moderate significance where the potential for subsidence impacts is assessed as more than likely to occur.
  - Test excavation and monitoring would be undertaken at rock shelter sites of moderate to high or high significance where the potential for subsidence impacts is assessed as more than likely to occur.

4.10 SOCIO-ECONOMICS

A Socio-Economic Review (including a regional economic impact review) was undertaken for the Modification by Gillespie Economics (2012) and is presented as Appendix H to the EA.

Benefit Cost Analysis

A BCA indicated the Modification would have incremental (i.e. in comparison to the approved Abel Underground Mine) net production benefits of $265M, with $165M of these net production benefits accruing to Australia (Appendix H).

For the Modification to be unjustifiable from an economic efficiency perspective, all incremental residual environmental impacts from the Modification to Australia would need to be valued by the community at greater than the estimate of the Australian net production benefits (i.e. greater than $165M) (Appendix H).

Key potential environmental, cultural and social impacts associated with the Modification have been quantified and included in the BCA (Appendix H). Some residual potential impacts (e.g. potential impacts to Aboriginal heritage) were not quantified. However, these residual potential impacts would need to be valued at greater than $165M for the Modification to be unjustifiable from an Australian economic perspective (Appendix H).

Regional Economy

The operation phase of the Abel Underground Mine (including the activities associated with the Modification) would make up to the following average annual contributions to the regional economy over 17 years (Appendix H):

- $459M in annual direct and indirect regional output or business turnover;
- $156M in annual direct and indirect regional value added;
- $96M in annual direct and indirect household income; and
- 1,052 direct and indirect jobs.

The incremental (i.e. in comparison to the approved Abel Underground Mine) average annual contributions of the Modification to the regional economy over 17 years are estimated to be (Appendix H):

- $81M in annual direct and indirect regional output or business turnover;
- $50M in annual direct and indirect regional value added;
- $5M in annual indirect household income; and
- 64 indirect jobs.

Businesses that can provide the inputs of the production process required by the Abel Underground Mine and/or the products and services required by employees would directly benefit by way of an increase in economic activity at the Abel Underground Mine due to the Modification (Appendix H).

In addition, because of the inter-linkages between sectors, many indirect businesses would also benefit (Appendix H).

Flow-on impacts from the Modification are likely to affect a number of different sectors of the regional economy. The sections most impacted by output, value-added and income flow-on are likely to be services to the mining sector; electricity supply sector; other property services sector; retail trade sector; wholesale trade sector; construction trade services sector; and the rail transport sector.

NSW Economy

The operation of the Abel Underground Mine (including the activities associated with the Modification) is estimated to make up to the following average annual contribution to the NSW economy over 17 years (Appendix H):

- $624M in annual direct and indirect regional output or business turnover;
- $244M in annual direct and indirect regional value added;
- $146M in annual direct and indirect household income; and
- 1,593 direct and indirect jobs.

The incremental average annual contributions of the Modification to the NSW economy over 17 years are estimated to be (Appendix H):

- $95M in annual direct and indirect regional output or business turnover;
- $57M in annual direct and indirect regional value added;
- $10M in annual indirect household income; and
- 112 indirect jobs.

The potential impacts of the Modification to the NSW economy are expected to be substantially greater than for the regional economy alone, as more expenditure from the Abel Underground Mine and households would be captured, and there is a greater level of inter-sectoral linkages in the larger NSW economy.

Employment, Population and Community Infrastructure

The Modification would result in additional employees for construction (i.e. a total of approximately additional 30 employees) and operations (i.e. a total of approximately 48 additional employees) at the Abel Underground Mine.

These employees would likely reside in the region, or alternatively, if employees are unable to be sourced locally (e.g. construction employees), they would most likely be sourced from the Sydney region (Appendix H).

Little, if any, population change in the Newcastle region is predicted as a result of the construction workforce (Appendix H).

Even if it were conservatively assumed the entire additional operational workforce (and associated flow-on workforce and families) migrated to the Newcastle region, the maximum additional population in the region would be 413 (Appendix H).

This growth would be insignificant in the context of historical and projected population growth in the region (Appendix H).

Mitigation Measures, Management and Monitoring

Donaldson Coal plays an active role in local communities through financial contributions to facilities, including the Donaldson Job Creation Trust (Section 2.14).

Donaldson Coal would continue to develop and run programs to assist with the recruitment of local labour, and would continue to work in partnership with Councils and the local community so that the benefits of the projected economic growth in the region are maximised and impacts minimised, as far as possible.

4.11 OTHER ENVIRONMENTAL ASPECTS

4.11.1 Road Transport

A review of potential road transport impacts was conducted for the Modification by GTA Consultants (2012) and is presented as Appendix G.

Road Network and Intersections

The Abel Underground Mine is surrounded by the following major roads (Figure 2):

- John Renshaw Drive;
- New England Highway;
- F3 (Sydney - Newcastle) Highway; and
- Weakleys Drive.

Access to the Abel Underground Mine (e.g. office administration buildings) is via the Abel Underground Mine Access Road, which is located off John Renshaw Drive, and is immediately adjacent to the Abel Box Cut.

The intersection between the Abel Underground Mine Access Road and John Renshaw Drive (Figure 17) is a “seagull” intersection with dedicated deceleration and acceleration lanes for vehicles turning in and out of the Abel Underground Mine (Appendix G).

Access to the Bloomfield CHPP is via Four Mile Creek Road, which runs south-west from the New England Highway to the Bloomfield CHPP. Four Mile Creek Road also provides access to the Bloomfield Colliery.

Four Mile Creek Road intersects the New England Highway at an unsignalised T-intersection, with a break in the wide median New England Highway to allow left and right turns into and out of Four Mile Creek Road (Figure 17) (Appendix G).

A right turn lane approximately 80 m long is provided for vehicles turning from the New England Highway to Four Mile Creek Road. An acceleration lane approximately 250 m long is provided for vehicles turning left from Four Mile Creek Road to the New England Highway to allow these vehicles to increase speed before joining the northbound New England Highway traffic (Appendix G).

New England Highway and Four Mile Creek Road Intersection

John Renshaw Drive and Abel Underground Mine Access Road Intersection

ABEL UPGRADE MODIFICATION

FIGURE 17
Key Intersections

Resource Strategies

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Modification

The Modification would potentially result in minor increases in road traffic on the public road network.

Potential changes on the Abel Underground Mine Access Road would be associated with up to approximately 25 additional operational employees and an increase in deliveries and visitors (with the increase assumed to proportional to the increase in ROM coal production) (Appendix G).

Potential changes on Four Mile Creek road would be associated with approximately 25 construction employees during 2013 for the alterations and upgrades to the CHPP, and approximately 23 additional operational employees at the Bloomfield CHPP (Appendix G).

In addition, very limited and short-term truck access would be required for construction of the downcast ventilation shaft, which would access the site (Figure 6) via John Renshaw Drive. Sporadic access by a maintenance vehicle would be required to check the downcast ventilation shaft. Therefore, it is unlikely there would be a measurable impact on the traffic associated with the construction and use of the downcast ventilation shaft.

