8.0 Environmental Assessment

8.1 Biodiversity

8.1.1 Introduction

This section provides an assessment of the potential impacts of the Project on biodiversity. EMM Consulting prepared a Biodiversity Assessment Report (BAR) for the Project (provided at **Appendix D** and summarised below). The BAR assessed the potential impact of the additional clearing proposed as part of the Project. The BAR also includes a gap analysis of previous ecological assessments undertaken within the Project Area and an assessment of potential impacts of the Project on matters of NES.

Documents reviewed as part of the desktop assessment include the following:

- *Flora, Fauna & Threatened Species Assessment: Bloomfield Colliery Completion of Mining and Rehabilitation, Part 3A Environmental Assessment*, prepared by EcoBiological, November 2008;
- *Bloomfield Colliery East Maitland, Part 3A variation ecology* report, prepared by Hunter Eco, May 2010; and
- *Bloomfield Colliery East Maitland, Biodiversity Assessment – Creek Cut Highwall,* prepared by Hunter Eco, November 2012.

8.1.2 Existing Environment

Previous ecological assessment (2008 EA)

The 2008 EA included an assessment of potential impacts to flora and fauna, including threatened species, populations and ecological communities. This assessment comprised the following:

- Desktop assessment and review of ecological databases to compile a list of threatened flora and fauna likely to occur on the site;
- Field survey to locate listed threatened species or communities occurring on the site;
- Assessment of potential ecological impacts; and
- Identification of mitigation measures to be implemented during the mining operations.

One Endangered Ecological Community and six threatened (TSC Act) fauna species were recorded in the vegetated disturbance areas. No species listed as threatened in the Commonwealth EPBC Act were found. An assessment of the impact of the loss of habitat on the EEC and the threatened species concluded that there would be no impact that would place any local populations at risk of extinction.

MOD 1 Clearing Area – 'MOD1 Study Area'

An additional disturbance area was approved to be cleared as part of the MOD 1 modification to the Project Approval (MP 07_0087) to allow for relocation of a powerline corridor and associated infrastructure. The MOD 1 assessment covered the 6.12ha of vegetation proposed to be cleared as part of the current Project to facilitate the further extraction of coal resources. This area is hereafter referred to as the 'MOD1 Study Area' (refer to **Figure 18**). Given that there would be no additional vegetation clearing in the MOD1 Study Area above that already approved under Project Approval MP 07_0087 (as modified), no further assessment under the BC Act is required to support the application for the MOD1 Study Area. Further assessment would only be required if the Project is likely to cause additional impacts compared to that which has previously been assessed and approved.

The gap analysis prepared by EMM Consulting (refer to Appendix A of **Appendix D**) identified that the previous ecology impact assessment undertaken for MOD 1 (Hunter Eco, 2010) did not address the matters of NES listed under the Commonwealth EPBC Act. Hunter Eco (2010) did not undertake a Protected Matters Search to determine if species or ecological communities listed under the EPBC Act were likely to be present. Also Hunter Eco (2010) did not prepare assessments of significance to determine the likelihood that the Project would significantly impact species and /or communities listed under the EPBC Act, or if a referral was required.

In the light of this omission, EMM Consulting prepared an assessment of the potential impacts of vegetation clearance within the MOD1 Study Area on matters of NES as listed under the EPBC Act (refer to Appendix A of **Appendix D**).

Additional Clearing Area –'Haul Road Study Area'

An additional 3.5 ha of previously rehabilitated landform (including 0.34 ha of native vegetation) would be cleared as part of the Project for the proposed widening of a haul road and upgrade of a watercourse. There are two defined areas that would be impacted on either side of the haul road and these combined areas are hereafter referred to as the Haul Road Study Area (refer to **Figure 18**). The Haul Road Study Area was rehabilitated before the Project Approval MP 07_0087 was granted in 2009. Whilst this area is within the existing approval area for the Colliery, it is not part of the approved extraction of disturbance footprint.

As the Project would involve clearing of native vegetation and increase of the Colliery's disturbance footprint, the BAR (refer **Appendix D**) included an assessment of likely biodiversity impacts of the Project on the Haul Road Study Area, having regard to guidelines such as the Framework for biodiversity Assessment (FBA).

Site Description

MOD1 Study Area

The MOD1 Study Area is a forested area of 6.12 ha south-west of the operating Creek Cut pit. To the south and south-west of the MOD1 Study Area is cleared land, also associated with the mine. To the north and north-west, the MOD1 Study Area is also bound by forest. The 6.12 ha of forest within the MOD1 Study Area is approved to be cleared under the Project Approval (MP 07_0087 as modified).

Database searches (including NSW OEH Atlas of Wildlife and Commonwealth Protected Matters Search Tool) were conducted by EMM Consulting on 7 April 2017 to obtain recent data on flora and fauna species, populations, communities and habitat listed under the EPBC Act that may occur in the MOD1 Study Area.

Field surveys were undertaken within the MOD1 Study Area targeted at identifying species and communities listed under the EPBC Act. Flora and vegetation surveys consisted of meander searches to document the vegetation structure and dominant flora species and to target threatened flora species. Fauna species were recorded opportunistically as they were encountered during the field survey. Evidence of fauna such as tracks, scats, scratches on and around trees and potential fauna habitat features were noted.

The entire MOD1 Study Area is forested although it appears to have been historically cleared as there is a lack of large trees and a large number of trees of a similar size, indicating a single regeneration event. A single vegetation type was identified within the MOD1 Study Area – the *Spotted Gum – Broad leaved Mahogany – Red Ironbark shrubby open forest*. A description of this community is provided at Appendix A ,of **Appendix D**. This community does not meet the listing of the Critically Endangered Ecological Community (CEEC) Central Hunter Valley eucalypt forest and woodland (CHVEFW) due to the frequent occurrence of contraindicative canopy species, including Red Ironbark and Forest Oak.

The vegetation within the MOD1 Study Area represents potential habitat for Black-eyed Susan (*Tetratheca juncea*) however targeted flora surveys did not detect the species, nor any other threatened flora listed under the EPBC Act.

No EPBC listed threatened fauna species or migratory fauna species were recorded during the field surveys within the MOD1 Study Area. Potential habitat for a number of EPBC listed threatened species, including the Regent Honeyeater, Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox and migratory species including the Satin Flycatcher and Rufous Fantail was identified within the MOD1 Study Area.

One Koala (*Phascolarctos cinereus)* feed tree species listed under SEPP 44 was recorded within the MOD1 Study Area (the Grey Gum (*Eucalyptus punctata*)). However, no primary or secondary feed trees listed for the North Coast Koala Management Area (KMA) were found and therefore it is unlikely that there are sufficient foraging resources to support the Koala within the MOD1 Study Area. No Koala scats were detected during the searches.

Haul Road Study Area

The Haul Road Study Area comprises two areas of land covering approximately 3.5 ha and is located north-east of the operating Creek Cut pit. The Haul Road Study Area is bound by rehabilitated landform and haul roads associated with the Colliery's current operations.

Database searches (including NSW OEH Atlas of Wildlife and Commonwealth Protected Matters Search Tool) were conducted by EMM Consulting on 7 September 2017 to obtain information about the flora and fauna species, populations, communities and habitats likely to occur within 10km of the Haul Road Study Area. An initial site investigation was conducted to gain an understanding of the vegetation structure and dominant flora species within the Haul Road Study Area. Mapping was conducted using a hand-held GPS unit, mobile tablet computers and aerial photo interpretation. The BAR included mapping of vegetation within an inner assessment circle of 100 ha and an outer assessment circle of 1000 ha (refer to **Figure 18**). Targeted flora surveys were then undertaken and fauna species were recorded opportunistically as they were encountered during the field surveys.

The previously rehabilitated landform is very disturbed. Within the Haul Road Study Area, the previous rehabilitation occurs as:

- Patches of regenerating forest (consisting of stands of regenerating trees of a similar size, no very large trees , a spars mid-storey and grassy understorey); and
- Exotic grassland dominated by grass species that are common to mine rehabilitation, especially Rhodes Grass (*Chloris gayana)*, with *Acacia sp.* Regrowth in the mid storey and no canopy layer.

The Haul Road Study Area supports 0.34 ha of native vegetation, occurring as small patches. The two Plant Community Types (PCTs) identified within the Haul Road Study Area are set out in **Table 10**. These PCTs represent the *Lower Hunter Spotted Gum- Ironbark Forest in the Sydney Basin Bioregion*, which is an Endangered Ecological Community (EEC) listed under the BC Act. These two PCTs were assessed as being in moderate / good condition in accordance with the FBA.

Table 10 Plant Community Types within the Haul Road Study Area

Plant Community Type	Vegetation formation	Vegetation class	Area (ha)
PCT 1590 – *Spotted Gum – Broad leaved Mahogany – Red Ironbark shrubby open forest*	Dry Sclerophyll Forests (shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	0.05
PCT 1592 – *Spotted Gum – Red Ironbark – Grey Gum – grass open forest of the Lower Hunter*	Dry Sclerophyll Forests (shrub/grass sub-formation)	Hunter-Macleay Dry sclerophyll Forests	0.29

A 3.2 ha area of non-native vegetation dominated by exotic grasses was identified; however this area had a site value score of less than 17 and is not considered further in the assessment of offsets. Descriptions of each PCT / vegetation zone are provided in Tables 4.3 to Table 4.5 of **Appendix D**.

Targeted flora surveys were undertaken for the following species, however no target flora species were recorded within the Haul Road Study Area:

- Black-eyed Susan (*Tetratheca juncea*);
- Netted Bottle Brush (*Callistemon linearifolius*);
- Scant Pomaderris (*Pomaderris queenslandica);*
- Singleton Mint Bush *(Prostanthera cineolifera);*
- Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora),* and
- White-flowered Wax Plant (*Cynanchum elegans).*

The regenerating forested areas are likely to provide habitat for a range of common fauna species. No tree hollows were observed within the forested patches in the study area, as a result of the relatively young canopy. Therefore, it is unlikely that the Haul Road Study Area provides shelter for arboreal

mammals or nesting habitat for hollow dependent birds, although these species may occasionally forage in these areas.

The regenerating forested areas may provide foraging habitat for a number of threatened bird species, forest owls, micro bats that are associated with the recorded vegetation types recorded. A list of ecosystem credit species predicted to occur within the Haul Road Study Area is provided in Table 5-2 of **Appendix D**. A list of species credit species predicted to occur and an assessment of whether the Haul Road Study Area provides suitable habitat is provided in Table 5-3 of **Appendix D**.

No threatened flora or fauna species listed under the BC Act or EPBC Act were recorded during the targeted surveys. Potential seasonal foraging habitat for a number of EPBC listed threatened species, including the Regent Honeyeater, Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox was identified, however the Haul Road Study Area does not provide habitat for an ecologically significant proportion of these species.

Two Koala feed tree species listed under SEPP 44 were recorded within the Haul Road Study Area; the Forest Red Gum and Grey Gum. Forest Red Gum comprised a small proportion of the canopy (5%) in PCT 1590 and Grey Gum a small proportion of the canopy (10%) in PCT 1592. The primary feed tree Forest Red Gum was recorded within PCT 1590 and no secondary feed trees listed for the North Coast KMA were found. Stringybark/supplementary species White Stringybark was recorded within PCT 1592. No Koala scats were detected during searches around the base of primary and supplementary feed tree species. Given the lack of records, the small proportion of Forest Red Gum and Grey Gum in the canopy, as well as the fragmented and disturbed nature of the area, it is unlikely that there are sufficient foraging resources to support the Koala within the Haul Road Study Area.

8.1.3 Impact Assessment

MOD1 Study Area

The direct impact of the Project on matters of NES includes clearance of vegetation. The impact assessment assumes complete disturbance/removal of Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest, which occupies an area of 6.12 ha within the MOD1 Study Area.

Significant impact assessments were prepared for the following EPBC listed species (detailed in Appendix A of **Appendix D**), in accordance with the criteria listed in the *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DoE, 2013):

- Critically endangered species:
  - Regent Honeyeater;
  - Swift Parrot;
- Vulnerable species:
  - Large eared Pied Bat;
  - Grey Headed Flying Fox;
- Migratory species:
  - Satin Flycatcher; and
  - Rufous Fantail.

Potential habitat for these species was found to be of poor value, primarily due to its condition, fragmented nature, existing threats and location next to an existing operating open cut mine. The habitat is unlikely to support important populations of matters of NES or be critical to the survival of a population or the species. Assessments of significance undertaken for these EPBC listed species concluded that significant impacts to matters of NES within the MOD1 Study Area would be unlikely to occur as a result of the proposed Project.

Nonetheless, a precautionary assessment approach has been adopted, and the Regent Honeyeater and Swift Parrot have been assumed to occasionally forage within the MOD1 Study Area. Accordingly, measures were recommended to mitigate potential impacts of the Project on potential habitat for the Regent Honeyeater and Swift Parrot.

Haul Road Study Area

The Project has potential for direct and indirect impacts within the Haul Road Study Area. Direct impacts would include the removal of 0.05 ha of PCT 1590 - *Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest* in moderate / good condition, and the removal of 0.29 ha of PCT 1592 – *Spotted Gum – Red Ironbark – Grey Gum – grass open forest of the Lower Hunter* in moderate / good condition.

Potential indirect impacts arising from the Project include:

- Temporarily increased noise levels from construction equipment, leading to disturbance of fauna (particularly during breeding season); and
- Temporary slight increase of traffic volume during construction as a result of upgrade of the haul road, leading to higher chance of fauna strike and increased noise levels leading to disturbance of fauna.

The Haul Road Study Area already occurs as small patches of vegetation and is already heavily impacted by edge effects. The Project would not significantly increase edge effects given the high level of existing clearance.

The upgrade of the haul road would not result in a permanent increase in traffic volume and impacts on biodiversity from operation of the proposed upgrade would be negligible. Residual impacts of the Project would include loss and minor increases in fragmentation of native vegetation and species habitat, and the potential for species to no longer utilise potential habitat within the Haul Road Study Area.

Consideration of the thresholds for assessment and offsetting in accordance with Section 9 of the FBA was undertaken and the following points are noted:

- The Haul Road Study Area does not support any 4th, 5th or 6th order streams, estuarine areas, important wetlands, or state or regional biodiversity links. Therefore there are no impacts to the landscape features that require further consideration;
- One TSC Act listed EEC *Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion* occurs within the Haul Road Study Area. The proposal would clear 0.34 ha of this EEC.
- The Haul Road Study Area does not include any areas of critical habitat. No impacts on critically endangered or endangered species would result from the proposal, and there are no impacts on species or populations requiring further consideration; and
- The proposal would result in the removal of 0.05 ha of PCT 1590 *Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest* (HU804), and 0.29 ha of PCT 1592 *Spotted Gum – Red Ironbark – Grey Gum - grass open forest of the Lower Hunter* (HU806). Impacts upon these PCTs would require offsetting.

The BAR included an assessment of biodiversity credits required as a result of impacts on the biodiversity values within the Haul Road Study Area. The assessment concluded that 10 ecosystems credits would be required to offset the residual impacts to native vegetation and a Biodiversity Offset Strategy was prepared. The Biobanking public register was checked for the availability of credits of the same PCTs as those being impacted. Credits were available for PCT 1592 (HU806) on the public register. There were no matching credits for PCT 1590 however the credit profile report includes PCT 1592 as an offset option for PCT 1590.

The PCTs and corresponding number of credits generated under the FBA were entered into the online Biodiversity Offset Payment Calculator on 9 November 2017. The calculator estimates a price of $2,000.64 per credit. The total payment required for the Project is $22,007.08 (including GST). Due to the small number of credits to be offset, payment into the Biodiversity Conservation Trust is the preferred option to secure offsets for this Project.

The assessment concluded that significant impacts on matters of NES under the EPBC Act would be unlikely to occur within the Haul Road Study Area as a result of the Project.

8.1.4 Mitigation Measures

Existing measures

The Colliery has established clearing practices in place as part of its EMS (as detailed in **Section 4.2.11**). These include minimisation of disturbance areas, pre-clearance surveys, salvaging and reusing material on site for habitat enhancement, conserving and reusing topsoils and weed management. These clearing practices would continue to be implemented for the Project in accordance with the approved EMS.

Pre-clearance surveys

Pre-clearance surveys of the forest to be removed would be conducted within 24 hours prior to commencement of clearing to identify any fauna species or habitat within areas of impact. Where clearing of vegetation and fauna habitat occurs, clearing protocols would be put in place, including checking trees for the presence of arboreal fauna prior to felling. Where feasible, animals found to be occupying trees would be safely relocated into nearby forest that would not be disturbed. Where feasible, transportable habitat features such as large logs and boulders would be placed in adjacent retained areas or in areas ready for seeding, to allow their continuation as potential fauna refuge sites.

Regent Honeyeater and Swift Parrot

In addition to these general fauna pre-clearance methods, the following measures would be implemented to mitigate potential impacts on habitat for the Regent Honeyeater and Swift Parrot:

- A qualified ecologist would undertake a targeted pre-clearance survey within 24 hours prior to the commencement of removal of potential foraging habitat for the Regent Honeyeater and Swift Parrot (potential foraging habitat includes the entire 6.12 ha study area);
- Pre-clearance surveys would be undertaken over a period of two days and surveys would be undertaken in the morning (i.e. within 3 hours of sunrise) to target the species highest activity period. Dependent on the clearing schedule, the survey effort would comprise:
  - 20 minute searches in areas up to 5 ha; or
  - 40 minute searches in areas of 6 – 30 ha.
- If Regent Honeyeaters or Swift Parrots **are not found** within the clearance area, then searches for Regent Honeyeater or Swift Parrot habitat trees (foraging trees) are not required;
- If Regent Honeyeaters or Swift Parrots **are found** within the clearance area, targeted searches for Regent Honeyeater or Swift Parrot habitat trees would be undertaken by a qualified ecologist;
- If habitat trees are found within the clearance area, a qualified ecologist would mark the trees with flagging tape and spray paint (e.g. with a ‘H’, denoting habitat tree);
- The two stage clearance protocol for habitat trees comprises:
  - Stage 1: Non-habitat trees would be cleared 24 hours prior to any habitat trees being cleared, to encourage Swift Parrots to move out of the habitat area; and
  - Stage 2: When Stage 1 is complete, habitat trees can be removed.

Weed control, microhabitat retention and demarcation

Other management strategies would include:

- Appropriate weed controls to avoid incursion of exotic weed species into the remaining surrounding forest;
- Salvaging microhabitat features, such as woody debris and logs, within adjacent suitable habitat, where possible to mitigate potential impacts to ground-swelling fauna; and
- Habitat adjacent to the proposed clearing would be demarcated to avoid accidental clearing. Vegetation clearing would be minimised and avoided where possible. Where opportunities for reduction in clearing extents occur, these would be implemented and micro-habitat features retained.

Construction of Haul Road Upgrade

Additional mitigation measures to be implemented during construction of the haul road upgrade would include:

- Appropriate exclusion fencing would be installed around vegetation to be retained directly adjacent to the development footprint;
  - Appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' would be installed;
  - The location of any 'No Go Zone' would be identified in site inductions;
  - Fencing would be secured with star pickets and would use high visibility bunting;
- All material stockpiles, vehicle parking and machinery storage would be located within cleared areas or areas proposed for clearing, and not in areas of retained native vegetation;
- A licenced wildlife salvage team would be on-site during vegetation removal to catch and relocate (if appropriate) wildlife encountered;
- Where appropriate, native vegetation cleared from the development site would be mulched for reuse on the site, to stabilise bare ground;
- Temporary stormwater controls would be implemented during construction to ensure that discharges to the drainage channels are consistent with existing conditions; and
- Sediment and erosion control measures would be implemented prior to construction works commencing (e.g. silt fences, sediment traps), to protect drainage channels. These would conform to relevant guidelines, would be maintained throughout the construction period and would be carefully removed following the completion of works.