ROM Coal Haulage

Any ROM coal haulage from the Abel Underground Mine to the Bloomfield CHPP would continue to be via sealed internal roads, and as such, would not impact the public road network.

ROM coal haulage from the Tasman Underground Mine to the Abel Underground Mine via public roads does not form part of the Abel Underground Mine (or the Modification).

Potential impacts associated with the proposed increase in ROM coal haulage from the Tasman Underground Mine to the Abel Underground Mine for the Tasman Extension Project were assessed in the Tasman Extension Project EIS.

Potential Impacts

Additional traffic generation associated with the Modification is expected to be well within the daily variations experienced on the major roads surrounding the Abel Underground Mine (i.e. John Renshaw Drive and the New England Highway) (Appendix G).

GTA Consultants (2012) considers the Abel Underground Mine Access Road/John Renshaw Drive and Four Mile Creek Road/New England Highway intersections are of a suitable standard to accommodate potential future traffic demands associated with the Modification, with acceleration and deceleration lanes already provided to minimise the interaction between turning and through traffic.

GTA Consultants (2012) concluded that any minor increases in traffic generation associated with the Modification could be satisfactorily accommodated on the public road network, with a negligible perceivable impact on operating conditions.

Mitigation Measures and Monitoring

As described in the Tasman Extension Project EIS, Donaldson Coal would implement long-term monitoring of the Abel Underground Mine Access Road/John Reshaw Drive intersection, initially at 5 year intervals, with the monitoring interval to be reviewed based on measured intersection performance. This would be done in consultation with the RMS.

This monitoring would be relevant to the Modification, and on this basis, GTA Consultants (2012) considers no additional measures to improve the safety of the road network are required for the Modification.

4.11.2 Greenhouse Gas Emissions

An assessment of expected greenhouse gas emissions for the Modification was conducted as part of the Air Quality and Greenhouse Gas Assessment, which is presented as Appendix E to the EA.

Estimated annual average greenhouse emissions over the Modification are predicted to be approximately 120 kt carbon dioxide equivalent (scope 1 and scope 2) per year (Appendix E).

Donaldson Coal is a participant in the National Greenhouse and Energy Report System, and as such, annually estimates greenhouse gas emissions and energy consumption for its operations, including the Abel Underground Mine, and this would continue for the Modification.

An Energy Savings Action Plan is in place at the Abel Underground Mine to improve energy efficiency at the site.

The Modification's contribution to global anthropogenic climate change would be in proportion with its contribution to global greenhouse gas emissions.

As the Modification's contribution to global greenhouse gas emissions would be negligible, the contribution to global climate change, and associated environmental impacts, would also be negligible.

4.11.3 Visual Amenity

A visual impact assessment was conducted for the Part 3A EA.

Due to the nature of the underground mining, and the minimal disturbance of the surface because of the use of existing surface facilities, the assessment concluded the Abel Underground Mine would not noticeably alter the visual environment of either the underground mining area or areas containing surface infrastructure.

The proposed downcast ventilation shaft for the Modification would be located within a vegetated area of land owned by Coal and Allied. The height of surrounding vegetation would obscure views of the downcast ventilation shaft (and the associated minimal lighting required for security and safety reasons) from public areas.

The modifications and upgrades to the Bloomfield CHPP would be within the approved disturbance area and immediately adjacent to existing infrastructure, and as such, would not significantly alter the visual impacts of the area.

The Modification may increase the potential for surface cracking and erosion on steep slopes (Section 4.3.2). However, the areas where this would potentially occur would not be visible from major roads. Management and mitigation measures for erosion are described in Section 4.3.3.

4.11.4 Non-Aboriginal Heritage

An assessment of the potential impacts to European heritage was undertaken for the Part 3A EA.

A review of European heritage registers was conducted, identifying an elevated corridor of the disused Richmond Vale Railway trackbed located within the south-eastern section of the Abel Underground Mine.

Appendix A identifies the disused Richmond Vale Railway trackbed as being located outside longwall and shortwall mining areas. As such, no additional impacts to the disused Richmond Vale Railway trackbed are predicted due to the Modification, in comparison to those impacts predicted and approved for the existing Abel Underground Mine.

4.11.5 Hazard and Risk

Donaldson Coal has prepared and implemented a number of management plans and control strategies as part of the Environmental Management Strategy (Section 2.13) to address the potential hazards and risks associated with the construction and operation of the Abel Underground Mine.

The proposed Modification would not significantly alter the consequences or likelihood of a hazardous event occurring at the Abel Underground Mine, as the operational activities on-site would be generally unchanged. Notwithstanding, environmental management plans and procedures would be updated for the Modification, where relevant (Section 5.3.2).

4.12 CONSIDERATION OF CUMULATIVE IMPACTS WITH OTHER NEARBY MINING OPERATIONS

Relevant potential cumulative impacts associated with the Modification and other mining operations were considered in the environmental assessment for the Modification.

A summary of where cumulative impacts have been considered is provided below. A description of the operational interactions between the Modification and other mining operations is provided in Sections 2.11 and 3.5.

4.12.1 Bloomfield Colliery

The assessment of key potential cumulative impacts of the Modification and the Bloomfield Colliery included:

- The groundwater modelling for the Modification included historic and approved mining operations at the Bloomfield Colliery (Section 4.4 and Appendix B).
- Noise and air quality modelling for the Modification included the handling and processing of ROM coal from the Bloomfield Colliery at the Bloomfield CHPP, and the rail loadout and transport of product coal from the Bloomfield Colliery (Sections 4.6 and 4.7 and Appendices D and E).
- Potential cumulative noise impacts associated with the Bloomfield Colliery and the Modification were assessed (Section 4.6 and Appendix D).

- Potential cumulative air quality impacts associated with the Bloomfield Colliery and the Modification were assessed (Section 4.7 and Appendix E).

4.12.2 Tasman Underground Mine and Tasman Extension Project

The assessment of key potential cumulative impacts of the Modification and the Tasman Underground Mine included:

- The groundwater modelling for the Modification included historic and proposed mining operations at the Tasman Underground Mine (Section 4.4 and Appendix B).
- Noise and air quality modelling for the Modification included the handling and processing of ROM coal from the Tasman Underground Mine at the Bloomfield CHPP, and the rail loadout and transport of product coal from the Tasman Underground Mine (Sections 4.6 and 4.7 and Appendices D and E).
- The proposed increase in ROM coal haulage movements from the Tasman Underground Mine to the Abel Underground Mine (i.e. associated with the Tasman Extension Project) was included as a source of future background traffic in the Road Transport Review (Section 4.11.1 and Appendix G).

4.12.3 Donaldson Open Cut Mine

The Donaldson Open Cut Mine is scheduled to cease operations at the end of 2013.

As such, there would potentially be some improvement in the noise and air quality environment of the Abel Underground Mine area following the completion of mining operations at the Donaldson Open Cut Mine.

Notwithstanding, the assessment of potential cumulative air quality impacts conservatively includes some contribution from the Donaldson Open Cut Mine, as air quality monitoring data has been used to characterise background air quality, and this data would include existing contributions from the Donaldson Open Cut Mine (Section 4.7 and Appendix E).

The groundwater modelling for the Modification included historic and approved mining operations at the Donaldson Open Cut Mine (Section 4.4 and Appendix B).

5 STATUTORY CONTEXT

5.1 APPLICABILITY OF SECTION 75W OF ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979

The Abel Underground Mine was approved under Part 3A of the EP&A Act by the NSW Minister for Planning on 7 June 2007 (Project Approval 05_0136) and therefore constitutes a "transitional Part 3A project" pursuant to the savings and transitional provisions in Schedule 6A of the EP&A Act.

Clause 3 of Schedule 6A provides that Part 3A of the EP&A Act continues to apply to and in respect of "transitional Part 3A projects" following its repeal. That is, Part 3A of the EP&A Act continues to apply to the Abel Underground Mine, notwithstanding its repeal[2].

Approval for the Modification is sought as a modification to the Abel Underground Mine Project Approval 05_0136 (Attachment 2) under section 75W of the EP&A Act. Section 75W of the EP&A Act relevantly provides:

> ***75W Modification of Minister's approval***
>
> *(1) In this section:*
>
> ***Minister's approval** means an approval to carry out a project under this Part, and includes an approval of a concept plan.*
>
> ***modification of approval** means changing the terms of a Minister's approval, including:*
>
> *a) revoking or varying a condition of the approval or imposing an additional condition of the approval, and*
>
> *b) changing the terms of any determination made by the Minister under Division 3 in connection with the approval.*
>
> *(2) The proponent may request the Minister to modify the Minister's approval for a project. The Minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under this Part.*
>
> *(3) The request for the Minister's approval is to be lodged with the Director-General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.*
>
> *(4) The Minister may modify the approval (with or without conditions) or disapprove of the modification.*
>
> …

The Director-General provided DGRs for the Modification on 21 February 2012 pursuant to section 75W(3) of the EP&A Act. This EA has been prepared in accordance with the DGRs issued by the Director-General (Attachment 1).

5.2 GENERAL STATUTORY REQUIREMENTS

5.2.1 State Environmental Planning Policies

Section 75R(2) of the EP&A Act provides that State Environmental Planning Policies (SEPPs) apply to the carrying out of a project approved under Part 3A.

The following SEPPs may be potentially relevant to the Modification:

- *State Environmental Planning Policy (Major Development) 2005* (Major Development SEPP);
- *State Environmental Planning Policy No 33 – Hazardous and Offensive Development* (SEPP 33);
- *State Environmental Planning Policy No 44 – Koala Habitat Protection* (SEPP 44); *and*
- *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP).

These SEPPs are discussed further in the sub-sections below.

State Environmental Planning Policy (Major Development) 2005

The Abel Underground Mine was a project of a kind that met the description in Schedule 1 of the Major Development SEPP and was declared to be a project to which Part 3A of the EP&A Act applies.

[2] Part 3A of the EP&A Act (as in force immediately before its repeal) continues to apply for the Abel Underground Mine. The description and quotations of relevant references to clauses of Part 3A in this document are as if Part 3A of the EP&A Act is still in force.

The Abel Underground Mine was approved under Part 3A of the EP&A Act by the NSW Minister for Planning on 7 June 2007 (Project Approval 05_0136) and constitutes a "transitional Part 3A project" pursuant to the savings and transitional provisions in Schedule 6A of the EP&A Act (Section 5.1).

State Environmental Planning Policy No 33 – Hazardous and Offensive Development

Clause 2 sets out the aims of SEPP 33, the following being relevant to the Modification:

> *(a) to amend the definitions of hazardous and offensive industries where used in environmental planning instruments, and*
>
> *…*
>
> *(d) to ensure that in determining whether a development is a hazardous or offensive industry, any measures proposed to be employed to reduce the impact of the development are taken into account, and*
>
> *(e) to ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact, and*
>
> *…*

The relevance of SEPP 33 to the Abel Underground Mine was described in the Part 3A EA, including a description of the management measures for the handling of hazardous materials, and justification as to why the Abel Underground is not an offensive industry.

Management measures for the handling of hazardous materials would be maintained for the Modification, and are described in Sections 4.3.3 and 4.11.5.

State Environmental Planning Policy No 44 – Koala Habitat Protection

SEPP 44 requires the council in certain LGAs (including Cessnock, Newcastle and Maitland) to consider whether the land which is the subject of the Development Application is "potential koala habitat" or "core koala habitat".

Clause 9 of SEPP 44 requires:

> *(1) Before a council may grant consent to a development application for consent to carry out development on land to which this Part applies that it is satisfied is a core koala habitat, there must be a plan of management prepared in accordance with Part 3 that applies to the land.*
>
> *(2) The council's determination of the development application must not be inconsistent with the plan of management.*

It was determined in the Part 3A EA that koala habitat was not present in the Abel Underground Mine area. There would be no change to the Abel Underground Mine area due to the Modification.

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The Mining SEPP applies to the whole of NSW.

Part 1 – Clause 2

Clause 2 sets out the aims of the Mining SEPP, as follows:

> *(a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State, and*
>
> *(b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and*
>
> *(c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources.*

Part 3 – Clauses 12 to 17

Part 3 of the Mining SEPP provides matters for consideration for development applications.

Clause 12

Clause 12 of the Mining SEPP requires that before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:

(a) consider:

(i) the existing uses and approved uses of land in the vicinity of the development, and

(ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and

(iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and

(b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and

(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).

The Modification would not change the land uses within the existing approved area of the Abel Underground Mine. In addition, there would be no change to the Abel Underground Mine area due to the Modification.

Accordingly the Minister can be satisfied as to these matters.

Clause 13

Clause 13 of the Mining SEPP requires that before determining any application for consent for development in the vicinity of an existing mine, petroleum production facility or extractive industry, to which this clause applies, the consent authority must:

(a) consider:

(i) the existing uses and approved uses of land in the vicinity of the development, and

(ii) whether or not the development is likely to have a significant impact on current or future extraction or recovery of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of, those resources), and

(iii) any ways in which the development may be incompatible with any of those existing or approved uses or that current or future extraction or recovery, and

(b) evaluate and compare the respective public benefits of the development and the uses, extraction and recovery referred to in paragraph (a) (i) and (ii), and

(c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).

The Modification would involve the continuation of underground mining within the existing approved area of the Abel Underground Mine.

The Modification would enable increased efficiency and quantity of coal recovery within the approved mining areas and seams for the Abel Underground Mine, resulting in increased employee numbers, revenue and associated taxes and royalties to the NSW State Government.

Two quarries overlie the longwall and shortwall mining areas (i.e. the Stockrington Quarry and the Black Hill Quarry). The approved mine layout includes underground mining beneath these quarries.