Biodiversity Offset Strategy

Ten ecosystem credits would be required to offset the impacts arising from the Project, and Bloomfield would pay the required offsetting cost (currently estimated to be $22,007.08 including GST) into the Biodiversity Conservation Trust.

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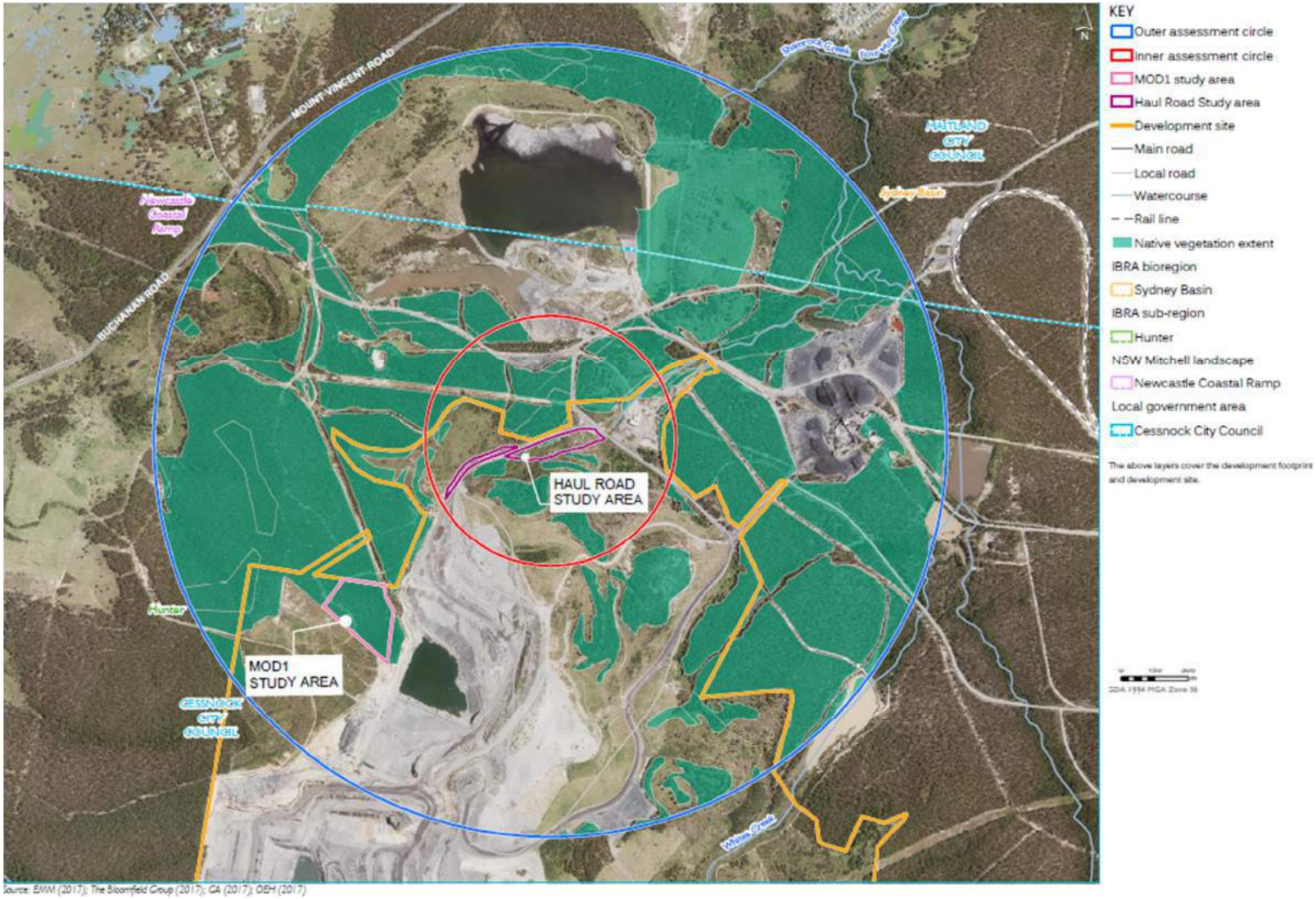

Figure 18 MOD1 Study Area and Haul Road Study Area for Biodiversity Assessment (Source: EMM Consulting, 2017)

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8.2 Noise, Vibration and Blasting

8.2.1 Introduction

This section provides an assessment of potential noise, vibration and blasting impacts associated with the Project. SLR Global Environmental Solutions (SLR) prepared a Noise and Vibration Impact Assessment (NVIA) which is provided at **Appendix E** and summarised below. The NVIA was completed with reference to the following guideline documents:

- *NSW Industrial Noise Policy* (INP) (EPA, 2000)[2];
- *Australian Standard AS 2187: Part 2-2006 Explosives - Storage and Use - Part 2: Use of Explosives;* and
- *Technical basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZEC, 1990).

It is noted that the INP was withdrawn and replaced by the *Noise Policy for Industry* (EPA, 2017) in October 2017. However the EPA's *Implementation and transitional arrangements for the Noise Policy for Industry (2017)* provides that, where SEARs were issued for a project prior to the release of the new policy, the assessment requirements referenced in the SEARs apply. The SEARs for the Project were issued in March 2017 and specifically require a noise and blasting assessment under the INP. Therefore the INP remains the relevant guideline with which to assess the Project.

The Project would utilise the existing rail loop and CHPP facilities already assessed as part of the approved Abel Underground Mine Project. Therefore, the noise impact from these facilities is only considered as part of the cumulative assessment. No changes to road and rail traffic would occur as a result of the Project nor are any construction activities proposed. Accordingly, road noise, rail noise and construction noise are not considered further in this noise assessment.

8.2.2 Existing Environment

There are numerous residential properties in the vicinity of the Project area. The sensitive receivers assessed in the NVIA are shown on **Figure 19**.

In accordance with the existing Noise Monitoring Program, quarterly noise monitoring is undertaken at locations around the Project area. Noise monitoring consists of continuous, unattended noise logging and operator attended noise surveys. Background noise monitoring was conducted at locations F, G, L, M and N (refer to **Figure 19**).

Attended noise surveys found that the noise environment at the assessed locations is dominated by road traffic and natural noises such as insect, frog, cicada and bird noise. Significant sources of road traffic noise in the region include the John Renshaw Drive, New England Highway, Buchanan Road and Hunter Expressway (which opened on 22 March 2014). The Rating Background Levels (RBLs) for the Project were reassessed to determine the change in the background noise levels within the Project area since the Hunter Expressway was opened.

The measured RBLs during the quarterly noise monitoring surveys conducted between April 2015 and March 2017 were used to calculate the representative long term RBL at each monitoring location (Table 7 of **Appendix E**). In accordance with the INP Application Notes for the modification of existing industrial premises, the RBLs and $L_{Aeq(period)}$ amenity levels were determined in the absence of existing Bloomfield Colliery operations (Table 9 of **Appendix E**).

Review of wind data from the on-site meteorological station between 2011 and 2017 indicated that prevailing wind conditions are a feature of the area and as such have been considered as part of the NVIA. Review of data from the Beresfield weather station indicated that the frequency of occurrence of F Class temperature inversions is greater than 30% and therefore this weather condition has been considered as part of the NVIA. The meteorological parameters used in the NVIA therefore included prevailing wind conditions and F Class temperature inversions.

[2] The INP has been replaced by the NSW Noise Policy for Industry (2017), however transitional arrangements provide that the INP remains the applicable noise guideline for the Project.

The existing Blast Monitoring Program is implemented for all blasting activities associated with the Colliery's mining operations. Blasting only occurs between 9am and 5pm Monday to Saturday, with no blasting conducted on Sundays and public holidays. Bloomfield operates a network of blast monitors to provide feedback on ground vibration and airblast levels for each blast. Data collected from the monitors is correlated with blast parameters such as charge weight and location and used to ensure future blasts are adequately designed to avoid exceedances of appropriate noise and vibration criteria.

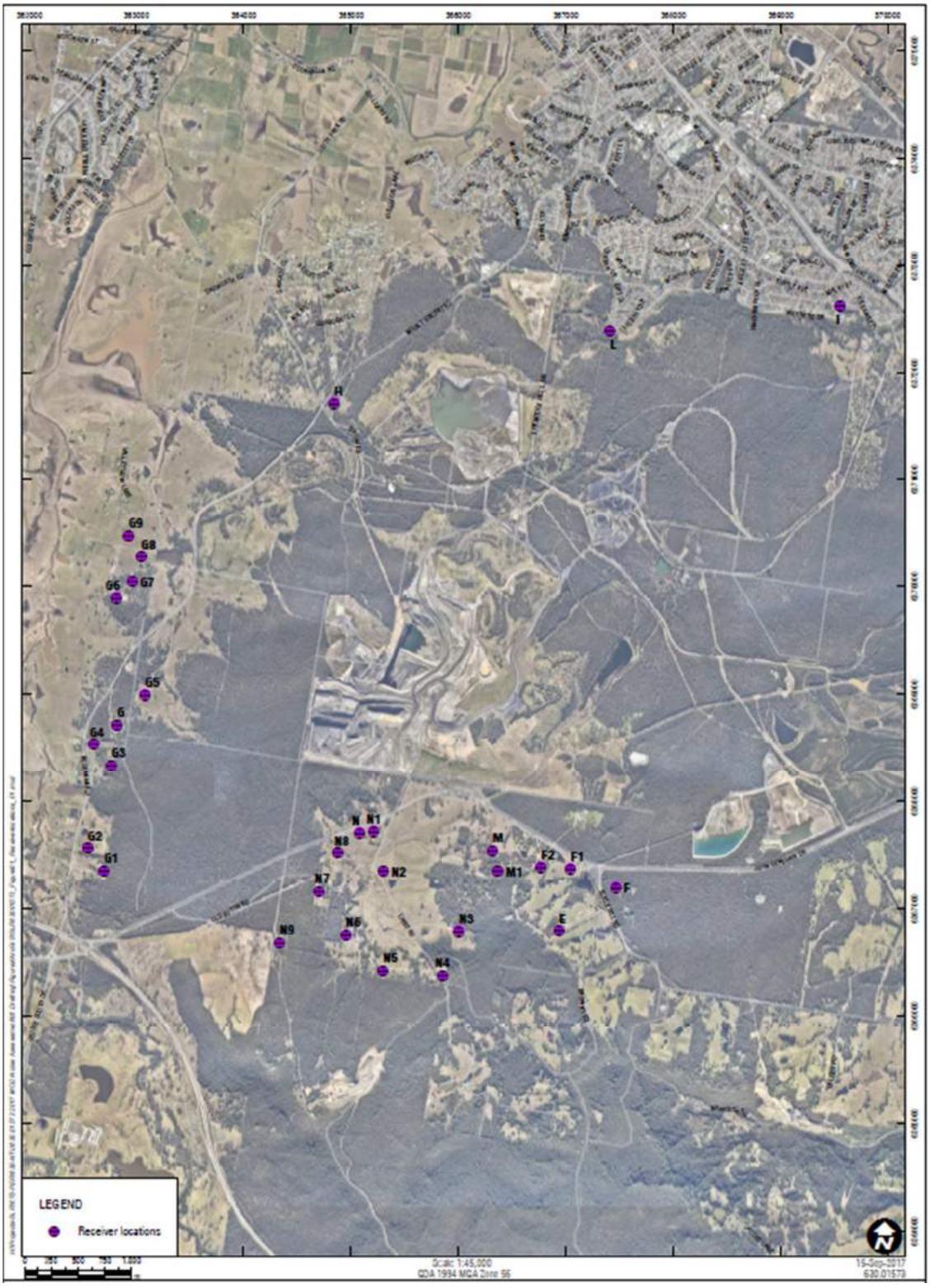


Figure 19 Sensitive Receivers Assessed in the NVIA

8.2.3 Noise Criteria

INP Intrusiveness and Amenity Criteria

The INP provides the framework and process for deriving noise criteria for the regulation of noise from industrial premises. The policy sets two separate noise criteria to meet environmental noise objectives; one to account for intrusive noise and the other to protect the amenity of particular land uses.

For assessing intrusiveness, the background noise level is measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5dB above the measured background level (L_{A90}).

The amenity assessment is based on noise criteria specific to land use and associated activities. The amenity criteria relate only to industrial-type noise and do not include road, rail or community noise. Where the existing noise level from industrial sources approaches the acceptable noise level, noise from new sources must be limited to protect the amenity of the area. Amenity criteria for receivers such as residences, schools, and recreation areas are provided in Table 4 of **Appendix E**.

Project Specific Noise Criteria

Project Specific Noise Levels (PSNLs) for the Project have been established in accordance with the procedures in the INP. The amenity criteria have been established using the results of ambient noise measurements (refer to **Section 8.2.2**) with adjustments to account for existing industrial noise contributions as necessary. The acoustic environment typifies that of suburban environments. The PSNLs for all assessed receptors are provided in **Table 11**.

Table 11 Project Specific Noise Levels

Location	Locality Area (Noise Amenity Area)	Period	Adopted RBL[1]	Intrusive Criteria[1,2] $L_{Aeq(15min)}$ dBA	Amenity Criteria[1,3] $L_{Aeq(period)}$ dBA
E, F – F2	Black Hill (Suburban)	Day	45	50	55
		Evening	42	47	45
		Night	40	45	40
G – G9, H	Buchanan & Louth Park (Suburban)	Day	40	45	55
		Evening	38	43	45
		Night	31	36	40
L, I	Ashtonfield (Suburban)	Day	34	39	55
		Evening	34	39[1]	45
		Night	33	38	40
M – M1, N – N9	Buttai (Suburban)	Day	44	49	55
		Evening	44	49	45
		Night	37	42	40

1. Evening RBL and criteria adjusted to be no greater than the daytime in accordance with the INP application notes
2. Intrusiveness criteria = Adopted RBL + 5 dB
3. Amenity criteria = Adopted RBL adjusted to account for existing industrial noise sources

Sleep Disturbance

The INP Application Notes provide guidance on setting sleep disturbance criteria. The EPA recognises that the current $L_{A1(1\ minute)}$ sleep disturbance criterion of 15dBA above the prevailing background $L_{A90(15min)}$ noise level is not ideal. However as there is insufficient information to determine a suitable alternative criterion, in the interim, the INP guideline suggests that the $L_{A1(1minute)}$ level of 15dBA above the RBL is a suitable screening criteria for sleep disturbance for the night-time period.

The night time $L_{A1(1\ minute)}$ Sleep Disturbance Noise Levels determined in accordance with the INP Application Notes are presented in **Table 12**.

Table 12 Sleep Disturbance Noise Levels

Location	Period	Adopted Night-time RBL	Sleep Disturbance Noise Goal LA1(1minute) dBA
E, F – F2	Night-time (10 pm – 7:00 am)	40	55
G – G9, H		31	46
L, I		33	48
M – M1, N – N9		37	52

Blasting and Vibration Criteria

Ground vibration and airblast levels which cause human discomfort are lower than recommended structural damage limits. Therefore, compliance with the lowest applicable human comfort criteria generally ensures that the potential to cause structural damage is negligible. The EPA currently adopts the ANZEC (1990) guidelines for assessing potential annoyance from blasting during daytime hours, as set out in **Table 13**.

Table 13 Blasting and Vibration Criteria

Blasting impact	Criteria
Airblast overpressure	≤ 115 dBL for 95% of blasts in a 12 month period ≤ 120 dBL for all blasts
Ground Vibration	≤ 5 mm/s for 95% of blasts in a 12 month period ≤ 10 mm/s for all blasts

8.2.4 Methodology

Operational Noise Modelling

The Conservation of Clean Air and Water Europe (CONCAWE) prediction methodology was utilised within SoundPLAN 3D modelling software (Version 7.4) to predict noise emissions from the Project. Prediction of noise emission levels was carried out under the meteorological parameters discussed at **Section 8.2.2** which included prevailing wind conditions and F Class temperature inversion. Plant and equipment considered in the modelled operational scenarios include an excavator, rear dump trucks, mining drills, dozers, graders and watercarts.

Noise predictions were carried out for three operational years, namely:

- Year 2018 - Representative of Bloomfield operations at the commencement of the Project;
- Year 2021 - Representative of Bloomfield operations midway through Project related mining operations; and
- Year 2025 - Representative of the furthest extent of Project related operations to the west.

For each of these operational years, three operational scenarios were modelled during each period (that is, day, evening, night, and night reduced operations). The operational scenarios included:

- Scenario 1: Coaling via the main (eastern) haul route (refer **Figure 3**);
- Scenario 2: Coaling via the alternate (western) haul route (refer **Figure 3**); and
- Scenario 3: Overburden.

Vibration and Blasting

The approach of this assessment was to determine the limiting factors to the blast design for the Project with the aim of achieving the relevant criteria at all locations. In order to predict the levels of

blast emissions (ground vibration and airblast) at the surrounding receivers from the Project, the measured ground vibration and airblast levels from blasting operations conducted in 2014 to 2016 were used to develop blast emissions site laws.

The ground vibration and airblast criteria cater for the inherent variation in emission levels from a given blast design by allowing a 5% exceedance of a general criterion up to a (never to be exceeded) maximum. Correspondingly, the "5% exceedance" (95% confidence) levels have been used in the blast emission site laws. Calculations were conducted using the respective 5% site law equations in order to determine the Maximum Instantaneous Charge (MIC).

8.2.5 Impact Assessment

Operational Noise

The predicted daytime, evening and night-time operational noise levels to the nearest residential receiver areas for year 2018, 2021 and 2025 operations are presented in full in **Appendix E** and summarised below. The predicted noise levels were compared against the Project Approval MP 07_0087 noise limits as well as the PSNLs.

Year 2018

Exceedances (by 1 - 4dBA) of the Project Approval noise limits are predicted at Locations E, F, G, and M. However, at Locations E, F and M, Project Approval noise limits have been set below the PSNLs. No exceedances of the PSNLs are predicted at Locations E, F and M.

At Location G exceedance (by 1 - 3dBA) of the Project Approval noise limits and PSNLs are predicted during the night-time. Exceedances (by 1 - 4dBA) of the PSNLs are predicted at Locations G5, G6, G7, G8, G9 and N2 during the night-time.

During reduced night-operations, compliance with the relevant PSNLs and Project Approval noise limits are predicted at all receiver locations with the exception of Location G5, which is owned by Bloomfield, and Location M. However when using the alternate haul route (that is, Scenario 2) noise levels comply with the PSNLs and Project Approval noise limits and as such coal haulage is possible at any time under prevailing weather conditions.

Year 2021

One exceedance (by 1dBA) of the Project Approval noise limits is predicted at Location M. However, at this location Project Approval noise limits have been set below the PSNLs. No exceedances of the PSNLs are predicted at Location M. At Location G5, exceedance (by 1dBA) of the night-time PSNL is predicted for Scenario 3 (overburden operations).

During reduced night-operations, compliance with the relevant PSNLs and Project Approval noise limits are predicted at all receiver locations.