No additional consequences of subsidence to these quarries are predicted due to the Modification in comparison to the approved mine layout (Appendix A). As such, the Modification would not be incompatible with these existing operations.

Subsidence management measures would be developed in consultation with Daracon (operator of the Stockrington Quarry) and Woodbury's Haulage and Earthmoving (operator of the Black Hill Quarry) (Section 4.2.6).

Accordingly the Minister can be satisfied as to these matters.

Clause 14

Clause 14(1) of the Mining SEPP requires that before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:

(a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,

(b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,

(c) that greenhouse gas emissions are minimised to the greatest extent practicable.

Existing subsidence management commitments for the Abel Underground Mine would be maintained for the Modification. As such, no additional impacts to significant water resources (Section 4.4) or biodiversity (Section 4.8) are predicted.

Greenhouse gas emissions would continue to be minimised to the greatest extent practicable, as described in the existing Energy Savings Action Plan (Section 4.11.2).

Accordingly the Minister can be satisfied as to these matters.

Clause 15

Clause 15 of the Mining SEPP requires that:

(1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.

(2) Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.

(3) The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.

The Modification is designed to increase the efficiency and quantity of coal recovery within the approved mining areas and seams for the Abel Underground Mine. It is expected the Modification would result in an additional 10 Mt ROM coal recovery over the life of the Abel Underground (Table 2), while maintaining existing subsidence management commitments.

Donaldson Coal has progressively presented Modification description information, mine layout plans and other information to the DRE during the development of this EA (Section 1.3).

Accordingly the Minister can be satisfied as to these matters.

Clause 16

Clause 16(1) of the Mining SEPP requires that, before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following:

(a) require that some or all of the transport of materials in connection with the development is not to be by public road,

(b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,

(c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.

The Abel Underground Mine does not involve the transport of ROM coal along public roads, and this would not change for the Modification.

The proposed increase in the transportation of ROM coal on public roads from the Tasman Underground Mine to the Abel Underground Mine does not form part of the Modification, and was described and assessed in the Tasman Extension Project EIS.

Accordingly the Minister can be satisfied as to these matters.

Clause 17

Clause 17 of the Mining SEPP requires that before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development. In particular, the consent authority must consider whether conditions of the consent should:

(a) require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or

(b) require waste generated by the development or the rehabilitation to be dealt with appropriately, or

(c) require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under section 145C of the Act and the Contaminated Land Management Act 1997), or

(d) require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.

Rehabilitation for the Modification would be consistent with existing rehabilitation and mine closure commitments detailed in the *Donaldson Open Cut and Abel Underground Coal Mines Landscape Management Plan* (Section 3.4).

5.2.2 Local Environmental Plans

Section 75R(3) of the EP&A Act provides that Local Environmental Plans (LEPs) do not apply to a project approved under Part 3A. In addition, section 75W does not require the consideration of LEPs in the Minister's determination of a request to modify a project approved under Part 3A.

Notwithstanding, the permissibility of the Abel Underground Mine (as modified) under the LEPs is discussed further below.

The Abel Underground Mine area is located within the Cessnock, Newcastle and Maitland LGAs and includes land zoned under the respective LEPs.

Cessnock Local Environmental Plans

The Abel Underground Mine area includes land zoned under the *Cessnock Local Environmental Plan 2011* (Cessnock LEP 2011) as:

- Zone RU2 (Rural Landscape);
- Zone SP2 (Infrastructure); and
- Zone E2 (Environmental Conservation).

The Abel Underground Mine area also includes land marked as "Deferred Matter" to which the Cessnock LEP 2011 does not apply pursuant to clause 1.3(1A).

Part 2 of the Cessnock LEP 2011 outlines the zone objectives that are relevant in determining whether the Modification (or any part of the Modification) is prohibited by the Cessnock LEP 2011, in any of the zones within the Abel Underground Mine area.

Mining is listed as permissible with consent on lands within Zone RU2 (Rural Landscape) under the Cessnock LEP 2011.

Mining is not listed as permissible on lands within SP2 (Infrastructure) and Zone E2 (Environmental Conservation).

The land marked as "Deferred Matter" in the Cessnock LEP 2011 is zoned under the *Cessnock Local Environmental Plan 1989* as Zone 1(a) (Rural "A").

Mining is permissible with consent on lands within Zone 1(a) (Rural "A") under the Cessnock LEP 1989.

The Cessnock LEP 2011 states:

> ***Note***. *A type of development referred to in the Land Use Table is a reference to that type of development only to the extent it is not regulated by an applicable State environmental planning policy. The following State environmental planning policies in particular may be relevant to development on land to which this Plan applies:*
>
> *…*
>
> *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*
>
> *…*

Clause 4 of the Mining SEPP relevantly provides:

> ***4 Land to which Policy applies***
>
> *This Policy applies to the State.*

Clause 5(3) gives the Mining SEPP primacy where there is any inconsistency between the provisions in the SEPP and the provisions in any other environmental planning instrument (subject to limited exceptions).

Clause 5(3) relevantly provides:

> ***5 Relationship with other environmental planning policies***
>
> *(3) … if this Policy is inconsistent with any other environmental planning instrument, whether made before or after this Policy, this Policy prevails to the extent of the inconsistency.*

The practical effect of clause 5(3) for the Abel Underground Mine is that if there is any inconsistency between the provisions of the Mining SEPP and those contained in the Cessnock LEP 2011, the provisions of the Mining SEPP will prevail.

Clauses 6 and 7 of the Mining SEPP provide what types of mining development are permissible without development consent and what types are permissible only with development consent. In this regard, clause 7(1) states:

> ***7 Development permissible with consent***
>
> *(1)* ***Mining***
>
> *Development for any of the following purposes may be carried out only with development consent:*
>
> *(a) underground mining carried out on any land,*
>
> *…*
>
> *(d) facilities for the processing or transportation of minerals or mineral bearing ores on land on which mining may be carried out (with or without development consent), but only if they were mined from that land or adjoining land,*
>
> *…*

The term 'underground mining' in the Mining SEPP is given an extended definition in clause 3(2) as follows:

> ***underground mining*** *means:*
>
> *(a) mining carried out beneath the earth's surface, including bord and pillar mining, longwall mining, top-level caving, sub-level caving and auger mining, and*
>
> *(b) shafts, drill holes, gas and water drainage works, surface rehabilitation works and access pits associated with that mining (whether carried out on or beneath the earth's surface),*
>
> *but does not include open cut mining.*

The effect of clause 7(1), in conjunction with the operation of clause 5(3) of the Mining SEPP, is that notwithstanding any prohibition contained in the land use table of the Cessnock LEP 2011, the Abel Underground Mine may be carried out with development consent.

Newcastle Local Environmental Plan 2012

The Abel Underground Mine area includes land zoned under the *Newcastle Local Environmental Plan 2012* (Newcastle LEP) as Zone E4 (Environmental Living).

Under Part 2 of the Newcastle LEP, mining is not listed as permissible on lands within Zone E4 (Environmental Living).