Year 2025

One exceedance (by 1dBA) of the Project Approval noise limits is predicted at Location M. However, at this location Project Approval noise limits have been set below the PSNLs. No exceedances of the PSNLs are predicted at Location M.

During reduced night-operations, compliance with the relevant PSNLs and Project Approval noise limits are predicted at all receiver locations.

Discussion of Results

Predicted noise levels show that generally Project operations have the potential to exceed the relevant PSNLs and Project Approval noise limits under prevailing noise enhancing weather conditions. During reduced night-time operations, noise levels at all locations (with the exception of Location G5 and Location M during operational Year 2018) are predicted to meet the relevant PSNLs and Project Approval noise limits under prevailing noise enhancing weather conditions.

Current mining activities at Bloomfield Colliery are guided by predicted upcoming weather conditions and mining areas that may pose a noise risk (due to working heights, topographical shielding etc.) under those weather conditions. This allows for the scheduling of mining operations to reduce noise impacts to the surrounding receivers as much as practicable. Given the flexibility in mining operations,

fleet composition and haul routes, the Project would be able to meet the relevant PSNLs and Project Approval 07_0087 noise limits at all locations under prevailing weather conditions.

Sleep Disturbance

In assessing sleep disturbance, typical L_{Amax} noise levels of acoustically significant plant and equipment to be used at the Colliery were used to predict noise emissions at the nearest residential areas. Noise events considered included loading haul trucks, haul truck movements, dozer and front end loader operations as well as haul trucks dumping.

A summary of the highest predicted sleep disturbance noise levels at the most affected locations for each of the assessed mining years is presented in Table 23 of **Appendix E**. The predicted maximum night-time noise levels would meet the relevant sleep disturbance criteria and Project Approval noise limits at all nearest residential receiver areas.

Cumulative Noise Impacts

Existing, approved and proposed mining in the vicinity of the Project includes the existing Abel Underground Mine, Donaldson Open Cut Mine and the Tasman Extension Underground Mine.

Given the separation distance between the Tasman Extension Underground Mine and the Project, cumulative impacts are expected to be negligible and therefore have not been considered. Donaldson Open Cut Mine has ceased production and all major earthworks on the site have been finalised. Therefore cumulative impacts from the Donaldson Open Cut Mine have not been included.

Abel Underground Mine was placed in care and maintenance on 28 April 2016, however given that future operation of the site is possible, and the current use of the Bloomfield CHPP under the Abel Underground Mine consent, cumulative impacts have been assessed.

To asses cumulative impacts from the Project and Abel Underground Mine, predicted intrusive noise levels were logarithmically added, with the result being adjusted to the equivalent amenity level for comparison against the amenity criterion for each location. The cumulative noise levels from the Project plus the Abel Underground Mine are not predicted to exceed the amenity criteria at relevant receiver locations or on more than 25 percent of, any privately owned land, with the exception of Lot 30/DP1113350 (vacant land owned by JD Hestlow (refer to **Figure 4**)).

Noise from Bloomfield coal haulage operations (i.e. Scenario 1 and Scenario 2) are predicted to exceed the relevant amenity criteria on more than 25 percent of Lot 30/DP1113350, however no exceedance is predicted during overburden operations (Scenario 3). Given the land is within 40 m of the existing haul route, mitigation of noise across Lot 30/DP1113350 would not be considered reasonable and feasible. Furthermore, it is noted that the Project does not seek to modify operations of the existing haul routes in the vicinity of Lot 30/DP1113350, and as such noise levels from Bloomfield Colliery on Lot 30/DP1113350 would not increase due to the Project.

Blasting

Table 14 presents the predicted airblast and ground vibration levels calculated using the respective 5% site law equations for Bloomfield Colliery. The MIC values used would depend on the location of the area being mined and its relation to the nearest affected receiver. Bloomfield utilises independent technical advice with regards to initiation techniques and timing as well as blast hole loading profiles to control the airblast and ground vibration impacts from mine blasting.

Table 14 Allowable Maximum Instantaneous Charge (MIC) and Blast Emissions Predictions

Year	Distance to Nearest Receiver (m)	Allowable MIC based on Ground Vibration or Airblast	Blast Emissions Prediction Based on Allowable MIC	
			Predicted PVS Ground Vibration (mm/s)	Predicted Airblast Level (dB Linear)
2018	1500	280	1.7	115
2021	1200	145	1.4	115
2024	1500	280	1.7	115

8.2.6 Mitigation Measures

Bloomfield would continue to implement noise and blasting management measures in accordance with the Noise Monitoring Plan and the Blasting Monitoring Program currently utilised at the Colliery to minimise the noise and vibration impacts to surrounding receivers. This includes scheduling of mining operations with regard to predicted weather conditions. During reduced night-time operations under prevailing weather conditions, potential noise impacts at Location M would be minimised by undertaking coal haulage via the alternate haul road (that is, Scenario 2).

The Noise Monitoring Plan and Blasting Monitoring Program would continue to be implemented for the duration of the Project and would be updated to reflect the Project as required.

8.3 Air Quality

8.3.1 Introduction

This section provides an assessment of potential air quality impacts associated with the Project. Todoroski Air Sciences prepared an Air Quality Impact Assessment (AQIA) which is provided at **Appendix F** and summarised below. The AQIA was completed with reference to the following documents:

- *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA, 2016); and
- *Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments* (NSW Government, 2014).

8.3.2 Existing Environment

The general area surrounding the Colliery is comprised of coal mining operations, agricultural activities and woodland. Suburban residential areas are located in relatively close proximity to the north of the Project. The Colliery is surrounded by dense forest (which would have a positive effect in limiting the transport of dust off-site). The sensitive receptors considered in the AQIA are shown on **Figure 20.**

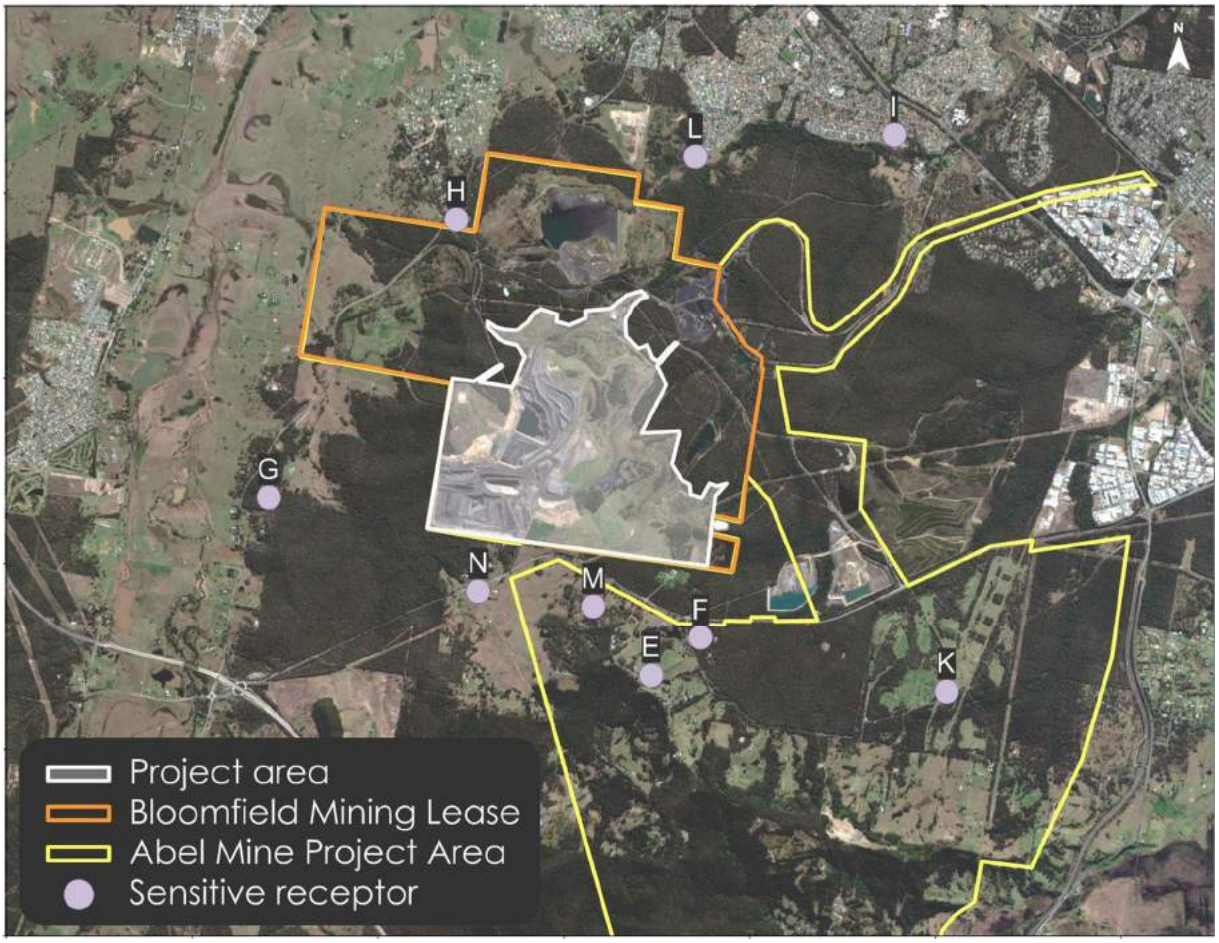


Figure 20 Air Quality Sensitive Receptors

Local Climate

Long term climatic data collected at the Bureau of Meteorology (BoM) weather station at Cessnock Airport were analysed to characterise the local climate in the proximity of the Project. The Cessnock Airport monitoring station is located approximately 21 km west of the Colliery. A summary of the long term data is provided in Section 4.1 of **Appendix F** and indicates the following:

- January is the hottest month with a mean maximum temperature of 30.1°C and July is the coldest month with a mean minimum temperature of 4.1°C;
- The annual average rainfall for the area is 743 mm over 73 days per year, with rainfall peaking during the summer months and declining during winter. February is the wettest month with an average rainfall of 97.8 mm and July is the driest month with an average rainfall of 29.0 mm;
- Relative humidity levels exhibit variability over the day, with higher humidity levels in the morning compared to the afternoon; and
- Wind speeds were found to be higher during the afternoon compared to the morning. Wind speeds during the warmer months have a greater spread between the 9am and 3pm conditions compared to the colder months.

Local Meteorology

The Colliery operates a meteorological station to assist with environmental management of site operations. Analysis of annual and seasonal windroses indicates that winds are generally light, with stronger winds occurring during the autumn and winter months. On an annual basis the general wind direction is along the west-northwest to east-southeast axis. Very few, almost non-existent, winds originate from the northeast quadrant throughout the year.

Local Air Quality Monitoring

The main sources of particulate matter in the wider area include active mining, agricultural activities, emissions from local anthropogenic activities such as motor vehicle exhaust and domestic wood heaters, urban activity and various other commercial and industrial activities.

Ambient air quality monitoring data from a number of monitoring locations were reviewed (Section 4.3 of **Appendix F**). This included data collected during 2012 to 2016 from Bloomfield's High Volume Air Samplers (HVAS), dust deposition gauges and the NSW EPA monitoring station at Beresfield. The review indicated the following:

- Annual average PM_{10} concentrations recorded at both the Bloomfield HVAS and Beresfield monitoring station were below the relevant annual average criterion (25 µg/m³). The maximum 24-hour average PM_{10} concentrations recorded at Bloomfield's HVAS monitor were below the relevant 24-hour average criterion (50 µg/m³), however there were occasional exceedances recorded at the Beresfield monitoring station;
- Annual average Total Suspended Particulate (TSP) concentrations at the Bloomfield HVAS were less than half the criterion (90 µg/m³). The recorded 24-hour average TSP concentrations follow a similar trend to the PM_{10} HVAS monitoring data;
- Dust monitoring gauges recorded an annual average insoluble deposition level below the criterion (4g/m^2/month);
- Annual average $PM_{2.5}$ concentrations at the Beresfield monitoring station were below the relevant criterion (8 µg/m³) for all periods except 2013 which recorded an annual average of 8.2 µg/m³. The 24-hour average $PM_{2.5}$ levels generally complied with the relevant criterion (25µg/m^3), with occasional exceedances recorded. Ambient $PM_{2.5}$ levels are likely to be governed by many non-mining background sources such as wood heaters and motor vehicles; and
- Nitrogen dioxide levels at the Beresfield monitoring station were well below the NSW EPA 1-hour average goal (246 µg/m³).

8.3.3 Methodology

Meteorological Modelling

Dispersion modelling was undertaken using the CALPUFF modelling suite. A key input into the dispersion modelling is the assessment of local meteorological conditions. The meteorological modelling methodology applied a 'hybrid' approach which includes a combination of prognostic model data from The Air Pollution Model (TAPM) with surface observations in the CALMET model.

The 2015 calendar year was selected as the period for modelling the Project. This period was selected based on a review of the long-term meteorological and ambient air quality conditions which a representative of the prevailing conditions. Accordingly, the available meteorological data for January 2015 to December 2015 from five nearby meteorological monitoring sites were used in the simulation, including:

- Bloomfield Colliery Weather Station;
- Williamtown RAAF Bureau of Meteorology (BoM) Station;
- Newcastle Nobbys Signal Station BoM Station;
- Cessnock Airport BoM Station; and
- Paterson (Tocal) BoM Station.

Modelling Scenario

One modelling scenario was used to represent the Project. A single indicative mine plan year (Year 2021) was chosen to represent potential worst-case impacts in regard to the quantity of material extracted in each year, the location of the operations and the potential to generate dust at the receptor locations. The scenario chosen for assessment (Year 2021) nominally represents the highest level of proposed activity for the modification in future years with a target of 1.3 million tonnes of ROM coal extracted.

For the modelled scenario, dust emission estimates were calculated by analysing the various types of dust generating activities taking place and utilising suitable emission factors. The emission factors were sourced from both local documentation and from the United States EPA (US EPA) developed documentation. Detailed emission inventories and emission estimate calculations are presented in Appendix C of **Appendix F**.

The estimated emissions are commensurate with a mining operation utilising reasonable and feasible best practice dust mitigation applied where applicable. Further detail regarding the dust control measures applied for the Colliery is provided below.

In addition to the estimated dust emissions from the Project, emissions from nearby approved mining operations (i.e. Abel Underground Mine) were also modelled, in accordance with the current consent (or current proposed project), to assess potential cumulative dust effects. Emissions estimates from Abel Underground Mine were derived from information provided in the air quality assessments for the Abel Underground Mine available in the public domain at the time of modelling.

The assessment of diesel emissions from the Project is focused on the potential emissions of oxides of nitrogen (NO_x), generally assessed as NO_2, arising from diesel powered equipment. Emissions from diesel powered equipment were estimated on the basis of manufacturer's data.

Dust Mitigation and Management

A range of air quality mitigation measures are applied at the Colliery to achieve a standard of mine operation consistent with current best practice for the control of dust emissions from coal mines in NSW. The measures applied to the Project reflect those outlined in the NSW EPA document, *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Katestone, 2011).

Where applicable, these controls were applied in the dust emission estimates. A summary of key dust controls applied to current operations at the Project is shown in **Table 15.**

Table 15 Summary of Key Dust Mitigation Measures

Activity	Dust mitigation measure
Drilling	· Dust suppression system. · Prevent disturbance of drill cuttings. · Application of water on dusty areas prior to drilling. · Ceasing operations when visible dust generated.
Blasting	· Water blast areas to suppress dispersion of drill cuttings. · Review meteorological and blast forecast prior to blasting.
Hauling on unsealed roads	· Water haul road surfaces. · Prevent material being deposited / spilled on haul roads. · Restrict general vehicle speed. · Trafficable areas clearly marked, vehicle movements restricted to these areas. · Trafficable areas and vehicle manoeuvring areas maintained. · Fleet optimisation to reduce vehicle kilometres travelled.
Material extraction/unloading	· Application of water on dusty areas prior to extraction. · Sheltered dumping during periods of adverse weather. · Minimise the fall distance of materials during loading and unloading. · Cease operation during high dust periods.
Unloading ROM coal to hopper	· Three-sided enclosure at ROM pad · Slower tipping during adverse weather conditions. · Drop heights reduced as far as practicable. · Visual triggers for dust mitigation.
Conveyors and transfers	· Enclosed conveyors. · Belt cleaning. · Enclosed chutes.
Dozer operation	· Avoid use during unfavourable conditions. · Minimise travel speed in dusty conditions. · Travel on watered routes between work areas.
Graders	· Travel on watered routes. · Water haul roads immediately after grading, where possible.
Exposed areas	· Minimise area of disturbance, rehabilitate areas as soon as feasible. · Apply interim stabilisation on areas inactive for long periods.
Coal processing	· Enclosed facility with internal water sprays.
Rehabilitation	· Rehabilitation expedited to achieve maximum coverage rate. · Vegetation actively managed.
ROM coal and product stockpiles	· Automated water sprays during high winds. · Minimise drop heights when stacking. · Manual implementation of water sprays and/or water cart during dusty periods. · Visual surveillance of dust plumes during activity. · Stockpiling and recovery of ROM coal is minimised where practical.
Rail operations	· Streamlined and consistent profiled coal surface within rail wagons. · Minimise spillage and parasitic loading. · Clean and collect any spillage on regular basis.

Background Dust Levels

All significant dust generating mining operations in the vicinity of Bloomfield Colliery were included in the dispersion model to assess the total potential dust impact. The total predicted effects from the Project (including existing effects) were added with the measured background levels (which also include any existing effects from the colliery). This approach is conservative (would lead to overestimation of impacts) as the existing colliery emissions are double counted in the assessment.

Ambient air quality monitoring data collected from the Colliery air quality monitoring network during 2015 were applied to represent the prevailing background dust levels. For $PM_{2.5}$, the ratio of the measured PM_{10} levels at the Colliery and Beresfield monitors to the Beresfield $PM_{2.5}$ level was applied to estimate the potential $PM_{2.5}$ level in the vicinity of the Colliery.

8.3.4 Impact Assessment

Predicted Dust Concentrations

The particulate dispersion modelling results for the Project operating in isolation (incremental impact) at each of the assessed sensitive receptor locations are shown in **Table 16**. The predicted cumulative $PM_{2.5}$, PM_{10}, TSP and dust deposition levels due to the Project with the estimated background levels are presented **Table 17.**

The results indicate the predicted levels would be below the relevant criteria at the assessed sensitive receiver locations.

Table 16 Dispersion Modelling Results for Sensitive Receptors – Incremental Impact

Receptor ID[1]	PM2.5 (µg/m³)		PM10 (µg/m³)		TSP (µg/m³)	Dust Deposition (g/m2/month)
Averaging Period	24-hour average	Annual average	24-hour average	Annual average	Annual average	Annual average
Criterion	-	-	-	-	-	2
E	3	<1	17	2	3	<0.1
F	4	1	21	3	5	0.1
G	7	1	38	4	7	0.1
H	7	1	35	7	10	0.1
I	2	<1	9	1	2	<0.1
K	3	<1	16	1	2	<0.1
L	3	1	13	3	5	0.1
M	6	1	29	3	5	0.1
N	4	<1	18	2	4	<0.1

1 – Refer to Figure 20 for location of receptors

Table 17 Dispersion Modelling Results for Sensitive Receptors – Cumulative Impact

Receptor ID[1]	PM2.5 (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)	Dust Deposition (g/m2/month)
Averaging Period	Annual average	Annual average	Annual average	Annual average
Criterion	8	25	90	4
E	6	16	32	1.5
F	6	17	34	1.6
G	6	18	36	1.6
H	7	21	39	1.6
I	6	15	31	1.5
K	6	15	31	1.5
L	6	17	34	1.6
M	6	17	34	1.6
N	6	16	33	1.5

*1 – Refer to **Figure 20** for location of receptors*

Dust Impacts on more than 25 per cent of privately-owned land

Potential impacts due to the Project, extending over more than 25 per cent of privately-owned land, were evaluated using predicted pollutant dispersion contours.

The predicted maximum 24-hour average PM_{10} level was found to have the greatest extent of the other assessed dust metrics and hence represents the most impacting parameter. The dispersion contours (**Figure 21**) indicate that there is only one privately-owned land parcel (Lot 30 / DP1113350) which would be impacted more than 25 per cent.

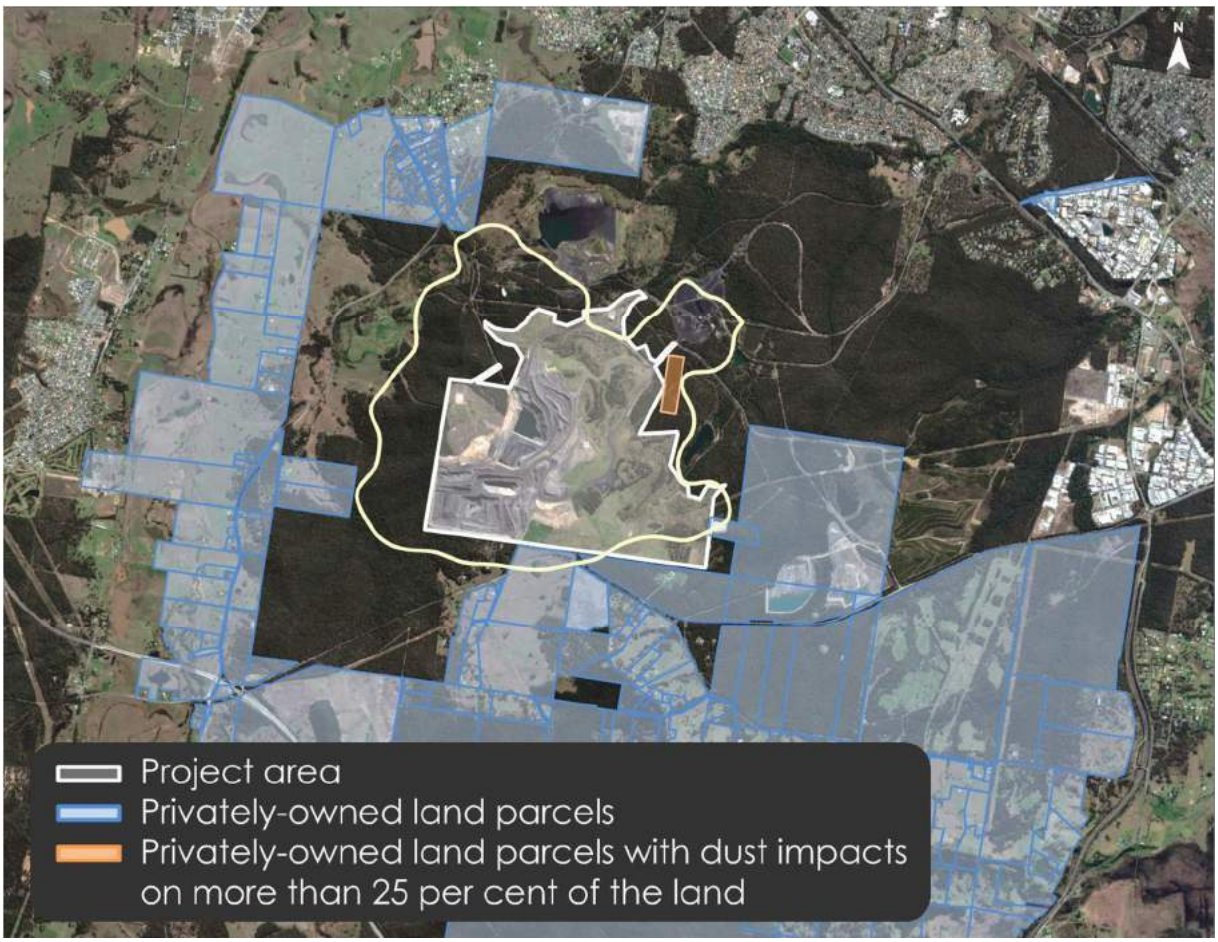


Figure 21 Predicted Maximum 24-hour Average PM_{10} Level (Source: Todoroski Air Sciences, 2017)

Total (Cumulative) 24-hour Average $PM_{2.5}$ and PM_{10}

As discussed in **Section 8.3.2**, maximum background levels have in the past reached levels near to the 24-hour average $PM_{2.5}$ and PM_{10} criteria. Due to these elevated levels in the monitoring data, the screening Level 1 NSW EPA approach of adding maximum background levels to maximum predicted Project only levels would not be appropriate for assessing the potential 24-hour average impacts on these elevated days.

In such situations, the NSW EPA approach applies a more thorough Level 2 assessment whereby the measured background level on a given day is added contemporaneously with the corresponding Project only level predicted using the same day's weather data. The results of the Level 2 contemporaneous assessment at each sensitive receptor location are shown in **Table 18.**

Table 18 NSW EPA Contemporaneous Assessment - Max No. of Additional Days Above the 24-hour Average Criterion

Receptor ID	$PM_{2.5}$ analysis	PM_{10} analysis
E	0	1
F	0	1
G	0	0
H	0	0
I	0	0
K	0	0
L	0	0
M	0	3
N	0	2

The results indicate that there is potential for cumulative 24-hour average PM_{10} impacts to occur at the assessed locations, without the use of reactive or predictive management systems to control short term dust levels. Further analysis (refer Section 6.3 of **Appendix F**) indicates that the predicted exceedances at these locations only marginally exceed the criteria. Given the conservatism in the assessment (double counting the existing Colliery emissions etc.) these effects may not actually occur, however the small reductions needed could easily be achieved through predictive and reactive dust control strategies, which would be operated at the site to mitigate such potential impacts.

Current predictive and reactive dust control measures applied at the Colliery include the use of predictive meteorological modelling software which incorporates regional weather station data and forecasts to predict daily weather events which may exacerbate dust impacts from planned operations. This forward planning is coupled with the use of real-time on-site weather station data to assist with planning decisions.

The Colliery also operates a network of portable real-time dust monitors. These monitors are nominally positioned upwind and downwind of mining activity with the measured levels providing an estimate of the potential amount of dust generated from the operations which can signal if excessive dust is being generated and further dust control is required.

Visual inspections of dust plumes are also used to identify those activities which require further controls to be applied at times such as watering, or activities which may need to be modified to reduce the amount of dust being generated, such as temporarily ceasing a particular activity.

To evaluate the effectiveness of the implementation of such predictive and reactive measures at the Project, the dispersion modelling was re-run to consider the effects of applying additional control measures and temporarily pausing activities in the pit and overburden areas during periods of elevated dust. Only the activities that can be controlled in the pit and overburden areas were ceased in the model, and dust from other sources such as wind erosion was still assumed for the purpose of the revised modelling. With the implementation of these reactive measures, modelling results predicted there would be no additional days above the 24-hour average criterion (Table 6-4 of **Appendix F**).

Predicted NO_2 Concentrations

Table 19 presents the predicted NO_2 dispersion modelling results, with isopleth diagrams presented in **Appendix F**. The results indicate that the predicted 1-hour and annual average NO_2 concentrations would be below the relevant criteria at each of the assessed sensitive receptor locations.

Table 19 Dispersion Modelling Results for Sensitive Receptors - NOs Concentrations (µg/m³)

Receptor ID	Incremental Impact		Cumulative Impact	
Averaging period	24-hour average	Annual average	24-hour average	Annual average
Criterion	-	-	246	62
E	60	0.8	105	40
F	65	1.0	110	40
G	60	2.0	105	41
H	70	2.2	115	41
I	26	0.4	71	40
K	27	0.5	72	40
L	35	0.6	80	40
M	102	1.4	147	40
N	118	1.2	164	40

Greenhouse gas emissions

Greenhouse gas (GHG) emissions are characterised into three different scopes, including Scope 1 (direct emissions), Scope 2 (indirect emissions from purchasing electricity) and Scope 3 (indirect emissions occurring as a result of the company's business activity but from sources not controlled by the company).

Bloomfield is required to report its GHG emissions in accordance with the requirements of the *National Greenhouse and Energy Reporting Act 2007*. Big Ben Holdings Pty Ltd is the controlling corporation which reports GHG emissions for the Colliery, Rix's Creek South and Rix's Creek North. For the Colliery, the 2016 reporting data provides a conservative estimate of GHG emissions during the life of the Project as the total ROM coal produced at the Colliery during this period was close to the proposed maximum (1.245 Mtpa compared to a proposed maximum of 1.3 Mtpa). Data for the 2016 reporting period were therefore used to calculate the GHG emissions over the life of the Project (**Table 20**).

Table 20 Summary of CO_2-e emissions per scope

Period	CO_2-e emissions (t CO_2-e)	
	Scope 1 Emissions	Scope 2 Emissions
Annual	23,079	5,549
Total (life of Project)	207,710	49,944

The estimated annual GHG emission for Australia for the year to December 2016 was 543.3 Mt CO_2-e (DoEE, 2017a). In comparison, the conservative estimated annual average GHG emission for the Project is 0.029 Mt CO_2-e (Scope 1 and Scope 2) which represents approximately 0.005% of the Australian annual GHG emissions.

At a State level, the GHG emissions for NSW in 2015 (the latest available data) were estimated to be 133.4 Mt CO_2-e (DoEE, 2017b). In comparison, the conservative estimated annual average GHG emission for the Project represents approximately 0.021% of the NSW annual GHG emission.

The contribution of GHG emissions from the Project relative to the national and state emissions are low and the predicted change would not be discernible. Bloomfield has prepared an Energy Savings Action Plan (ESAP) in accordance with the conditions of the Project Approval and the requirements of the *Guidelines for Energy Savings Actions Plans* (Department of Energy, Utilities and Sustainability, 2005). The ESAP aims to identify opportunities to reduce GHG emissions from the Project Area and ensure annual reporting of GHG emissions and tracking of energy savings opportunities are undertaken. Bloomfield would continue to monitor and report its GHG emissions in accordance with the ESAP and legislative requirements.

Summary

As the Project is not seeking changes to the intensity or general extent of mining, or changes in the mining equipment fleet or mining method, the Project is not expected to result in significant changes to the existing level of impact.

Dispersion modelling indicates that dust levels would be below the relevant criterion at the privately-owned receptor locations. The results also indicate that without reactive or predictive mitigation measures, there is some potential for cumulative 24-hour average PM_{10} levels to marginally exceed the EPA impact assessment criteria. However, with the use of the now routine day-to-day reactive and predictive systems at the operations, no unacceptable levels of impact would be expected to arise.

It is noted that the approach taken in the AQIA is conservative, and would significantly overestimate the likely impacts. For example, conservative emission estimation is applied using maximum mining rates, the dispersion modelling does not include the effect of rainfall or in-pit dust retention, and the background levels used mean that existing dust emissions from the Colliery are double counted in the cumulative assessment.

Overall, the potential air quality impacts associated with the Project are not expected to be significantly different from the existing approved operations.

8.3.5 Mitigation Measures

Bloomfield would continue to implement air quality management measures currently used at the Colliery, including the predictive management system, to mitigate air quality emissions from its operations as discussed in **Section 8.3.3**. This includes a reactive dust mitigation strategy and forecast management system. Bloomfield would continue to monitor and report its GHG emissions in accordance with the ESAP and legislative requirements.

The Air Quality Monitoring Program and Blast Monitoring Program would continue to be implemented for the duration of the Project. Existing management plans and procedures would be updated to reflect the Project as required.

8.4 Soils and Water

8.4.1 Introduction

This section provides an assessment of the potential impacts of the Project on soils and water. This assessment is supported by a Surface Water Assessment prepared by AECOM, which is provided at **Appendix G** and summarised below. The Surface Water Assessment was prepared in accordance with the following guidelines:

- *National Water Quality Management Strategy Australian Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000);
- *ANZECC Guidelines and Water Quality Objectives in NSW* (DEC, 2006);
- *Managing Urban Stormwater: Soils & Construction – Volume 2E: Mines and Quarries* (DECC, 2008); and
- *Managing Urban Stormwater Soils and Construction – Volume 1* (Landcom, 2004).

8.4.2 Existing Environment

Geology and Soils

The *Newcastle Coalfield Regional Geology Map (1:100 000)* (Hawley et al, 1995) indicates that the Project Area is underlain by Paleozoic, Late Permian sandstone which makes up the Tomago Coal Measures. Sediments above, below and between the coal seams comprise predominantly interbedded mudstone, siltstone and sandstone.

Review of the *Soil Landscapes of the Newcastle 1:100 000 Sheet* (Matthei, 1995) indicates that the derived soils are comprised of the Shamrock Hill erosional landscape, the Beresfield residual landscape and areas of disturbed terrain.

A search of the EPA Contaminated Land Record indicates that land within the Project Area is not identified as contaminated land. Review of the Australian Soil Resource Information System and the Cessnock LEP 2011 indicates that there is an extremely low probability of occurrence of acid sulfate soils within the Project Area.

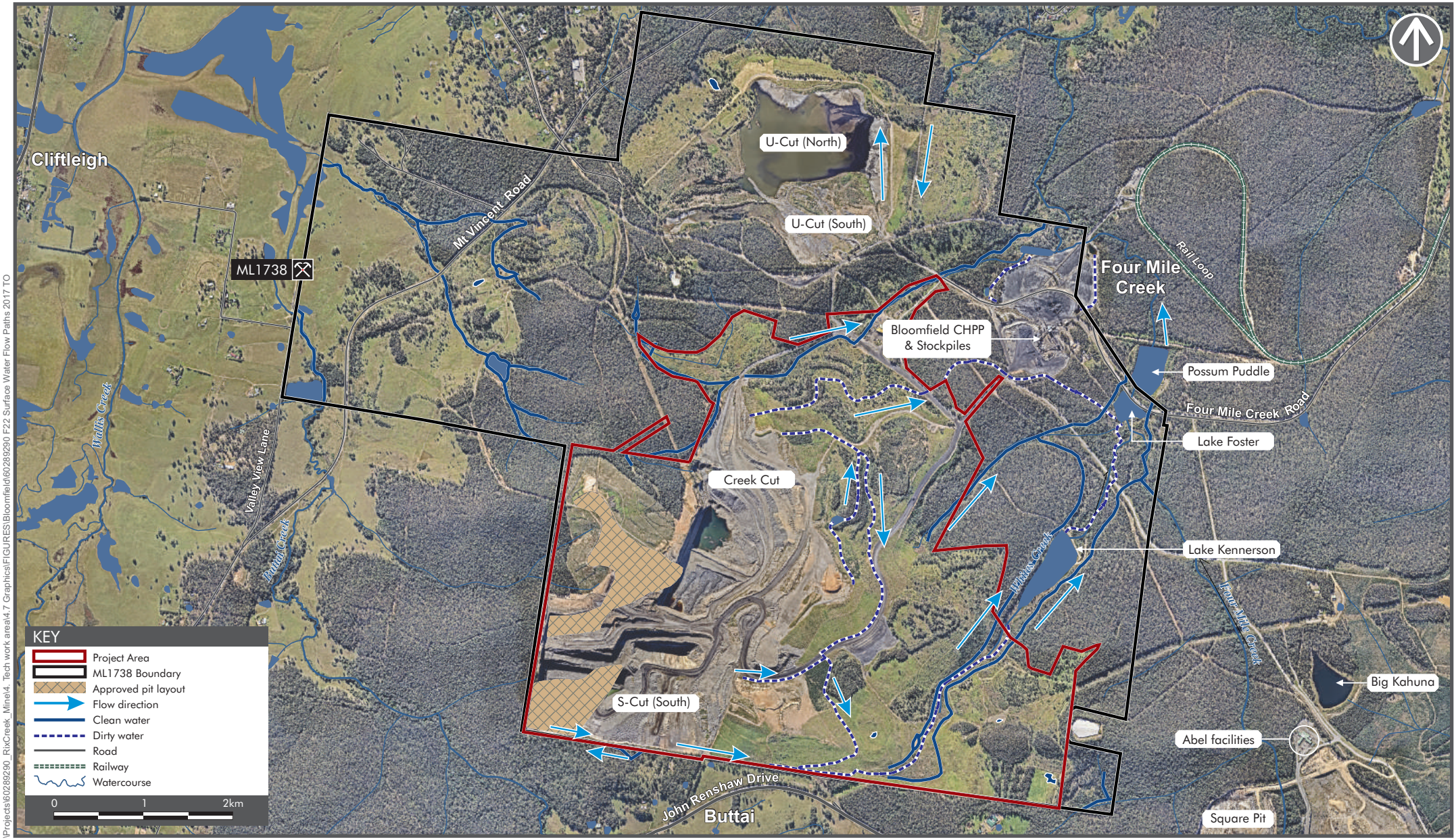
Mine Water Management System

The existing water management system at the Colliery has been developed in collaboration with neighbouring mine sites (particularly the Abel Underground Mine). The integrated system involves the management of all surface runoff and groundwater sources associated with the Abel, Bloomfield and Donaldson mines, ensuring continuous supply to the Bloomfield CHPP whilst minimising discharge to Four Mile Creek from the operational areas.

The existing water management system incorporates:

- Removal of water from active pits;
- Storage of water in lakes and voids;
- Controlled discharge into Four Mile Creek in accordance with EPL requirements;
- Control of stormwater pollution from ‘dirty catchments’ such as the:
  - Overburden dumps;
  - Waste disposal areas utilised by the CHPP;
  - Stockpile areas; and
  - Workshop area.

Figure 22 shows the clean and dirty water flow paths around the Project Area, as well as the location of current water storage dams, active operational areas and tailings emplacement area.



\Projects\60289290_RixCreek_Mine\4. Tech work area\4.7 Graphics\FIGURES\Bloomfield\60289290 F22 Surface Water Flow Paths 2017 TO

AECOM

SURFACE WATER FLOW PATHS

Bloomfield Project

FIGURE 22

Clean water

The major natural creek running through the site is Four Mile Creek. Most of the operational mining areas at Bloomfield are located within the catchment of Four Mile Creek. A series of drains and levees direct Four Mile Creek around Lake Foster (mine water storage) and into Possums Puddle (clean water storage). From Possums Puddle, clean water overflows, or is discharged, back into Four Mile Creek.

Runoff from undisturbed and rehabilitated areas is directed away from operational areas and mine water storages via diversion banks and channels. These banks and channels direct runoff into clean water dams or natural watercourses.

The major clean water storage dam is Possums Puddle. Clean water is not accessed for operational purposes and these dams overflow into natural drainage systems.