As per the discussion above, the effect of clause 7(1), in conjunction with the operation of clause 5(3) of the Mining SEPP, is that notwithstanding any prohibition contained in the land use table of the Newcastle LEP, the Abel Underground Mine may be carried out with development consent.

Maitland Local Environmental Plan 2011

The portion of the Abel Underground Mine area within the Maitland LGA includes the rail loop and spur and northern section of Bloomfield Colliery where tailings may be disposed.

The Abel Underground Mine area includes land zoned under the *Maitland Local Environmental Plan 2011* (Maitland LEP 2011) as:

- Zone RU2 (Rural Landscape);
- Zone E3 (Environmental Management);
- Zone SP2 (Infrastructure) (Road); and
- Zone SP2 (Infrastructure) (Rail).

Under Part 2 of the Maitland LEP (Permitted or Prohibited Development), mining is listed as permissible with consent on lands within Zone RU2 (Rural Landscape).

Mining is not listed as permissible on lands within Zone E3 (Environmental Management) and Zone SP2 (Infrastructure). The rail spur is permissible within Zone SP2 (Infrastructure) for the purpose of rail.

As per the discussion above, the effect of clause 7(1), in conjunction with the operation of clause 5(3) of the Mining SEPP, is that notwithstanding any prohibition contained in the land use table of the Maitland LEP, the Abel Underground Mine may be carried out with development consent.

5.2.3 Commonwealth Environment Protection and Biodiversity Conservation Act, 1999

Donaldson Coal lodged a Referral under the *Environment Protection and Biodiversity Conservation Act, 1999* in August 2007 for the Abel Underground Mine. On 10 October 2007, a delegate of the Commonwealth Minister for the Environment and Water Resources decided the Abel Underground Mine is not a controlled action (2007/3695).

The potential impacts of the Modification on ecology have been assessed in Appendix I and summarised in Section 4.8. These assessments indicate there would be no significant impact on matters of national environmental significance as a result of the Modification.

It is therefore considered there is no need to refer the Modification to the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities.

5.2.4 Aquifer Interference Policy

Policy Overview

The NSW *Aquifer Interference Policy* (NSW Government, 2012) (AIP) has been developed by the NSW Government as a component of the *Strategic Regional Land Use Policy*. The AIP applies state wide and details water licence and impact assessment requirements.

The AIP has been developed to ensure equitable water sharing between various water users and proper licensing of water taken by aquifer interference activities such that the take is accounted for in the water budget and water sharing arrangements. The AIP will also enhance existing regulation, contributing to a comprehensive framework to protect the rights of all water users and the environment in NSW.

The *Water Management Act, 2000* (WM Act) defines an aquifer interference activity as that which involves any of the following:

- *the penetration of an aquifer;*
- *the interference with water in an aquifer;*
- *the obstruction of the flow of water in an aquifer;*
- *the taking of water from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations; and*
- *the disposal of water taken from an aquifer in the course of carrying out mining or any other activity prescribed by the regulations.*

Examples of aquifer interference activities include mining, coal seam gas extraction, injection of water, and commercial, industrial, agricultural and residential activities that intercept the water table or interfere with aquifers (NSW Government, 2012).

The AIP applies to all aquifer interference activities but has been developed in particular to address the following activities (NSW Government, 2012):

- ***mining activities*** *such as open cut voids, underground mine workings and the disposal of water taken from an aquifer including water taken as part of coal seam gas extraction;*
- *other* ***extractive industries****, such as sand and gravel extraction;*
- ***coal seam gas activities****, including those related to both exploration and production;*
- *other large projects which require* ***dewatering*** *such as for the construction and maintenance of associated works, such as buildings, roads and other civil works;*
- ***injection works*** *used to transmit water into an aquifer; and*
- *activities with the potential to contaminate groundwater or result in unacceptable loss of storage or structural damage to an aquifer.*

Licensing Requirements

The AIP requires all water taken by aquifer interference activities to be accounted for within the extraction limits set by the relevant Water Sharing Plan. A water licence is required whether water is taken either incidentally or for consumptive use, where any act by a person carrying out an aquifer interference activity causes (NSW Government, 2012):

- *the removal of water from a water source; or*
- *the movement of water from one part of an aquifer to another part of an aquifer; or*
- *the movement of water from one water source to another water source, such as:*
  - *from an aquifer to an adjacent aquifer; or*
  - *from an aquifer to a river/lake; or*
  - *from a river/lake to an aquifer.*

The AIP also requires consideration of the continued take of water from groundwater or connected surface waters following cessation of an aquifer interference activity. Licences are required to be held to adequately account for the ongoing take of water until the system returns to equilibrium, or alternatively, sufficient licences are required to be surrendered to the Minister.

Minimal Impact Considerations

In addition to licensing requirements, the WM Act includes the concept of ensuring “no more than minimal harm”. In this regard the AIP includes minimal impact considerations relating to water table and groundwater pressure drawdown and changes in groundwater and surface water quality.

The AIP provides that:

> *Aquifer interference approvals are not to be granted unless the Minister is satisfied that adequate arrangements are in force to ensure that no more than minimal harm will be done to any water source, or its dependent ecosystems, as a consequence of its being interfered with in the course of the activities to which the approval relates.*
>
> *While aquifer interference approvals are not required to be granted, the minimal harm test under the Water Management Act 2000 is not activated for the assessment of impacts. Therefore, this Policy establishes and objectively defines minimal impact considerations as they relate to water-dependent assets and these considerations will be used as the basis for providing advice to either the gateway process, the Planning Assessment Commission or the Minister for Planning.*

The AIP establishes minimal impact considerations for groundwater categories of both "highly productive" and "less productive" groundwater. Highly productive groundwater is defined by the AIP as groundwater which (NSW Government, 2012):

> *... is defined in this Policy as a groundwater source that is declared in the Regulations and will be based on the following criteria*
>
> *a) has total dissolved solids of less than 1,500 mg/L, and*
>
> *b) contains water supply works that can yield water at a rate greater than 5 L/sec.*

The AIP further groups highly productive groundwater into the following categories:

- Alluvial.
- Coastal sands.
- Porous rock, including;
  - Great Artesian Basin – Eastern Recharge and Southern Recharge;
  - Great Artesian Basin – Surat, Warrego and Central; and
  - other porous rock.
- Fractured rock.

The AIP similarly defines categories for less productive groundwater which include:

- Alluvial.
- Porous rock.
- Fractured rock.

The minimal impact considerations developed for highly productive alluvial water sources are summarised in Table 12.

Licensing Requirements for the Modification

In water sources where Water Sharing Plans do not yet apply, an aquifer interference activity that is taking groundwater is required to hold a water licence under Part 5 of the *Water Act, 1912.*

The fractured rock aquifer system in the coal measures within the Abel Underground Mine area is such a water source.

Donaldson Coal currently holds bore licence number 20BL171935 issued on 5 August 2008 under Part 5 of the *Water Act, 1912*, which authorises groundwater extraction not to exceed 500 ML within any 12 month period (Appendix B).