Dirty water

Dirty water is managed through a series of storages and interconnecting pipelines, including:

- Lake Kennerson (200 ML capacity) – receives all the dirty water from the open cut pits (S-Cut and Creek Cut), except the drain at the northern end of the cut which goes directly to Lake Foster. From Lake Kennerson it is either discharged off-site via a clean water diversion drain in accordance with EPL 396, or sent to Lake Foster if required for use in the Bloomfield CHPP or for dust suppression. A pipeline connects the “Big Kahuna”, the main water storage for Abel, to Lake Kennerson;
- Lake Foster (45 ML capacity) receives all other dirty water from site, the tailings return water, CHPP stockpile runoff dams, and the one dirty water drain from the open cut (seen at the northern end of the cut). Lake Foster feeds the Bloomfield CHPP and water cart for dust suppression; and
- Stockpile Dam (22 ML capacity) collects runoff from the stockpile near the CHPP and is transferred to Lake Foster for use in the CHPP.

Mine water

Mine water is defined as pit water, mining water, water that collects in the Bloomfield S-cut (south) and Bloomfield Creek-cut (north) and which has been removed by water management methods to continue the operations of the mine. This water may have elevated total dissolved solids (TDS), above the values that represent fresh water as defined by ANZECC and ARMCANZ (2000).

Bloomfield has two major mine water storage facilities, the Lake Kennerson and Lake Foster. Water pumped from the open cuts (S-Cut and Creek Cut) travels via open drains to Lake Kennerson. Runoff from disturbed areas (i.e. high wall, haul roads, overburden dumps awaiting rehabilitation) which has the potential to carry suspended solids, is also directed to Lake Kennerson. Lake Kennerson dissipates velocity and allows the settlement of suspended solids.

Lake Kennerson has a valve-controlled pipe which, when opened, feeds to Lake Foster. Lake Foster also receives decant water from the tailings storage facility (U-Cut) and water from the stockpile dam, which collects the runoff from the CHPP and coal stockpile pads. Mine water is pumped, primarily from Lake Foster, to the CHPP for use in coal processing and for dust suppression purposes by spraying on the coal stockpile pads.

Mine water is discharged, via lockable valve pipes, into an open drain that flows to Four Mile Creek. Discharges are undertaken in accordance with the conditions of EPL 396. Water sampling is undertaken during discharge, and a monitoring station continuously monitors electrical conductivity (EC) and water level.

Currently, fine coal rejects (tailings) are transferred for disposal to a disused open cut pit (contiguous to the old underground workings) which forms a tailings emplacement area to the north of the active mining area. Water from the historic underground workings is used in dust suppression and coal processing.

Wastewater

Wastewater generated on site, consisting of domestic waste from bathhouses, administration offices and associated amenity areas, passes through a Cessnock City Council approved anaerobic wastewater treatment system.

Access Road, Bloomfield CHPP and stockpile area

The main access road between Creek Cut, S-Cut North and the ROM coal stockpile is drained, via a table drain, to a low (vegetated) detention basin on the southern side of road. This detention basin acts as a sediment control pond. Once the basin is sufficiently full, water overflows through a culvert under the access road and discharges into the drainage line that flows along the western side of the workshop area and eventually becomes Elwells Creek, a tributary of Four Mile Creek.

The current water supply to the Bloomfield CHPP is primarily pumped from Lake Foster. Mine water from the open cut pit areas is transferred to the mine water storage facilities (Lake Kennerson and Lake Foster) and then back to the CHPP. Surface water runoff from the Bloomfield CHPP and stockpile areas are directed to the Stockpile Dam where is it transferred to Lake Foster for reuse in the CHPP.

Erosion and sediment management

Erosion and sedimentation control is an integral part of the site's water management system. The design of rehabilitated areas incorporates water management structures to effectively shed run-off water, whilst minimising erosion and sediment load. Progressive rehabilitation of disturbed areas also reduces the potential for erosion and downstream sedimentation. There are a number of sediment basins around the site that are positioned to intercept runoff from other disturbed areas on-site, such as from haul roads, stockpile pads, infrastructure areas, and recently rehabilitated areas.

Silt traps along the edges of haul roads and hardstand areas are cleaned at regular intervals. They have been designed to capture surface runoff during rain events and allow sediment to settle. All silt traps, dams, drains, bunds, lines, valves and other infrastructure used to manage runoff are inspected on a quarterly basis as part of the site EMS.

Tailings Management

Disposal of coarse rejects and fine tailings are approved as part of the Abel Project Approval, and are described here for background purposes. The size of the void storage required on the Project Area (discussed at **Section 4.3.2**) is subject to tailings production from Abel, which is currently in care and maintenance. The latest estimate of the tailings storage required for disposal indicates that for every one million tonnes of ROM coal per annum, approximately 0.17 million tonnes comprises tailings reject material.

Groundwater – surface water interaction

Groundwater in the alluvium associated with Wallis Creek and the Hunter River floodplain is believed to be in direct hydraulic connection with the surface water in these wetlands areas. These localised occurrences of surficial groundwater do not represent a significant or regionally extensive aquifer system, and should really be considered to be part of the surface water flow system. There is believed to be minimal interaction between the surface drainage system (including the alluvial and other surficial groundwater), and the deeper groundwater within the coal measures. Potential groundwater impacts associated with the Project are assessed separately in **Section 8.5**.

Water Balance

A site water balance was developed by Evans and Peck (2012) for the Abel EA and assessed the operation of both Bloomfield and Abel over the life of the Abel project (up to and including 2030). The water balance model considered both mines as the water management is integrated across both sites. There are formal agreements in place between Abel and Bloomfield including protocols relating to the transfer of water from Abel to Bloomfield.

Bloomfield Colliery

The site water balance model indicates that the Project is capable of meeting all water needs for dust suppression from the groundwater inflows and surface runoff into the mine pits, and typically

generates a net surplus of water that can contribute to the water supply required for operation of the Bloomfield CHPP.

Abel Underground Mine

The Abel Upgrade Modification Surface Water Assessment (Evans and Peck 2012) staged the impact assessment of surface water management for the Abel project into two stages:

Stage 1: 2013 – 2018:

- Use of the Donaldson Square Pit to store the higher salinity water expected from the Abel Underground Mine as well as tailings from the Bloomfield CHPP when required;
- Use of spare capacity in the Donaldson Square Pit for storage of tailings; and
- Treatment of mine water (i.e. using a reverse osmosis [RO] plant) to a standard suitable for discharge to Four Mile Creek.

Stage 2: 2019 – 2030:

- Transfer of water from Abel Underground Mine to Lake Foster for use in the Bloomfield CHPP;
- Placement of tailings in one of the major Bloomfield Colliery voids (S-Cut [South] and S-Cut [North]) as they become available; and
- Placement of any excess mine water in one of the major Bloomfield Colliery voids as required.

The Abel project includes the construction of a reverse osmosis treatment plant in the future. The intention of the reverse osmosis treatment plant would be to treat surplus mine water and enable discharge to Four Mile Creek, via the Big Kahuna. In order to ensure opportunities for licensed discharge can be compliant with water quality limits, the salinity in the Big Kahuna needs to be maintained below 2,000 µS/cm.

The Abel Underground Mine Water Management Plan (Donaldson Coal, 2014), noted the following key aspects of mine water management since the 2012 Project Approval:

- The use of the Donaldson Square Pit is no longer considered viable (see Stage 1 above);
- Since August 2013, some areas of old underground workings have been allowed to progressively fill with groundwater – only inflow from localised areas has been transferred to the Big Kahuna;
- Water for underground operational purposes is drawn from the Hunter Water potable supply;
- Water from the Big Kahuna is used for on-site operational purposes, principally dust suppression;
- Water is periodically transferred from the Big Kahuna (Abel) to Lake Kennerson (Bloomfield) via a pipeline, which has a capacity of 8 ML/day; and
- When conditions permit under Abel's EPL, water is discharged to Four Mile Creek from the Big Kahuna Dam.

To date, the Abel Underground Mine water make has been significantly less than the annual rates previously predicted due to lower rates of production and the practice of allowing water to accumulate in parts of the worked-out areas of the mine. Due to the changes in Abel's operations since the original Project Approval, "Stage 1" of the surface water assessment is likely to extend well beyond 2018, and the need for the construction of a reverse osmosis treatment plant has not yet been triggered.

Water balance inputs

The catchment areas and storage volumes used in the water balance are presented in **Table 21**.

Table 21 Water Balance Catchment Areas and Storage Volumes

Catchments	Area (ha)	Storage volume (ML)
West Pit	28.7	-
Abel Mine Facilities	2.1	-
Storage / Voids		
Big Kahuna	4.9	400
Donaldson Square Pit	21	2,900
S-Cut (South) and catchment	55	10,000
Creek-Cut (S-Cut North) and catchment	68	10,000

Water requirements for mine operations comprise water use for dust suppression on haul roads, work areas and stockpiles, with the largest water requirement for the Bloomfield CHPP. The adopted water transfers and storage operating rules were modelled by Evans and Peck (2012) and stated as follows:

- Discharge from Big Kahuna to Four Mile Creek is modelled to occur at a rate of 8 ML/day for 5 days following any day over 10 mm of rainfall;
- Transfer from Big Kahuna to Lake Kennerson occurs at a rate of 8 ML/day, after 3-4 days following discharge to Four Mile Creek;
- The RO plant is assumed to have an inflow of 4 ML/day with the waste brine (assumed to be 25% of the inflow) returned to the Donaldson Square Pit. The output of the RO plant is assumed to have a salinity of 150 mg/L (250 µS/cm); and
- 'Top-up' supply to account for the assumed 10% loss from water supplied for the underground operations is assumed to be taken from the Donaldson Square Pit.

Water Balance results

The water balance by Evans and Peck (2012) noted that the overall water balance is dominated by the groundwater inflow to Abel underground. The effect of climate on water use for dust suppression and the number of opportunities for discharge to Four Mile Creek are secondary factors in the overall site water balance.

The water balance assumed that Bloomfield S-Cut (South) would be available for storage of tailings and water from the end of 2018. However, Abel has been in care and maintenance since June 2016. Lower extraction rates and ability to store water in Abel's unused underground workings has resulted in less mine water make than previously projected.

Surface Water Quality

Routine monthly ambient water quality monitoring is undertaken at thirteen locations within and around the Project Area, including along Four Mile Creek and its tributaries (upstream to downstream). Water quality monitoring data has been collected since 1996. A summary of background water quality data is provided in Table 5 and Table 6 of **Appendix G.**

Controlled discharges to Four Mile Creek occur from EPL Point 1 (the Lake Foster discharge pipe outlet). During a planned discharge event, water samples are collected and analysed in accordance with the requirements of EPL 396. Summaries of annual discharges from Lake Kennerson and associated water quality data are provided in Table 7 and Table 8 of **Appendix G.**

To date there have been four unplanned discharges as a result of large rainfall events or pipe failure which resulted in water overflowing from storage dams and leaving the site. These incidents were reported to the EPA in accordance with Project Approval and EPL requirements. Of the planned discharges, there have been a small number of isolated incidents where water quality was outside of EPL compliance limits.

The water management system is designed so that uncontrolled discharges should not occur. However in the event that an uncontrolled discharge occurs, procedures include sampling and analysis for the same suite of pollutants as for a controlled discharge event.

8.4.3 Impact Assessment

Mine Water Management

Recent differences in Abel's mine water make, water budget and projections of tailings production (compared to the 2012 projections) are not an impediment to the ongoing operations of Bloomfield through to 2030. Abel's Project Approval includes an allowance for disposal of surplus water to Bloomfield voids in future years, and that if Bloomfield is still operational, appropriate means are available to dispose of surplus water (if that were to occur) via an RO plant if necessary and modifications to the Donaldson Square Pit, which could then be discharged to Four Mile Creek under appropriate conditions.

With Abel in care and maintenance mode, and the volume of ROM coal processed by the CHPP well below maximum approved rates, there is no need to create additional storage for tailings in the interim, not required. Currently the U-cut north and south pit is being used for disposal of tailings and is projected to have sufficient capacity up until 2019. Bloomfield has an approved (Dam Safety Committee) augmentation plan to increase the capacity of this tailings emplacement area if required.

The proposed extension of mining is not predicted to have significant impacts on water supply or demand, or offsite water quality impacts. Management on site is consistent with current guidelines, in that:

- Natural catchments are managed to divert clean water;
- Mine water and runoff from disturbed areas is captured and stored on site; and
- Mine water is reused on site for CHPP operations and dust suppression to minimise the use of higher quality water.

The design and operation of the existing water management system allows a high degree of flexibility in and significant capacity to account for variations in climatic conditions and production rates. No further impacts to surface water management, beyond that approved under the current Project Approval are predicted.

Catchments

The Project includes a modification of the previously approved final landform by moving the final void approximately 200m to the west. The amended final landform would result in the following changes to the existing approved design:

- The final eastern slopes of the overburden dump would drain east towards Four Mile Creek. The catchment area draining towards Four Mile Creek would increase by approximately 40 Ha and the catchment area draining to Buttai Creek and its tributaries would has increase by approximately 188 Ha, as compared to the currently approved final landform design; and
- The proposed catchment area draining towards the final void would be approximately 52 Ha, a decrease from the 240 Ha under the currently approved final landscape design.

A reduced catchment draining to the final void would have a positive effect on Four Mile Creek and Buttai Creek and its tributaries, as it results in less water being removed from the natural catchment hydrology in the post-mining phase, and less water draining to the final mining void.

Surface Water Quality

The potential impacts of Bloomfield's current and future operations relate to the risks of contamination from disturbed catchments, mine water, and process water being released off site to natural waterbodies.

Controlled discharges from the Colliery to Four Mile Creek occur from the Lake Foster discharge pipe outlet and are monitored and reported in accordance with EPL 396. The Project would not increase or decrease the probability of unplanned discharges, or water quality risks, from Bloomfield's operations. However the risks of unplanned discharges would continue to exist up until the end of extraction

(2030) and until such time as the site is rehabilitated noting that risks would decrease with the progressive rehabilitation of post mining areas across the life of the Project.

Soils – Erosion and Sediment Control

The Project would involve removal of up to 3.5 ha of previously rehabilitated landform for the proposed widening of the haul road and upgrade of the adjacent watercourse. However the potential impact to soils associated with these works would be minor and temporary provided the management measures set out in the Erosion and Sediment Control Plan are implemented during these works.

The extension of mining to 2030 is considered to have negligible potential impact to soils. The mining operations would continue to extract within previously nominated pit limits, as the new mining fleet is capable of extracting coal that was previously considered unrecoverable.

The amended final landform would result in an increased proportion of the rehabilitated catchment areas draining to Four Mile Creek and Buttai Creek and its tributaries as opposed to the final void. These potential impacts would be mitigated through current site practices, for example the design and operation of drainage lines, sediment basins and erosion and sedimentation controls (refer to **Section 8.4.4**).

Cumulative Impact

The Abel and the Colliery's existing operations have a cumulative impact on the local soil and water environment. The sites are operating within their approved limits, and would continue to do so up until the approved limit of mining in 2030.

There are minor additional impacts related to soil, water quality and surface water as a result of the Project. These can be addressed by the mitigation measures provided in **Section 8.4.4**. Therefore, no additional impacts are predicted when considering other projects within the region.

8.4.4 Mitigation Measures

Mine Water Management

The existing Water Management Plan would be reviewed and revised to incorporate the Project and ensure that the management of soil and water continues to:

- Stay current and consistent with relevant guidelines and best practice;
- Account for projected changes in operation; and
- Update water balance modelling and projections on the basis of observed results (i.e. variations in mine water make, groundwater monitoring).

At such time that Abel returns to production, reconsideration of the water balance would be undertaken as part of the ongoing management plan review process. This would enable and support appropriate planning to ensure mine water and tailings would continue to be contained on site.

Catchments

Rehabilitated catchments would continue to be managed as per the existing Water Management Plan and Rehabilitation Management Plan, in accordance with the following principles:

- Rehabilitated landform would be progressively rehabilitated;
- Runoff from areas undergoing rehabilitation would be managed with appropriately designed water and sediment management structures (contour banks, drains, and drop structures); and
- Ongoing monitoring of the landform would be carried out to repair and restore areas of erosion or instability.

Discharge of water from the final landform would not occur to Four Mile Creek or Buttai Creek and its tributaries until the catchment is considered 'rehabilitated' in accordance with the Rehabilitation Monitoring Plan and associated regulator sign-off and approvals.

Surface Water Quality

Potential impacts to receiving waters would be mitigated through implementation of the mine water management system, which includes:

- Runoff from undisturbed and rehabilitated areas would be directed away from operational areas and mine water storages via diversion banks and channels; and
- Mine and sediment water would be collected for treatment before discharge via Lake Kennerson, Lake Foster and sediment basins to intercept runoff from disturbed areas.

Surface water monitoring would continue to be undertaken in accordance with Bloomfield's EPL 396. The existing monitoring program would be periodically reviewed to ensure the program continues to be adequate and consistent with current guidelines and policy requirements.

Erosion and Sediment Control

The erosion and sediment control plan would continue to be implemented to ensure that the discharge of all water from the site is managed and meets appropriate quality standards. Key elements of the erosion and sediment control plan include:

- Coordination of mining to minimise exposure to disturbed soils;
- Separation or diversion of clean water catchments from disturbed areas to minimise sediment laden and mine water volumes for management;
- Collection and management of runoff sediment control devices;
- Appropriate storage and handling of topsoil materials;
- Revegetation of disturbed areas following site disturbance; and
- A maintenance program for control structures.

8.5 Groundwater

8.5.1 Introduction

This section provides an assessment of potential impacts of the Project on groundwater resources. AECOM prepared a Groundwater Impact Assessment which is provided at **Appendix H** and summarised below. The Groundwater Impact Assessment assessed the hydrogeological impacts of the Project including potential changes to the site water balance and water management system at the Colliery. The assessment was based on data from a predictive groundwater model for the Colliery developed independently by HydroSimulations (attached as Appendix B of **Appendix H**). The Groundwater Impact Assessment was completed with reference to the following documents:

- *NSW Aquifer Interference Policy* (DPI Water, 2012);
- *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016*; and
- *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*.

8.5.2 Existing Environment

Local hydrogeology

The topography surrounding the Project Area is dominated by gentle undulations to low hilly country. The Project Area is located within the Permian Tomago Coal Measures of the Hunter Valley Coalfields within the Sydney Basin. The target coal seams are the Big Ben, Donaldson, Elwells Creek, Whites Creek and Upper and Lower Buttai seams. Interburden between the coal seams consists of interbedded mudstone, siltstone and sandstone along with minor uneconomical coal seams. The overlying Newcastle coal measures do not outcrop at the site. The sediments dip to the south and south-west. Minor dykes and faults cross cut the strata.

To the west of the Project Area, Quaternary alluvial deposits of gravel, sand, silt and clay are associated with Wallis Creek which in part forms a wetland system of disconnected ponds and swamps. To the east, Quaternary sediments are associated with the Hunter River floodplain. Hexham Swamp has formed within the Quaternary sediments of the floodplain. Across the Project Area there are minor alluvial deposits associated with creeks such as Four Mile Creek and Buttai Creek.

There are two aquifer groups that dominate the Upper Hunter Valley, the alluvial deposits of the Quaternary and consolidated sedimentary rocks of the Permian. Within the Project Area, the hard rock Permian coal measures are the main aquifer unit, with the coal seams themselves representing the most permeable material within the formation. Groundwater typically is restricted to the cleat and fractures within the coal. Groundwater is also present in the Quaternary alluvium, swamp, floodplain and estuarine sediments. The alluvial groundwater is shallow with groundwater levels being topographically controlled.

The Bloomfield groundwater monitoring network consists of five standpipe piezometers and five bores with datalogged Vibrating Wire Piezometers (VWPs) (refer **Figure 23**). Monitoring of groundwater levels indicates a progressive decline with depth, with stronger vertical gradients on the southern boundary and minimal gradients at the western sites. The highest groundwater levels are in the northern part of the site where the coal measures outcrop.

Long-term mining effects on the local groundwater system can be seen through a decrease in groundwater elevation in piezometers monitoring the deeper coal seam aquifers, which isn't seen in the upper alluvial aquifer. This infers the alluvium/ weathered overburden and the deeper coal measures are not hydraulically connected.

Recharge and discharge

Recharge for the surficial alluvial aquifers and outcrop areas is dominated by rainfall. The alluvial aquifer is likely to be connected to Wallis Creek and Hexham Swamp, and would discharge to the streams. Coal seams are recharged by rainfall only at outcrop areas. At depth the coal seams are recharged by lateral flow down-gradient from outcrop areas and vertical flow through the overburden.

Groundwater discharge occurs by:

- Evapotranspiration in shallow water table areas;
- Spring flow;
- Baseflow contributions in wet periods
- Evaporation from in-pit pools and seepage faces
- Direct pump out

Groundwater Usage

There are 22 registered bores within 4.5km of the Project Area (refer **Figure 23**), most of which are monitoring bores. Four of the registered bores are listed as being for domestic / stock / farming purposes (GW051353, GW051647, GW058760 and GW061307).

Groundwater Dependent Ecosystems

There are no high priority Groundwater Dependent Ecosystems (GDEs) listed in the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources* or the *Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources* in the vicinity of the Project Area.

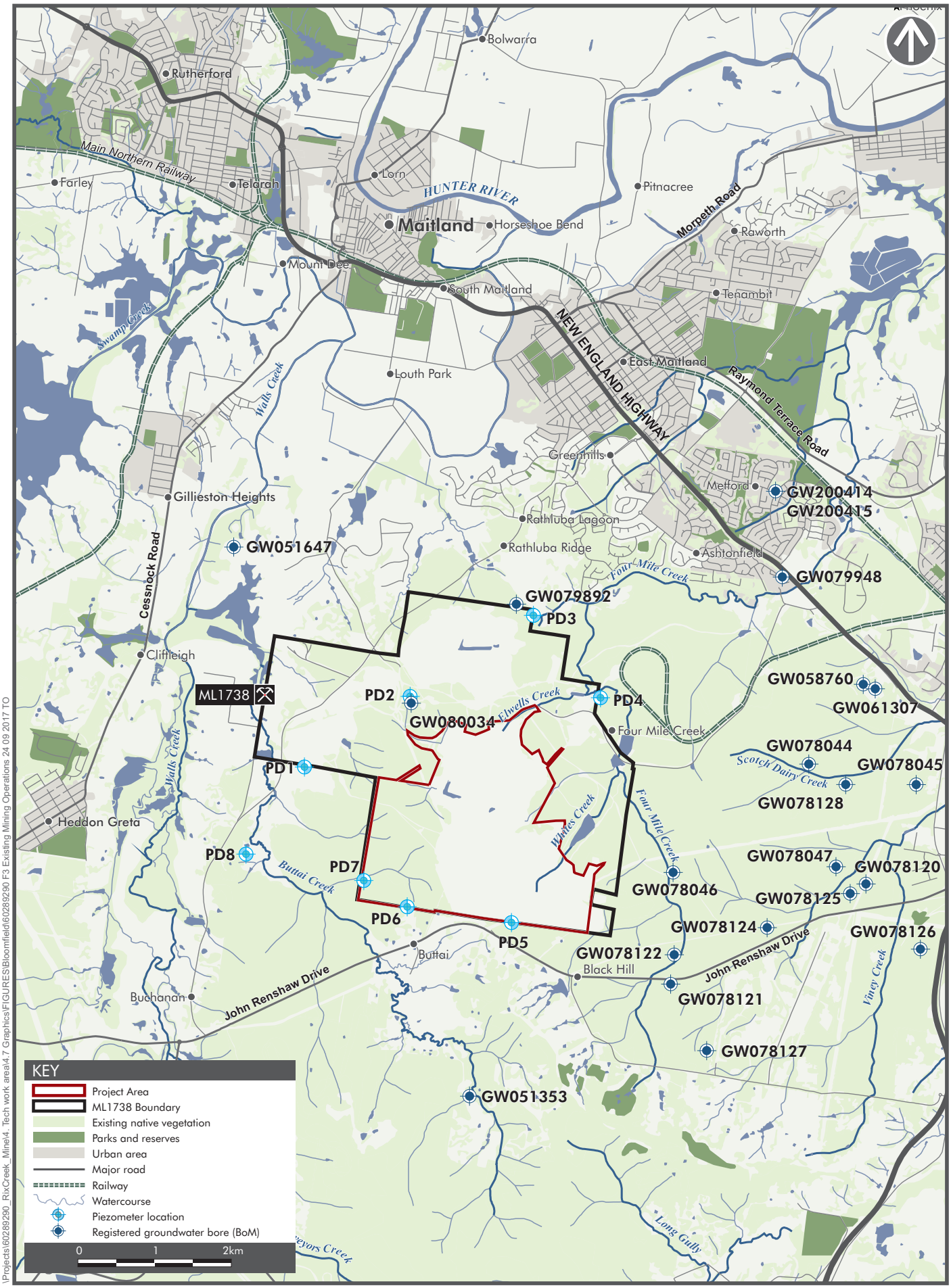
Groundwater Quality

Groundwater in the vicinity of the Project Area is generally saline and of negligible beneficial use. The concentration of Total Dissolved Solids ranged from 1000 mg/L to 13,000 mg/L and the pH is generally close to neutral.

Groundwater surface water interaction

The shallow alluvial aquifer, which is associated with Wallis Creek and the Hunter River floodplain, is inferred to be in direct hydraulic connection with the lower reaches of the major tributary streams in the area. Groundwater in the localised surficial weathered bedrock is inferred to be in hydraulic connection with the high-level streams. These limited occurrences of surficial groundwater do not represent a significant or regionally extensive aquifer system. There is no evidence of connectivity between surface waters and the deeper aquifers of the coal measures.

Modelling of the groundwater and surface water interactions for surface water systems surrounding Bloomfield found that all watercourses were inferred to be gaining systems with the exception of Buttai Creek and Hexham Swamp.



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AECOM

GROUNDWATER MONITORING BORES AND SURROUNDING REGISTERED BORES

Bloomfield Project

FIGURE 23

8.5.3 Impact Assessment

Groundwater extraction

Groundwater extraction via mine inflows was modelled as part of the predictive groundwater model prepared by HydroSimulation (Appendix B of **Appendix H**). During the calibration period (2006 – 2017) simulated inflows were modelled to be 0.9 ML/day at the start of mining (2006), peaking at 1.6 ML/day in 2013. During the prediction and recovery period (2018 – 2031) simulated inflows were predicted to peak at 1.5 ML/day during 2020-2021, with inflows at the cessation of mining in 2025 predicted to be approximately 1.0 ML/day.

The Groundwater Impact Assessment noted that the groundwater model is conservative and applies a higher rainfall recharge at various locations across the model domain, resulting in higher predicted mine flows. Two areas of increased modelled recharge include:

- Mine spoil area; and
- Catchments of surface water run-off diversions.

The mine spoil area (43.3 ha) and the hardstand workshop area (7.5 ha) west of the mine spoil area will receive no rainfall recharge as runoff is captured from these areas and discharged off-site.

Clean water catchments across the site divert clean surface water runoff to storage dams which are part of the natural surface water system limiting rainfall recharge. There are four clean water sub-catchments (Buttai Creek, Four Mile Creek, Possum Puddle west and Possum Puddle east) with a total surface area of 623 ha.

The modelled inflow rates were therefore refined to remove these areas from the model, which resulted in a reduction of mine inflows by a total of 78.0 ML/year. The estimated annual water requirements for licensing is summarised in **Table 22**.

The predicted licence requirements from the refined inflows vary from 369.5 ML/year in 2016/17, reaching a maximum of 482 ML/year in 2020/21 and declining to zero in 2026/27. These predicted mine inflows are within the existing water licence requirement of 500 ML/year.

Table 22 Modelled and Refined Mine Inflows for each Operational Year

Year	Licence Requirement (ML / year)	
	Modelled inflow	Refined Inflow
2016/17	447.5	369.5
2017/18	487.5	409.5
2018/19	520	442
2019/20	540.5	462.5
2020/21	560	482
2021/22	491	413
2022/23	338	260
2023/24	310	232
2024/25	367	289
2025/26	183.5	105.5
2026/27	0	0

Predicted alluvial takes from the Wallis Creek Water Source and the Newcastle Water Source were considered in the overall mine inflow rates. During the prediction period and subsequent 100 year recovery period (2018 – 2132), the maximum and mean take from the Wallis Creek Water Source was predicted to be 26 ML/year and 12 ML/ year respectively, and the maximum and mean take from the Newcastle Water Source was predicted to be 8 ML/year and 2 ML/year respectively.

The final void would remain a sink and would a wide spread effect of lowering water levels in the vicinity of the Project Area in the long term. A hypothetical monitoring point within the final void is predicted to only recover 15m after 100 years, with a void water surface of -40m Australian Height Datum (AHD).

Groundwater drawdown

Predicted groundwater heads were modelled to show groundwater level and drawdown at the completion of mining in 2025. The results indicate the following:

- Drawdown as a result of mining activities at the Colliery are expected to reach a maximum in the Mine Year 20 or 2025, at which time mining activities are scheduled to cease in the southern end of the approved extraction area and the groundwater levels would start to recover;
- Drawdown of 100 m is predicted in the surficial aquifer layer 1 in the Bloomfield extraction area and final mine void (alluvial and regolith) although it is limited in extent;
- Significant drawdown is also evident within the lease area to the north-west of approved extraction area corresponding with historical open cut and underground mining;
- Drawdown is generally less than 0.5 m outside the Bloomfield lease area apart from the south-west corner where the 2 m drawdown contour extends outside the lease approximately 600 m beneath Buttai Creek;
- The predicted drawdowns are not expected to negatively impact GDE's as historical mining in the area has previously lowered water levels far below the ground surface;
- The Donaldson open cut and final void are predicted to experience significant drawdown, however there is no overlap of the water table drawdowns produced by the various mines;
- Predicted drawdowns at the end of mining in nearby registered bores (within 5 km) are generally predicted to be less than 1 m, however drawdowns between 1 – 2 m are predicted for three bores (GW078047, GW078128 and GW078044) which is within the Aquifer Interference Policy threshold of 2 m; and
- Larger drawdowns are predicted for GW078124 and GW078124, with 20 m and 17 m drawdown respectively due to the final void at the Donaldson mine.

Groundwater quality impacts

Groundwater within the Bloomfield mine lease is saline and of negligible beneficial use. The potential impacts of Bloomfield's current and future operations relate to the risks of contamination from disturbed catchments, mine water, and process water being released off site to natural waterbodies.

As previously noted in **Section 8.4.3**, controlled discharges to Four Mile Creek from the Colliery occur from the Lake Foster discharge pipe outlet and are monitored and reported in accordance with EPL 396. The Project would not increase or decrease the probability of unplanned discharges, or water quality risks, from Bloomfield's operations. However these risks would continue to exist up until the end of extraction (2030) and until such time as the site is rehabilitated noting that risks would decrease with the progressive rehabilitation of post mining areas across the life of the project.

Baseflow impacts

The predictive model included assessment of potential impacts on baseflow for local watercourses. The model can predict reductions to baseflow for gaining streams, but cannot predict increases in leakage from losing streams. Baseflows were extracted from the model for both the mining and the null case simulations, for cumulative stresses imposed by all mines in the vicinity of the Project Area. The results indicate that:

- Four Mile Creek was predicted to have converted from a gaining stream to a losing stream around 2011, therefore its average baseflow of 0.24 kL/day (equivalent to 0.1 ML/year) would have been lost at that time;
- The difference between mining and null case simulations for all other watercourses was negligible, indicating that Bloomfield mining is having an insignificant effect on baseflow capture; and

· The leakages from Hexham Swamp differed by no more than 1 kL/day between null and mining simulations, which would be within numerical error bounds.

Aquifer Interference Policy

The Groundwater Impact Assessment included a minimal impact assessment for the groundwater potentially impacted by the Project in accordance with the Aquifer Interference Policy. The majority of the Project Area is considered to be within a 'Less Productive Groundwater Source' within fractured rock, based on the low number of registered bores in the area. The minimal impact considerations for 'highly productive groundwater' in a fractured rock aquifer and for 'less productive groundwater' in a coastal aquifer are presented in

Table 23 Minimal Impact Considerations for a 'Highly Productive Groundwater Alluvial Aquifer'

Minimal impact considerations	Response
Water Table – Level 1 Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic 'post water sharing plan' variations, 40 m from any: High priority groundwater dependent ecosystem; or 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.	There are no high priority groundwater dependent ecosystems listed under the *North Coast Fractured and Porous Rock Groundwater Sources.* No culturally significant sites were identified within the *North Coast Fractured and Porous Rock Groundwater Sources.* Groundwater modelling indicates that drawdown effects on the surficial aquifer are not expected to have any adverse impact on groundwater dependent ecosystems because the groundwater levels are already well below ground surface.
Water Table – Level 2 If more than 10% cumulative variation in the water table, allowing for typical climatic 'post water sharing plan' variations, 40 m from any: High priority groundwater dependent ecosystem; or High priority culturally significant site; listed in the schedule of the relevant water sharing plan, if appropriate studies 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 a 2 m decline cumulatively at any water supply work then make good provisions should apply.	The alluvium of both the Wallis Creek Water Source and the Newcastle Water Source (along the lower Hunter) are classified as 'Highly Productive' by DPI Water. The calculated alluvial takes (rounded to the nearest ML/year) for separate simulation phases are discussed at **Section 8.5.3 Groundwater Extraction**. These takes are due only to Bloomfield mining. The standpipe SP4-2 is located near Four Mile Creek. It is more likely that the water level in this bore is influenced by water level in the creek, when it flows. The simulated hydrograph shows a rising trend for some years, followed by stabilisation. SP7-1 is located at the western border of the Bloomfield mine. The prediction and recovery stages of the simulated hydrograph suggest that the water level will decline due to mining and not recover significantly. This bore would remain within the zone of influence of the final void. Most of the drawdown for registered bores calculated by the model are much less than 1 m, while drawdown greater than 1 m and up to 2 m are predicted at three bores (GW078047, GW078128 and GW078044), which is within the AIP's 2 m threshold. Large predicted drawdowns of 20 m and 17 m at bores GW078124 and GW078123 are due to the final void at the Donaldson mine.

Minimal impact considerations	Response
	Mitigation measures have been recommended for GW078124 and GW078123 located near the Donaldson Mine where it has been predicted that the drawdown exceeds a water level decline of more than 2 m. The predicted groundwater level decline will not prevent the long term viability of the bore and make good provisions will be covered by the Donaldson Mine groundwater management plan.
Water Quality – Level 1 Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.	Not applicable
Water Quality – Level 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.	Not applicable

Table 24 Minimal Impact Considerations for a 'Less Productive Fractured Rock Aquifer'

Minimal impact considerations	Response
Water Pressure – Level 1 A cumulative pressure head decline of not more than a two metre decline, at any water supply work.	Significant drawdown is also evident within the lease area to the north-west of the approved extraction area, coincident with historical open cut and underground mining. Drawdown from open cut mining is propagating into the high-permeability underground voids, with some spatial confinement offered by a north-westerly trending dyke. The drawdown is generally less than 0.5 m outside the Bloomfield lease boundary except for the south-west corner where a 2-m drawdown contour extends off-lease. The 2 m of drawdown extends beneath Buttai Creek for a distance of about 600 m.
Water Pressure – Level 2 If the predicted pressure head decline is greater than condition 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.	Whites Creek Seam: All three vibrating wire piezometers (VWP) lie along the southern boundary of the Bloomfield lease. All simulated hydrographs show significant mining effects, with the degree of recovery being minimal but increasing from east to west, due to the effects of adjacent underground mining. Donaldson Seam: Four out of seven bores (SP2-1, VW1(35m), VW6(114m) and VW7(95m)) in this layer show slow water level recovery post-mining. Water levels at bores SP3-1 and VW5(71m) show no sign of recovery. Most bores are influenced by

Minimal impact considerations	Response
	adjacent underground mining. Big Ben Seam: All simulated hydrographs show significant declines due to mining, with slow or negligible recovery in some cases. Most bores are influenced by adjacent or historical underground mining.
Water Quality – Level 1 Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40 m from the activity.	Not applicable
Water Quality – Level 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.	Not applicable

All predicted impacts are less than Level 1 minimal impact considerations (as defined in the Aquifer Interference Policy) and are therefore considered acceptable with appropriate monitoring during operation.

8.5.4 Mitigation Measures

Monitoring

Ongoing quarterly monitoring of the onsite piezometer network and monthly surface water monitoring would continue to be implemented to monitor the drawdown effects from depressurisation of the regional aquifer. The installation of additional monitoring points would be considered where areas of predicted drawdown are significantly different to that of actual drawdown.

The frequency of water level measurements within the pit should be compatible with evaporation rates obtained from the site's weather station which will allow refinement of model calibration and inflow predictions.

Management

Bloomfield has an existing Water Management Plan (WMP) which details the monitoring and management measures which are currently in place for the management of groundwater (and surface water) at the Colliery. The WMP would be reviewed and updated in accordance with the conditions of consent to monitor groundwater levels in monitoring wells and in the pit. Groundwater discharge would be monitored to quantify pit inflows to ensure the discharge licence conditions are satisfied.

The monitoring data collected from groundwater and surface water systems enables management of groundwater by:

- Establishment of groundwater and surface water trigger levels based on the beneficial use of each water body;
- Development of mitigation measures which may include the provision of 'make good' measures in bores where excessive drawdown may be experienced. This could involve deepening a water supply bore or providing an alternative water supply. No surface water mitigation measures are proposed due to the minimal predicted impacts; and
- Plotting of groundwater level data as hydrographs and comparing to rainfall.
- Collation of the results of the groundwater monitoring program on an annual basis and presenting in an annual report as required under the conditions of consent.

8.6 Visual Impacts and Rehabilitation

8.6.1 Introduction

This section provides an assessment of the potential visual impacts of the Project and the proposed rehabilitation activities.

8.6.2 Existing Environment

Visual Environment Previously Assessed (2008 EA)

An assessment of the visual environment, including lighting, was undertaken as part of the 2008 EA. This previous assessment identified viewing points around the site (shown on **Figure 24**) with the potential to view operations occurring within the site, particularly residences or other places of public access such as roads or public buildings. The visual impact of the Colliery operations was then determined for both day and night-time operations. The assessment did not address the visual impacts of the CHPP, which forms part of the Abel Project Approval.

The existing visual environment of the Project Area would be similar to that assessed in the 2008 EA as there have been no substantial changes to the Colliery infrastructure or operations since the previous visual assessment was prepared. The 2008 EA assessed the following four main visual elements of the operations:

- The open cut mining area, consisting of the active mine pits, emplacement areas, haul ramps and areas of active rehabilitation;
- Haul road for the transportation of ROM coal from the open cut mining area to the ROM coal stockpile at the CHPP;
- Access road from the open cut mining area to the workshop; and
- The workshop area consisting of the workshop/maintenance shed, fuel farm and hard stand area for equipment storage.