Predicted maximum annual groundwater inflows for the Modification (2,304 ML/annum) are provided in Table 13. Donaldson Coal would apply for a revision to bore licence number 20BL171935 to account for the maximum predicted annual groundwater inflows.

In water sources where water sharing plans do apply, the AIP requires all water taken by aquifer interference activities to be accounted for within the extraction limits set by the relevant Water Sharing Plan.

The Water Sharing Plan relevant to the Abel Underground Mining area is the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009* (the HUAWSP). Therefore, licensing under the HUAWSP may be required where aquifer interference activities take flow from connected surface water sources.

Predicted maximum annual losses from relevant water sources of the HUAWSP due to the approved operations and for the Modification are summarised in Table 13.

Predicted losses are negligible in the Wallis Creek Water Source (Table 13). Predicted losses in the Newcastle Water Source are also considered to be minimal (i.e. in comparison to natural fluxes).

Notwithstanding, Donaldson Coal would obtain necessary licences for the Newcastle Water Source of the HUAWSP, if required.

The Newcastle Water Source has a total surface water entitlement of 551 ML/annum. Trading of surface water entitlements is permitted in the Newcastle Water Source, and if required, Donaldson Coal would purchase necessary surface water entitlements to account for any predicted surface water losses.

Table 12
Minimal Impact Considerations for Aquifer Interference Activities

Water Source	Minimal Impact Consideration		
	Water Table	**Water Pressure**	**Water Quality**
Highly Productive Alluvial Water Sources	1. Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan; or A maximum of a 2 m decline cumulatively at any water supply work. 2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan then appropriate studies will need to demonstrate to the Minister's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than 2 m decline cumulatively at any water supply work then make good provisions should apply.	1. A cumulative pressure head decline of not more than 40% of the "post-water sharing plan" pressure head above the base of the water source to a maximum of a 2 m decline, at any water supply work. 2. If the predicted pressure head decline is greater than requirement 1. above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.	1. (a) Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity; and (b) No increase of more than 1% per activity in long-term average salinity in a highly connected surface water source at the nearest point to the activity. Redesign of a highly connected surface water source that is defined as a "reliable water supply" is not an appropriate mitigation measure to meet considerations 1.(a) and 1.(b) above. (c) No mining activity to be below the natural ground surface within 200 m laterally from the top of high bank or 100 m vertically beneath (or the three dimensional extent of the alluvial water source - whichever is the lesser distance) of a highly connected surface water source that is defined as a "reliable water supply". (d) Not more than 10% cumulatively of the three dimensional extent of the alluvial material in this water source to be excavated by mining activities beyond 200m laterally from the top of high bank and 100 m vertically beneath a highly connected surface water source that is defined as a "reliable water supply". 2. If condition 1.(a) is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works. If condition 1.(b) or 1.(d) are not met then appropriate studies are required to demonstrate to the Minister's satisfaction that the River Condition Index category of the highly connected surface water source will not be reduced at the nearest point to the activity. If condition 1.(c) or (d) are not met, then appropriate studies are required to demonstrate to the Minister's satisfaction that: • there will be negligible river bank or high wall instability risks; • during the activity's operation and post-closure, levee banks and landform design should prevent the Probable Maximum Flood from entering the activity's site; and • low-permeability barriers between the site and the highly connected surface water source will be appropriately designed, installed and maintained to ensure their long-term effectiveness at minimising interaction between saline groundwater and the highly connected surface water supply.

Table 12 (Continued)
Minimal Impact Considerations for Aquifer Interference Activities

Water Source	Minimal Impact Consideration		
	Water Table	**Water Pressure**	**Water Quality**
Less Productive Porous and Fractured Rock Water Sources	1. Less than or equal to a 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan; or A maximum of a 2 m decline cumulatively at any water supply work. 2. If more than 10% cumulative variation in the water table, allowing for typical climatic "post-water sharing plan" variations, 40 m from any: (a) high priority groundwater dependent ecosystem; or (a) high priority culturally significant site; listed in the schedule of the relevant water sharing plan if appropriate studies demonstrate to the Minster's satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site. If more than 2 m decline cumulatively at any water supply work then make good provisions should apply.	1. A cumulative pressure head decline of not more than a 2 m decline, at any water supply work. 2. If the predicted pressure head decline is greater than requirement 1. above, then appropriate studies are required to demonstrate to the Minister's satisfaction that the decline will not prevent the long-term viability of the affected water supply works unless make good provisions apply.	1. Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity. 2. If condition 1 is not met then appropriate studies will need to demonstrate to the Minister's satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.

Source: Table 1, AIP (NSW Government, 2012).

Table 13
Predicted Maximum Annual Inflow Volumes during Mining Operations

Water Sharing Plan	Management Zone/ Groundwater Source	Predicted Maximum Annual Inflow Volumes (ML/annum)		
		Currently Approved	Change due to the Modification	Modification (Total)
HUAWSP*	Wallis Creek Water Source	0.04	(+) 0.15	0.19
	Newcastle Water Source	11.40	(-) 0.01	11.39
Water Act, 1912	Fractured Rock	N/A	N/A	2,304

Source: After Appendix B.

* HUAWSP = the Hunter Unregulated and Alluvial Water Sharing Plan.

Post-closure predicted maximum annual stream baseflow losses are consistent with, or less than, those predicted during operations. Given this, any licences required to be held during operations would be held as required post-closure.

The numerical groundwater model would be refined over the progression of the mine life in order to more accurately calculate the post-closure licensing requirements.

Minimal Impact Considerations

As discussed above, the AIP establishes minimal impact considerations for highly productive and less productive groundwater.

NOW mapping indicates that highly productive groundwater occurs within ML 1618 and also in areas adjacent to the Modification.

No differentiation between highly productive and less productive groundwater, or verification of the mapped highly productive groundwater, has been undertaken as part of this assessment. Therefore, potential impacts of the Modification to alluvium have been conservatively assessed against the minimal impact considerations relating to highly productive groundwater.

The impacts of the Modification to the fractured rock aquifer system in the coal measures have been assessed against the criteria for less productive groundwater.

Highly Productive Alluvial Water Sources

The water table minimal impact considerations for aquifer interference activities within highly productive alluvial water sources are presented in Table 12.

The closest high priority groundwater dependent ecosystem to the underground mining area is associated with the Pambalong Nature Reserve, and is located immediately adjacent to ML 1618.

ML 1618 was designed to avoid the Pambalong Nature Reserve. In addition, the Modification mine layout has been designed such that there would be no longwall or shortwall mining beneath the Blue Gum Creek alluvium (located upstream of the Pambalong Nature Reserve), to meet the existing subsidence management commitment for the Abel Underground Mine (Section 4.2.5).

Predicted cumulative drawdown in the alluvium associated with the Modification mine layout in the vicinity of the Pambalong Nature Reserve is predicted to be less than approximately 0.5 m (Appendix B). The predicted drawdown for the Modification mine layout is consistent with the drawdown predicted for the approved mine layout (Appendix B).