The landscape and visual setting of the Project area and its surrounds is defined by undulating rural hills. Three major visual features of this landscape are the existing Colliery, Donaldson Open Cut Mine, and the natural feature of Elliots Hill. There are extensive small rural landholdings surrounding the Colliery to the north, south and west. Residential areas of Ashtonfield are visible to the north.

The Project area cannot be viewed from the east due to intervening ridgelines and vegetation. A vegetated ridgeline to the west prevents close views from this direction, although distant views from Kurri Kurri may be possible. Some Louth Park, East Maitland and Ashtonfield residences to the north and north-east have views to the disturbed grasslands that form part of the tailings management system, however most views are limited by an east-west running ridgeline. South of the Colliery, rural residences are located along John Renshaw Drive, Lings Road, Black Hill Road and Browns Road. Bloomfield operations are generally screened by native vegetation and an intervening ridgeline which includes Elliots Hill.

Viewers along John Renshaw Drive are generally limited to passing motorists. John Renshaw Drive functions primarily as a link road and large proportion of motorists would use the road to commute to work or to transport goods. This suggests that they would be less sensitive to changes in the visual environment than, for example, recreational users or tourists. Views towards the Colliery are restricted to works along the southern boundary which, when rehabilitated, would block views of active mining operations as they progress northwards.

Generally the assessment of visual impact identified a low visual impact level associated with the Colliery operations. Only one viewing location (Location D – Buttai Valley south of John Renshaw Drive) was considered to have moderate-low visual impact during operations, and it was noted that this would diminish over time as the overburden dump and rehabilitation progresses west out of their line of sight behind Elliots Hill.

The assessment of lighting included direct and diffuse light effects. Locations that were considered to have direct line of sight to night lighting are Buttai Valley and, at a further distance, Black Hill to the south. Potential impacts of direct lighting are managed through consultation with residents and

attention to the direction of fixed site lighting. A diffuse effect of the lighting and its interaction with atmospheric conditions may from time to time create a glow around the Project Area.

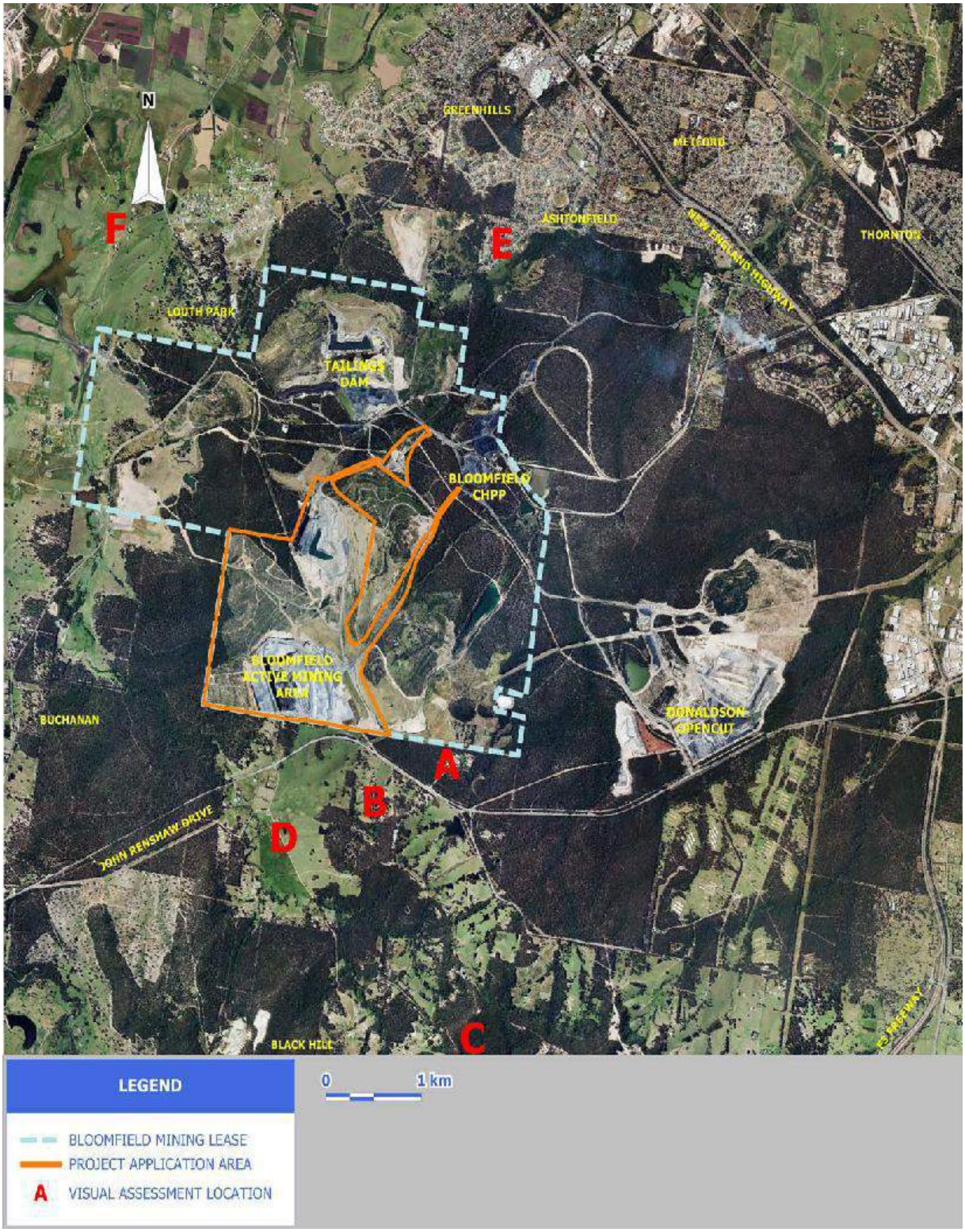


Figure 24 Visual Assessment Site Locations from 2008 EA (Source: Business Environment, 2008)

Current Rehabilitation Strategy

Rehabilitation at the Colliery is currently undertaken in accordance with the Rehabilitation Management Plan (RMP) and the current MOP developed by Bloomfield for the Colliery site. The RMP has been prepared in accordance with the Project Approval 07_0087 conditions of consent, requirements of EPL 396 and mining leases, and commitments outlined in Bloomfield's Environment Management Policy. The current MOP has been prepared in accordance with the requirements of the mining leases (CCL 761 and ML 1738).

The overall aim of rehabilitation at the Colliery is to provide a safe and stable landform, compatible with the surrounding landscape, which allows for a range of possible post-mining land-uses including mixed-used development. The general rehabilitation, landform and vegetation objectives of the RMP and the current MOP are based on those detailed in the 2008 EA and include:

General Rehabilitation Objectives

- Land will be rehabilitated in accordance with relevant DRE standards applicable at the time of rehabilitation;
- Rehabilitated land will represent a minimal source of off-site environmental impacts, such as dust, water pollution, visual amenity and weeds;
- All infrastructure owned by Bloomfield Colliery must be removed under the terms of its Commercial Lease with the landowner (Ashtonfields);
- Rehabilitated land will require ongoing management inputs no greater than similar adjacent land; and
- Rehabilitation will be compatible with the proposed post-mining land-use (mixed-used development).

Landform Objectives

- Rehabilitated land will be safe and stable;
- Land capability will be returned to a class similar to that existing prior to the commencement of mining; and
- Mined land will be re-contoured to a landform compatible with the surrounding natural landscape.

Vegetation Objectives

- Rehabilitated land will be top-dressed, fertilised and sown with grass seed and/or native vegetation species; and
- A sustainable vegetation cover will be established on rehabilitated land.

The RMP also sets out the specific completion criteria and progress indicators for each of the rehabilitation objectives.

The rehabilitation methodology implemented at the site is detailed in Section 3.4 of the 2008 EA and in Appendix A of the current RMP. Rehabilitation works generally consist of reshaping of overburden dumps and re-establishment of a vegetative cover. This is divided into the following stages:

- Landform reshaping;
- Preparation of the ground surface (e.g. topdressing material application);
- Species selection and revegetation; and
- Site monitoring and maintenance.

Rehabilitation activities are carried out throughout the year, with the aim of timing vegetation seeding operations in spring and autumn. As reported in the Bloomfield 2016 AEMR, to date 488 hectares have been rehabilitated within the Project area.

Under the current consent, mining at the Colliery will cease in 2021. In accordance with the Abel Project Approval, the Bloomfield CHPP would continue to process coal from the neighbouring Abel

Underground Mine until 31 December 2030. The approved final landform incorporates a final void remaining on the Colliery site following cessation of Bloomfield mining operations, to be used for disposal of tailings from the CHPP. Previous estimates have indicated that 20 million m^3 of storage capacity would be required for the final void as a tailings facility. This includes disposal of approximately 18 million m^3 of waste rejects and a further 2 million m^3 of overburden capping. Tailings material would be capped with 2 metres of overburden material and soil and rehabilitated.

Given that the final void would be utilised for tailings emplacement from the Abel Underground Mine, rehabilitation of the final void currently forms part of the Abel Project Approval. Section 2.13.2 of the *Abel Underground Mine Part 3A Environmental Assessment* (Abel EA) (Donaldson Coal, 2006) states the following:

> *It is proposed to fill former open cut areas within Bloomfield Colliery with tailings from the coal washing process. This will assist in filling and rehabilitating these areas. Rehabilitation will be undertaken in accordance with DPI guidelines which require the Bloomfield Mine Operations Plan, required as a condition of the Bloomfield mining lease, to provide details on proposed outcomes to be achieved through rehabilitation and final landform. Dewatering of these tailings areas will continue to be undertaken in accordance with current methods, which include the pumping of excess water back to the washery for settling and reuse, and the covering of dewatered areas with soil, landform shaping and seeding for tree cover.*

The current MOP sets out the following rehabilitation objective for the Active Mining Area domain:

> *After mining operations conclude the remaining final void will be utilised as a tailings disposal area. After tailings operations are completed (est 2030) the landform will be graded and contoured to be compatible with surrounding natural landscape as far as possible. The mining void remaining in the post mining landscape will be safe, stable and non-polluting. Final void batters will be seeded with a pasture grass seed mix suitable for grazing purposes or seeded with a mix of native tree and shrub species similar to the surrounding vegetation community.*

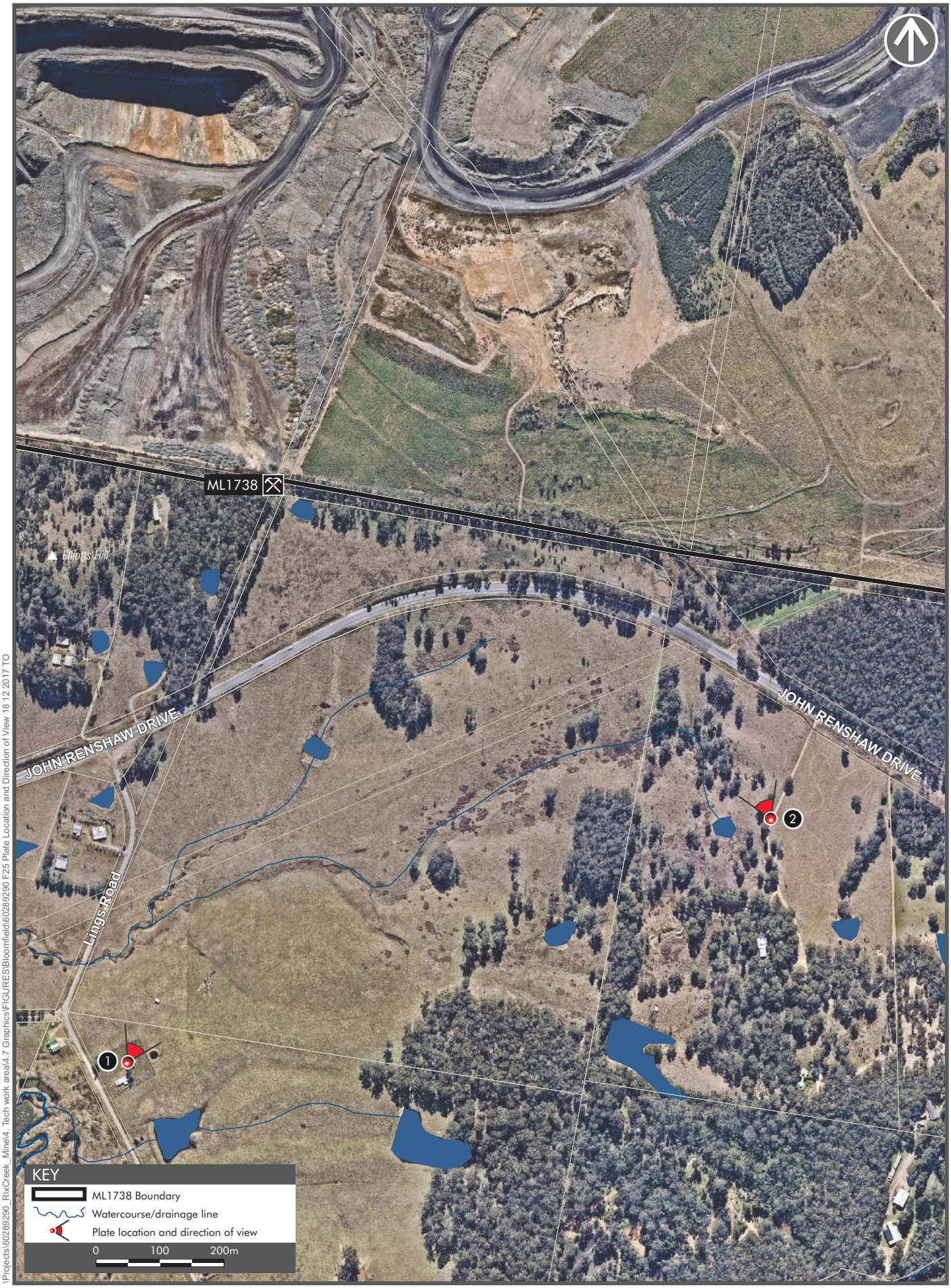
8.6.3 Impact Assessment

Visual Impacts

The Project would involve the ongoing extraction of coal from within existing approved extraction areas. Following on from the visual impact assessment previously undertaken for the approved Project elements and infrastructure (identified in **Section 8.6.2**), the visual impact of the Project on these elements was reviewed.

A number of these elements such as the workshop and haul roads are not visible at offsite receiver locations now or during the proposed mine life extension. The potential visual impacts of the Project relate primarily to the change in final landform which would see a shift in the final void approximately 200m to the west. This means that views to the overburden emplacement area may change compared to that originally assessed.

The potential visual impacts associated with the proposed overburden emplacement area were assessed through the development of photomontages to illustrate the visual effect from two of the most impacted viewing locations (locations shown on **Figure 25**). Photomontages (provided at **Plate 1** and **Plate 2**) indicate that the visual impact of the Project would be minimal.



\Projects\60289290_RixCreek_Mine4. Tech work area\4.7 Graphics\FIGURES\Bloomfield\60289290 F25 Plate Location and Direction of View 18.12.2017 TO

AECOM

VIEWPOINT LOCATIONS
Bloomfield Project

FIGURE 25

EXISTING VIEW

WITH PROJECT

AECOM

RESIDENCE - LINGS ROAD, BUTTAI

Bloomfield Project

PLATE 1

EXISTING VIEW

WITH PROJECT

Rehabilitation and Final Landform

The existing rehabilitation methods and monitoring procedures would continue to be implemented across the Project area, and the RMP and MOP would be updated to incorporate the Project.

As noted in **Section 6.2**, DRG requested that the EA include consideration of Section E: Rehabilitation of the Indicative SEARs for SSD Mining projects (NSW Government, 2015). The following sections address each of the headings set out in Section E of the Indicative SEARs.

Post-mining land use

Post mining land use options are discussed in **Section 4.4.4**. This includes identification of post mining land use options, justification of the preferred approach and how this relates to the rehabilitation strategies of neighbouring mines within the region.

Rehabilitation objectives and domains

The general rehabilitation, landform and vegetation objectives are described in **Section 8.6.2**, while the rehabilitation objectives specific to the relevant primary and secondary domains are provided in Table 10 of the current MOP. The objectives, performance indicators, measures and completion criteria for the relevant defined domains are set out in Table 12 of the current MOP.

Rehabilitation methodology

As discussed in **Section 8.6.2** the existing rehabilitation methods are detailed in Appendix A of the RMP and Section 6 of the current MOP. At the commencement of the MOP term, all available areas have been rehabilitated. Shaping and rehabilitation of existing overburden emplacement areas would not be able to continue until backfilling areas within the void have reached the final landform.

Geotechnical investigations would be undertaken to confirm shear strength of tailings emplacement areas and capping requirements. Preliminary geotechnical investigations of the existing tailings emplacement area have been undertaken (as discussed at **Section 4.3.3**), and similar characteristics are expected given the similar source of material. Recommendations provided by geotechnical specialists would be implemented during tailings emplacement for the Project.

The indicative development of the open cut and overburden emplacement domain and proposed final landform for the key production milestones is shown in **Figure 6** to **Figure 9**, including the commencement of the Project (2018), the maximum year of mining activity (2021) and completion of the Project (proposed final landform) with and without Abel Underground Mine resuming operations .

Conceptual final landform design

The final landform for the Project would depend on the future operational status of the Abel Underground Mine, which is currently in care and maintenance. As such, indicative final landforms for two scenarios have been prepared, including a scenario with Abel Underground Mine remaining in care and maintenance (**Figure 8**) and a scenario with Abel Underground Mine resuming operations (**Figure 9**). The final landform design will be reassessed on a regular basis to consider the status of the Abel Underground Mine and to inform the rehabilitation strategy. The indicative final land use for the site is discussed in **Section 4.4.4** and shown on **Figure 17**.

Monitoring and research

The rehabilitation monitoring program undertaken at the site is detailed in Section 7 of the current MOP and includes maintenance inspections, rehabilitation monitoring and review of inspection data over time to assess rehabilitation performance. Monitoring is currently undertaken at 24 locations throughout the mine site. A Trigger Action Response Plan is included in the RMP which sets out the proposed intervention and adaptive management measures to be implemented in the event of unexpected variations or impacts to rehabilitation outcomes.

Post-closure maintenance

The progress of rehabilitated areas is monitored as part of the ongoing assessment program which is used to collect sufficient data on the rehabilitated land to compare against the completion criteria to assess rehabilitation development, sustainability and suitability for sign-off.

Rehabilitation monitoring data is reviewed upon completion of monitoring. Remedial actions for significant anomalies detected during monitoring (i.e. failed rehabilitation, failed water management structures, significant weed infestations) are included in environmental works planning. Monitoring data is compared with previous years' data, to identify long-term trends in rehabilitation development. Once three sets of data have been collected, this information is compared to completion criteria and areas deemed suitable for sign-off are identified.

Rehabilitated areas that are not progressing towards the completion criteria are identified and corrective strategies are devised or the monitoring period is extended. The results of rehabilitation monitoring are reported in the AEMR.

Barriers or limitations to effective rehabilitation

Bloomfield has completed an overarching risk assessment to identify the potential threats to the success of rehabilitation at the site. Results of the risk assessment are detailed in Section 3 of the current MOP. Key aspects include:

- Disturbance of Aboriginal Heritage;
- Disturbance of European Heritage;
- Erosion and sedimentation;
- Fire Hazard;
- Dust;
- Noise;
- Contamination of surface and ground water resources;
- Storage and management and hydrocarbons including spills and leaks; and
- Introduction of weeds.