Cumulative drawdown associated with the Modification mine layout in any alluvium is predicted to be less than 2 m.

Historic groundwater monitoring in the shallow weathered Permian adjacent to the Pambalong Nature Reserve shows groundwater levels fluctuate by more than 10 m in response to rainfall (Appendix B).

As such, it is expected any drawdown at the Pambalong Nature Reserve associated with the Modification mine layout would be less than 10% of the cumulative variation in the water table.

In addition, RPS Aquaterra (2012a) considers it very unlikely the Modification would result in any additional impact on GDEs, including Pambalong Nature Reserve, in comparison to the approved Abel Underground Mine.

No culturally significant sites are located near the Abel Underground Mine, and the Modification would not impact any culturally significant sites.

Mining associated with the Modification would not occur within 200 m laterally, or 100 m vertically beneath, a surface water source defined as a "reliable water supply".

The existing Groundwater Management Plan would be updated for the Modification to include additional multi-level piezometers to monitor groundwater levels to the north and west of Pambalong Nature Reserve (Section 4.4.3).

As detailed in the existing Groundwater Management Plan, a deviation of drawdown of 0.5 m relative to normal seasonal and climatically influenced fluctuations in the near-surface groundwater levels would require a response action (i.e. TARP), with the response program to be carried out in consultation with the DP&I and NOW.

All non-mine owned registered groundwater bores are located outside the extent of predicted drawdown effects from mining at the Abel Underground Mine, including for the Modification. Therefore, no impacts to privately-owned water supply works are predicted (Appendix B).

No impacts to the water quality of alluvium are predicted due to the Modification (Appendix B).

Given the above, it is considered the Modification adequately satisfies minimal impact considerations relating to highly productive alluvial water sources defined in the AIP and outlined in Table 12.

Less Productive Porous and Fractured Rock Water Sources

The watertable minimal impact considerations for aquifer interference activities within less productive porous rock water sources are presented in Table 12.

As described above, the Modification is not expected to impact any relevant GDEs or privately-owned water supply works.

As such, it is considered the Modification adequately satisfies minimal impact considerations relating to less productive porous rock water sources defined in the AIP and outlined in Table 12.

5.3 CONDITIONS, LICENCES AND PLANS THAT REQUIRE REVISION

5.3.1 Project Approval Conditions

Conditions 6 and 7, Schedule 3 of Project Approval 05_0136 (Attachment 2) stipulate limits of approval as follows:

6. *The Proponent shall not extract more than 4.5 million tonnes of ROM coal a year from the Abel site.*
7. *No more than 6.5 million tonnes of ROM coal may be processed a year on the Bloomfield site.*

Conditions 6 and 7, Schedule 2 of Project Approval 05_0136 would require revision as a result of the Modification as follows:

6. *The Proponent shall not extract more than **6.1** million tonnes of ROM coal a year from the Abel site.*
7. *No more than **8.5** million tonnes of ROM coal may be processed a year on the Bloomfield site.*

Condition 7, Schedule 4 of Project Approval 05_0136 (Attachment 2) currently requires the preparation of a SMP for all underground mining operations at the Abel Underground Mine as follows:

7. *Prior to carrying out any underground mining operations that could cause subsidence, the Proponent shall prepare a Subsidence Management Plan (SMP) to the satisfaction of the Director-General of DPI. This plan must be prepared in accordance with the:*
   - *(a) New Approval Process for Management of Coal Mining Subsidence – Policy; and*
   - *(b) Guideline for Applications for Subsidence Management Plan Approvals (or latest versions or replacements of these documents).*

It is envisaged that Project Approval 05_0136 would be revised to include a requirement to prepare an Extraction Plan for second workings at the Abel Underground Mine, rather than a SMP which is currently required by Condition 7 of Schedule 4.

In addition, it is envisaged that Conditions 1 to 6 of Schedule 4 of Project Approval 05_0136 would be contemporised to include subsidence performance measures.

5.3.2 Management/Monitoring Plans

A revised AHMP has been prepared in consultation with registered Aboriginal stakeholders to incorporate the Modification and is provided in Appendix H.

If alterations to the Bloomfield U Cut South area are required, the AHMP would be revised further to include the proposed clearance area (Section 4.9.2).

In addition, the *Donaldson Open Cut and Abel Underground Coal Mines Landscape Management Plan* would be updated prior to any storage of tailings or brine in the Donaldson Square Pit.

Other management plans (e.g. the Water Management Plan) may require revision to reflect updated environmental management measures or changes to Project Approval 05_0136 conditions resulting from the Modification.

6 SUMMARY OF MANAGEMENT, MITIGATION AND MONITORING

This section provides a consolidated summary of all proposed environmental commitments for the Modification, as well as management and monitoring measures.

6.1 MODIFICATION SPECIFIC COMMITMENTS

6.1.1 Subsidence Performance Measures

Donaldson Coal commits to maintaining the existing Abel Underground Mine subsidence management commitments for the Modification.

The mine plan for the Modification has been developed to meet the existing subsidence impact limits specified in Project Approval 05_0136, which are as follows:

- The Abel Underground Mine does not result in any subsidence impacts on:
  - Pambalong Nature Reserve; and
  - the surface of the F3 Freeway.
- Mining is limited to first workings beneath, and designed to ensure that mining causes no subsidence impacts requiring mitigation works on:
  - principal residences and other specified structures (without the approval of the relevant landowner);
  - Black Hill Public School;
  - Black Hill Church and cemetery;
  - Schedule 2 streams (i.e. 3rd order and above streams);
  - rainforest areas; and
  - Blue Gum Creek alluvium.
- Not more than 60% of coal seam is to be extracted from beneath identified cliff areas.

The Subsidence Assessment prepared for the Modification (Appendix A) demonstrated that the Modification mine layout could be developed to meet existing subsidence management commitments.

In addition, Extraction Plans will be prepared prior to the commencement of mining in each area of the Abel Underground Mine to demonstrate that subsidence management commitments can be achieved.

Subsidence monitoring, management and mitigation protocols will be detailed in relevant Extraction Plans.

6.1.2 Investigations of Historic Workings in the Borehole Seam

The existing conditions of the historic workings in the Borehole Seam will be investigated further, prior to the commencement of proposed mining in the underlying areas, as part of the Extraction Plan process (Section 4.2.6).

6.1.3 Downcast Ventilation Shaft

The downcast ventilation shaft will be located to avoid impacts to Aboriginal heritage (Section 4.9.2).

Consistent with the existing biodiversity offset requirement, a biodiversity offset (of like for like vegetation with a ratio of 2:1) will be established as compensatory habitat for any additional clearance associated with the construction of the downcast ventilation shaft to maintain or improve biodiversity values in the medium to long-term[3] (Section 4.8.4).

Construction noise associated with the downcast ventilation shaft will be managed by full enclosure of 24 hour per day drilling activities in a temporary acoustic shed (Section 4.6.2).

In addition, Donaldson Coal will consult with potentially affected landowners, notifying them of the timing and duration of construction activities at least six months prior to commencement (expected in 2015) (Section 4.6.2).

6.1.4 Revised Overland Conveyor Alignment

Construction of an overland conveyor from the Abel Box Cut to the Bloomfield CHPP is currently approved.

The proposed revised alignment of the approved overland conveyor will be located to avoid impacts to Aboriginal heritage (Section 4.9.2).

[3] Biodiversity offsets would not be based on the BioBanking methodology.

Consistent with the existing biodiversity offset requirement, a biodiversity offset (of like for like vegetation with a ratio of 2:1) will be established as compensatory habitat for any additional clearance associated with the revised alignment of the overland conveyor to maintain or improve biodiversity values in the medium to long-term[4] (Section 4.8.4).

6.1.5 Alterations to the Bloomfield U Cut South Void

If the alterations to the Bloomfield U Cut South void are required, surveys will be conducted with Aboriginal stakeholders prior to any additional surface disturbance in this area in accordance with the protocols described in the AHMP (Section 4.9.2).

The AHMP will be updated in consultation with relevant Aboriginal stakeholders to include the proposed clearance area. Additional disturbance for the alterations to the Bloomfield U Cut South void will not occur without approval of the updated AHMP by the DP&I.

Consistent with the existing biodiversity offset requirement, a biodiversity offset (of like for like vegetation with a ratio of 2:1) will be established as compensatory habitat for any additional clearance required for alterations to the Bloomfield U Cut South Void to maintain or improve biodiversity values in the medium to long-term[4] (Section 4.8.4).

6.2 ENVIRONMENTAL MANAGEMENT AND MONITORING

Section 4 outlines proposed environmental mitigation, management and monitoring measures.

Section 3.4 describes rehabilitation of disturbed areas for the Modification, as well as water, coal reject disposal and waste management measures.

A summary of existing/proposed environmental monitoring and management plans for the Modification is provided in Table 14.

Notwithstanding, environmental management, monitoring and reporting will be conducted in accordance with the conditions of Project Approval 05_0136, which may be updated as result of approval of the Modification.

6.3 COMMUNITY CONTRIBUTIONS

Donaldson Coal's existing community contributions will continue for the Modification. These include (Section 2.14):

- Donaldson Job Creation Trust;
- Donaldson Community Welfare Trust; and
- Donaldson Conservation Trust.

[4] Biodiversity offsets would not be based on the BioBanking methodology.

Table 14
Summary of Environmental Management and Monitoring Plans

Existing/Proposed Management and Monitoring Plans	Key EA Sections
Environmental Management Strategy	Sections 2.13 and 4.11.5
Abel Underground Coal (Integrated with Donaldson Open Cut, Tasman Underground and Bloomfield Open Cut Coal Mines) Integrated Environmental Monitoring Program	Sections 4.5, 4.6 and 4.7
Subsidence Management Plan/Extractions Plans*, including: • Public Safety Management Plan • Property Subsidence Management Plan • Infrastructure Management Plan • Principal Residence Management Plan • Dam Monitoring and Management Strategy • First Workings Management Plan • AHMP** • Water Management Plan**	Section 4.2
Pollution Incident Response Management Protocol	Section 4.3
Water Management Plan**, including: • Site Water Balance • Erosion and Sediment Control Plan • Surface Water Monitoring Program • Groundwater Management Plan • Groundwater Monitoring Program • Disposal of Tailings and Coarse Rejects	Sections 3.3.6, 3.3.7, 4.3 and 4.4
Noise Monitoring Program	Section 4.6
Air Quality Monitoring Program	Section 4.7
Flora and Fauna Management Plan	Section 4.8
Donaldson Coal Bushland Conservation Area Management Plan	Section 4.8
AHMP**	Section 4.9
Energy Savings Action Plan	Section 4.11.2
Donaldson Open Cut and Abel Underground Coal Mines Landscape Management Plan**, including: • Mine Closure Plan • Rehabilitation Management Plan • Final Void Management Plan	Sections 3.4 and 4.8

* New management/monitoring plan to be prepared.

** Management/monitoring plan to be updated.

7 CONCLUSION

Modification Description

The proposed Modification to the Abel Underground Mine would involve the continuation of underground mining within the approved area (i.e. ML 1618) and the approved seams (Upper and Lower Donaldson Seams). However, in addition to the approved bord and pillar mining method, it is proposed to also employ a combination of longwall, shortwall and bord and pillar mining.

The Modification would enable increased efficiency and quantity of coal recovery within the approved mining areas and seams for the Abel Underground Mine, resulting in increased employee numbers, revenue and associated taxes and royalties to the NSW State Government.

ROM coal extraction from the Abel Underground Mine would increase from the currently approved rate of 4.5 Mtpa up to 6.1 Mtpa due to the Modification.

Modification Mine Layout

The Modification mine layout has been designed to meet the existing subsidence management commitments detailed in Project Approval 05_0136 for the Abel Underground Mine.

The Subsidence Assessment prepared for the Modification (MSEC, 2012) demonstrated that the Modification mine layout could be developed to meet the existing subsidence management commitments.

Environmental Review

As the Modification mine layout would meet the existing subsidence management commitments in Project Approval 05_0136, no additional consequences from subsidence to key natural and built surface features are predicted, in comparison to those predicted for the approved Abel Underground Mine.

In addition, there would be no additional impacts to groundwater or surface water resources, or groundwater dependent ecosystems, due to the Modification.

No exceedances of relevant operational noise or air quality criteria are predicted at receiver locations when considering changes in surface infrastructure and the increased ROM coal production rate, and associated increase in the processing rate at the Bloomfield CHPP, for the Modification.

The Modification would result in minor additional vegetation clearance. However, this clearance would not include any TECs.

Changes in the method of mining associated with the Modification (i.e. longwall or shortwall mining) may increase the potential for impacts to Aboriginal heritage sites with either a low, or low to moderate, significance. These potential impacts were described in the draft Aboriginal Cultural Heritage Assessment which was reviewed by Aboriginal stakeholders. Mitigation measures for the sites were developed in consultation with these stakeholders.

Mitigation Measures, Management and Monitoring

The environmental review indicates there would be limited additional environmental impacts due to the Modification in comparison to those associated with the existing Abel Underground Mine.

As such, the existing mitigation measures and monitoring requirements specified in the conditions and limits in Project Approval 05_0136 and Donaldson Coal's EPLs (11080 and 12856) would be maintained for the Modification, and are considered suitable for the ongoing management of potential environmental impacts.

Notwithstanding, existing management plans would be updated as required for the Modification (e.g. the Water Management Plan). In addition, SMPs/Extraction Plans would be prepared prior to the commencement of any second workings at the Abel Underground Mine.

A draft revision of the AHMP has been prepared in consultation with the relevant Aboriginal stakeholders, outlining mitigation measures for additional potential impacts to Aboriginal heritage associated with the Modification. The AHMP would be revised further, as required.

Biodiversity offset land would be secured, as required, prior to the commencement of any additional clearing associated with the Modification.

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