The proposed mitigation measures to reduce the key risks identified in the risk assessment are presented in the Trigger Action Response Plan in the RMP.

The alternative final void options considered during the development of the mine plan are discussed in **Section 4.4**. The preferred final landform has removed the need to retain a highwall as part of the final void. The impact of the Project on surface water and groundwater in relation to the likely final water level in the void has been assessed at **Section 8.4** and **Section 8.5** respectively.

8.6.4 Mitigation Measures

The Colliery has established rehabilitation and monitoring procedures as part of its RMP and MOP for the site. These rehabilitation methods would continue to be implemented for the duration of the Project. Geotechnical investigations would be conducted by qualified geotechnical specialists to guide the tailings emplacement strategy and capping requirements and management strategies recommended would be implemented for the Project.

Existing management plans and procedures, including the RMP and MOP, would be updated to reflect the Project as required. Any changes to the final landform would be subject to discussion with the relevant agencies (including DRG).

8.7 Social and Economic

8.7.1 Introduction

This section provides an assessment of potential social and economic impacts and benefits associated with the Project.

8.7.2 Existing Environment

Regional Profile

The 2008 EA included discussion of the socio-economic regional profile, including analysis of the 2006 census data. The 2006 census indicated the population of the Cessnock LGA was 48,265 with approximately 7.7% of the employed people in Cessnock working in the mining sector.

The 2011 census data (ABS 2011) showed a population increase of 5.3% in the Cessnock LGA compared to 2006 data, with 50,840 people in the LGA, of which 10.2% were employed in the mining sector and 8.7% specifically in the coal mining industry. In comparison, approximately 0.6% and 0.4% of working people in NSW and Australia wide respectively were employed in the coal mining industry. This shows the continuing importance of coal mining in the local economy.

The 2016 census data (ABS 2016) shows strong population growth of approximately 9.3% compared to 2011 data, with approximately 55,560 people living in the Cessnock LGA. Employment data for the 2016 census was not yet available at the time of writing this EA.

The Hunter Region has a diverse and changing economy, with the mining and tourism industries overtaking the region's traditional agricultural base (the viticulture and equine industries). In addition to direct employment in the mining sector, employment in downstream industries (e.g. transport, health and other service) as a result of the presence of the mining sector, adds to the regional importance of the mining industry.

Bloomfield Group Workforce

A summary of the Bloomfield Group workforce (which includes the Colliery, Rix's Creek North and Rix's Creek South mines, and associated engineering companies) was provided in the *Environmental Impact Statement for the Rix's Creek Mine Continuation of Mining Project* (AECOM, 2015). This information provides an insight into the social context of the mines and functional linkages with the local community and economy. The key characteristics of The Bloomfield Group's workforce are as follows:

- Over 96% of the workforce is employed on a permanent full time basis. The average length of employment for The Bloomfield Group is 10 years while average length of employment in the mining industry is 16 years, characteristic of a relatively stable workforce;
- The most common level of school education completed by employees was Year 10 or below (55%), while 32% of employees completed Year 12. Nearly half of the workforce holds a Trade/TAFE qualification; and
- Approximately 53% of employees have a mortgage while 25% own their property outright; approximately 14% of employees are renting.

The majority of the workforce resides in or in the vicinity of Maitland (33%), followed by Singleton (11%) and Lake Macquarie (10%). Approximately 35% of employees at the Mine live in Singleton. Total household expenditure was highest in Maitland, Newcastle, Singleton and Lake Macquarie, which together account for $14.7 million per annum or 70% of spending estimated across all Bloomfield employees. As anticipated, employees at the Mine have a high proportion of expenditure in Singleton (38%), and workers from Bloomfield Mine and other surveyed organisations have a high proportion of their expenditure in Maitland and surrounding suburbs (45%).

Bloomfield Group Suppliers

The survey of the principal Bloomfield Group suppliers (local, State and national suppliers) showed that an estimated annual expenditure of approximately $52.47 million was directly dependent upon The Bloomfield Group operations. Local businesses/suppliers (Singleton) generated expenditure of

$13.12 million and $22.03 million was generated from regional businesses/suppliers (wider Hunter Valley).

Community Funding

The Bloomfield Group financially supports local organisations through The Bloomfield Group Foundation and other sponsorship programs, and encourages employees to participate in charitable and community events. Through sponsorship programs and The Bloomfield Group Foundation, the Bloomfield Group donated almost $3.4 million to the community between March 2006 and March 2017.

Community Consultative Committee

The Bloomfield CCC commenced in 2010 following issue of the Project Approval in 2009. The CCC is currently comprised of a chairperson, three community representatives and three Colliery employees. Cessnock City Council has recently withdrawn representation on the committee. The CCC meets three times per year and provides a forum for open discussion between Bloomfield and the community on issues directly related to the Colliery's operations, environmental performance and community relations.

8.7.3 Assessment of Impacts

Principles for Social Impact Assessment

The International Principles for Social Impact Assessment (Vanclay, 2003) summarises the key elements that should be considered when determining the potential social impacts of an activity or development:

- People's way of life – that is, how they live, work, play and interact with one another on a day-to-day basis;
- Their culture – that is, their shared beliefs, customs, values and language or dialect;
- Their community – its cohesion, stability, character, services and facilities;
- Their political systems – the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose;
- Their environment – the quality of the air and water people use; the availability and quality of the food they eat; the level of hazard or risk, dust and noise they are exposed to; the adequacy of sanitation, their physical safety, and their access to and control over resources;
- Their health and wellbeing – health is a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity;
- Their personal and property rights – particularly whether people are economically affected, or experience personal disadvantage which may include a violation of their civil liberties; and
- Their fears and aspirations – their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

An assessment of each of these elements in relation to the Project is provided in **Table 25**.

Table 25 Project Social Impact Assessment

Potential Social Impact Element	Project Impact Assessment
People's way of life	The Project is located within an established mining area. The assessments undertaken have indicated that the Project would have a minimal impact on surrounding areas, therefore it is considered unlikely that the Project would have a measurable impact on any peoples' way of life.
Culture	An assessment of the potential impacts of the Project on the indigenous and historical culture of the locality is provided in **Section 8.8.1**. This assessment concludes that the Project would have a negligible impact on heritage values. There are no cultural land uses (religious, community organisations, etc.) in close proximity to the Project Area that would be impacted by the Project.
Community	The Project as designed, after considering all options, would maximise the continued social and economic benefits from the use of the Project area. There would be no impact to community cohesion. There would be local and regional flow-on benefits from the Project related to capital investment, ongoing employment and purchasing carried out during operations.
Political systems	The Project would have a negligible impact on political systems at any scale. Community participation regarding the Colliery operation is currently provided through the CCC and this would continue to be provided throughout the Project.
Environment	This EIS includes a comprehensive environmental impact assessment aimed at determining the scale and nature of the Project's potential environmental impacts (refer to **Section 8.0**). Where the potential for impacts to occur has been identified, management actions and mitigation measures have been recommended to maintain impacts to acceptable levels. With these management measures in place, it is considered that the Project would not have a significant environmental impact.
Health and wellbeing	An assessment of potential hazards, risks and human health impacts of the Project is provided in **Section 8.0** in relation to a number of potential aspects including noise, air quality and social and economic impacts. These assessments concluded that the Project is unlikely to pose a risk to the health or wellbeing of the community.
Personal and property rights	The Project is located on land owned by an independent third party and held by Bloomfield under a long standing commercial lease. No additional land holdings or acquisitions would be required. The Project site is located within an established mining area with appropriate offsets to sensitive (residential) land uses, meaning the Project is unlikely to have an impact on personal or property rights.
Fears and aspirations	The Project would prolong the life of the Colliery and provide ongoing employment for the existing 93 personnel for an additional nine years beyond the existing life of the mine. Other community benefits would include the continuation of indirect employment, contributions through sponsorship programs and flow on benefits to the local economy.

Based on the assessment provided in **Table 25**, the Project would not have an adverse impact on the social fabric of the local community.

Social Amenity

Potential impacts and community concerns relating to social amenity have largely been identified via CCC meetings and community hotline data (complaints) for 2009 - 2016. The Bloomfield AEMR show a decline in the number of community complaints received, with about 20 complaints in 2009 and 2010, about 10 complaints in 2011 - 2014, and five complaints in 2015 and 2016 (Bloomfield, 2016).

The main concerns related to noise and blasting, with fewer community complaints related to air quality (dust and odour), transport, wild dogs and weeds. Impacts on social amenity from the Colliery operations are summarised in **Table 26**, together with their risk ranking (low, medium or high).

Table 26 Impacts on Social Amenity

Issue	Impact*	Social / community Risk
Blasting	Blasting related complaints constitute the most prominent issue for the community, with almost half (47%) of all complaints between 2009 and 2016. Blasting complaints generally refer to overpressure levels and vibration. The majority of these blasting complaints were received during 2009 and 2010, with only one or two each year since 2012.	Low/Moderate
Noise	Noise impacts constituted over a third (37%) of all complaints between 2009 and 2016. Complaints are generally related to operational noise from the Mine, however noise from coal trains passing residential areas was also considered to be an issue. Noise complaints have also declined, with only one or two received each year since 2015.	Low/Moderate
Air Quality	Air quality complaints (including dust and odour issues) accounted for 10% of all complaints received. Complaints relating to dust and odour may be attributed to blasting activities and other operational activities such as bulldozing and haulage. Generally only one or two complaints per year relating to dust or odour have been received.	Low
Other	All other complaints including traffic (2%), wild dogs (3%), and weeds (1%) were relatively minor.	Low

*Figures have been rounded.

Community Infrastructure and Services

Project factors that can impact community services and infrastructure include:

- Changing demand due to an increase in temporary or permanent population;
- Changing behaviours of users, such as workforce rosters determining patterns of peak service utilisation; and/or
- Direct impacts on physical infrastructure during Project construction and/or operation.

The Project involves the continuation of existing mining activities with the existing workforce and would not require construction of new infrastructure or facilities. Therefore the Project would not result in additional impact on accommodation and housing, community facilities and services.

Economic Impacts

The continuation of mining activities at the Colliery would have positive economic impacts through the provision of ongoing employment to existing employees and flow-on benefits to other industries. Other industries that may benefit include those supplying inputs to the mining sector (such as trade, manufacturing and professional services), those that support the mining sector through its supply chain (such as property and business services), and consumer oriented industries (such as retail and hospitality services). The Project would also have a positive economic impact through payment of mining royalties to the State Government.

If the Project does not proceed, economic impacts would primarily be negative due to the reduction in employment following closure of the Colliery in 2021 and a reduction in the flow on benefits to the wider community. Payment of royalties to the State Government would cease and the economic benefits of the remaining coal reserves would go unrealised.

8.7.4 Mitigation Measures

Bloomfield currently undertakes a number of monitoring, management and mitigation activities in relation to identified community concerns, which include noise, blasting and air quality monitoring; rehabilitation of land to minimise visual impact; manning of a 24 hour community hotline; and regular meetings of the CCC. It also contributes to wider community needs through the Bloomfield Foundation and other programs. These programs and protocols would continue to be implemented throughout the life of the Project which would ensure that social amenity impacts are minimal and community benefit is maximised. No additional mitigation measures related to social and economic impacts would be required for the Project.

8.8 Other Matters

8.8.1 Aboriginal and Historic Heritage

Introduction

This section provides an assessment of the potential impacts of the Project on Aboriginal and historic heritage. Documents reviewed as part of the desktop assessment include the following:

- *Aboriginal Heritage Impact Assessment: Bloomfield Colliery Completion of Mining and Rehabilitation, Part 3A Environmental Assessment*, prepared by South East Archaeology, November 2008;
- *Bloomfield Colliery, Hunter Valley, New South Wales: Completion of Mining and Rehabilitation Project – Report on Salvage of Aboriginal Objects*, prepared by South East Archaeology, July 2012;
- *Bloomfield Colliery, Hunter Valley, New South Wales: Completion of Mining and Rehabilitation Project – Aboriginal Heritage Impact Assessment – Addendum Report on Assessment of Additional Area*, prepared by South East Archaeology, September 2012;
- *Bloomfield Colliery, Hunter Valley, New South Wales – Report on Salvage of Artefacts Identified During Aboriginal Monitoring*, prepared by South East Archaeology, April 2014; and
- *Bloomfield Colliery, Hunter Valley, New South Wales – Report on Salvage of Artefacts Identified During Aboriginal Monitoring*, prepared by South East Archaeology, February 2016.

In addition, searches of the following databases were undertaken on 13 July 2017 to identify previously recorded heritage items in proximity to the Project area:

- Aboriginal heritage:
  - Aboriginal Heritage Information Management System (AHIMS) (OEH, 2017);
- Historic Heritage:
  - State Heritage Register;
  - Cessnock LEP 2011;
  - Maitland LEP 2011; and
  - National Heritage List.

Copies of the searches results are provided in **Appendix I.**

Existing Environment

Aboriginal Heritage

A search of the AHIMS database was undertaken on 13 July 2017[3] and identified 15 previously recorded Aboriginal heritage sites in the vicinity of the Project Area (refer **Appendix I**).

The Aboriginal Heritage Impact Assessment undertaken for the previous 2008 EA included a review of the archaeological background of the Project area, searches of relevant heritage databases, and field survey of the Project Area. This included a comprehensive program of consultation with the local Aboriginal community, including the Mindaribba LALC, the Lower Hunter Wonnarua Council and the Awabakal Traditional Owners Aboriginal Corporation.

A predictive model was constructed to identify areas of high archaeological potential, in which the Project area was divided into 'modified' and 'unmodified' areas based on past and existing land use. 'Modified' areas included land that had been extensively impacted by past mining activities, earthmoving works or building, such that there was negligible potential for Aboriginal heritage items to survive. 'Unmodified' areas included land yet to be mined (immediately west of the S Cut and southwest of the Creek Cut) in which there remained some potential for heritage evidence.

[3] The AHIMS search remains valid for twelve months

The field surveys identified a total of six Aboriginal heritage sites (referred to as B2, B16, B18, B19, B20 and B22), comprising 19 loci of identified evidence within the 'unmodified' area. These were all stone artefact occurrences, containing 53 lithic items in a very low density distribution. These sites were assessed as being of low scientific significance within a local context.

Project Approval (MP 07_0087) was granted for the Project on 3 September 2009. An ACHMP was subsequently prepared in accordance with the Project Approval conditions of consent. The ACHMP was prepared in consultation with the OEH and was approved by the DP&E on 27 May 2010.

Archaeological salvage of the six Aboriginal heritage sites identified during the field surveys was undertaken by South East Archaeology in 2010 in accordance with the ACHMP. Representatives from Mindaribba LALC participated and monitored the process, which included surface collection of all visible artefacts and documentation of artefacts collected. In all, 79 artefacts were salvaged and are being stored at the Colliery.

Several other heritage investigations have since been conducted at the Colliery, including archaeological monitoring during the stripping of vegetation and topsoil in preparation for mining activities. In 2014, representatives of the Mindaribba LALC monitored the initial vegetation and topsoil removal from within a 3.8 hectare area of previously undisturbed land. Six stone artefacts were identified and were recorded, assessed and collected by South East Archaeology and Mindaribba LALC. The salvaged artefacts are being stored at the Colliery.

In 2014 an additional 3.8 hectares was stripped of topsoil in preparation for mining activities. In accordance with the approved ACHMP Bloomfield engaged an archaeologist and the Mindaribba LALC to monitor the ground disturbance works and salvage identified artefacts. A further six stone artefacts were salvaged and are being stored at Bloomfield Colliery.

In 2016 an additional three hectares was cleared of vegetation and stripped of topsoil in preparation for mining activities. Representatives of the Mindaribba LALC and South East Archaeology monitored the ground disturbance works and one additional artefact was identified. The stone artefact was recorded, assessed and collected in accordance with the ACHMP and is being stored at Bloomfield Colliery.

Historic Heritage

Historical records indicate that there has been a long period (approximately 180 years) of non-Aboriginal use of the Project area, including for timber harvesting, coal extraction and pastoral use. During this time, mining has occurred on the site using both underground and open cut methods.

A search of relevant heritage databases was undertaken on 13 July 2017. There are three listed heritage items in the vicinity of the Project Area (refer **Figure 26**):

- Buttai No. 1 Reservoir (Lot 1, Buttai Road);
- Buttai No. 2 Reservoir (Lot 1, Buttai Road); and
- Buttai Cemetery / Elliot Family Graves (659 John Renshaw Drive).

The Buttai Reservoir No. 1 and No. 2 are listed on the Hunter Water Corporation Section 170 Register and are located approximately 330m from the Project Area at its nearest point and approximately 1km north of proposed extraction areas. Buttai Reservoir No. 1 is the oldest operating reservoir within the Hunter Water system and was constructed as an intermediate water storage for the original water supply scheme which pumped water from the Hunter River into Newcastle. Buttai Reservoir No. 2 was part of the 1920s expansion to the Walka system and was built adjoining Reservoir No. 1. The Reservoirs continue to function within the modern water supply system.

The Buttai Cemetery is listed on the Cessnock LEP 2011 as locally significant and is located on Bloomfield owned land adjacent to the Project Area to the south. The cemetery contains a range of monuments dating from 1874 to 1976, documenting the history of the Elliot family.

Impact Assessment

Aboriginal Heritage

The Project would have no additional impact on Aboriginal heritage sites as mining would be undertaken within the existing approved extraction area. The previous Aboriginal Heritage Impact Assessment concluded that potential impacts of the mining operations on Aboriginal heritage would be low.

Mining operations are currently undertaken in accordance with the approved ACHMP prepared for the site, which documents the procedures for archaeological survey, collection, documentation and storage of Aboriginal heritage items in consultation with Aboriginal groups and regulatory authorities. The approved ACHMP would continue to be implemented for the management of Aboriginal cultural heritage within the Project area.

Historic Heritage

Given the historical use of the site for underground and open cut mining, various relics may be on the site in the form of buried disused equipment or other infrastructure. However as noted in the previous 2008 EA, the requirement to obtain an excavation permit under the *Heritage Act 1977* does not apply to transitional Part 3A projects assessed under the former Part 3A (repealed) provisions of the EP&A Act.

The 2008 EA did not identify any heritage listed items in the vicinity of the Project Area, however there are three heritage items on or adjacent to the Project Area that are now listed on the Cessnock LEP or on the Hunter Water Corporation s.170 Register. This EA therefore includes consideration of the potential impact to these items as a result of the Project.

The Buttai Reservoir No. 1 and No. 2 are located over 1km from the proposed extraction areas. Given the distance of these items from active mining pits, the Project would not result in direct impact to these items.

The Buttai Cemetery is on land owned by Bloomfield and is immediately adjacent to the Project Area, south of the active open cut pit S-Cut (South) (**Figure 26**). General mining activities, such as the operation of large vehicles and blasting activities, in particular the associated ground vibrations, have the potential to impact the structural integrity of heritage sites, such as the Buttai Cemetery.

Blasting activities are undertaken in accordance with EPL 396 conditions and requirements, which includes the following criteria:

- The airblast overpressure level from blasting must not exceed 115 dB (Lin peak) for more than 5% of the total number of blasts each year, and must not exceed 120dB (Lin peak) at any time, at the relevant blast monitoring points; and
- The ground vibration peak particle velocity from blasting operations must not exceed 5 mm/second for more than 5% of the total number of blasts each year, and must not exceed 10 mm/second at any time, at the relevant blast monitoring points.

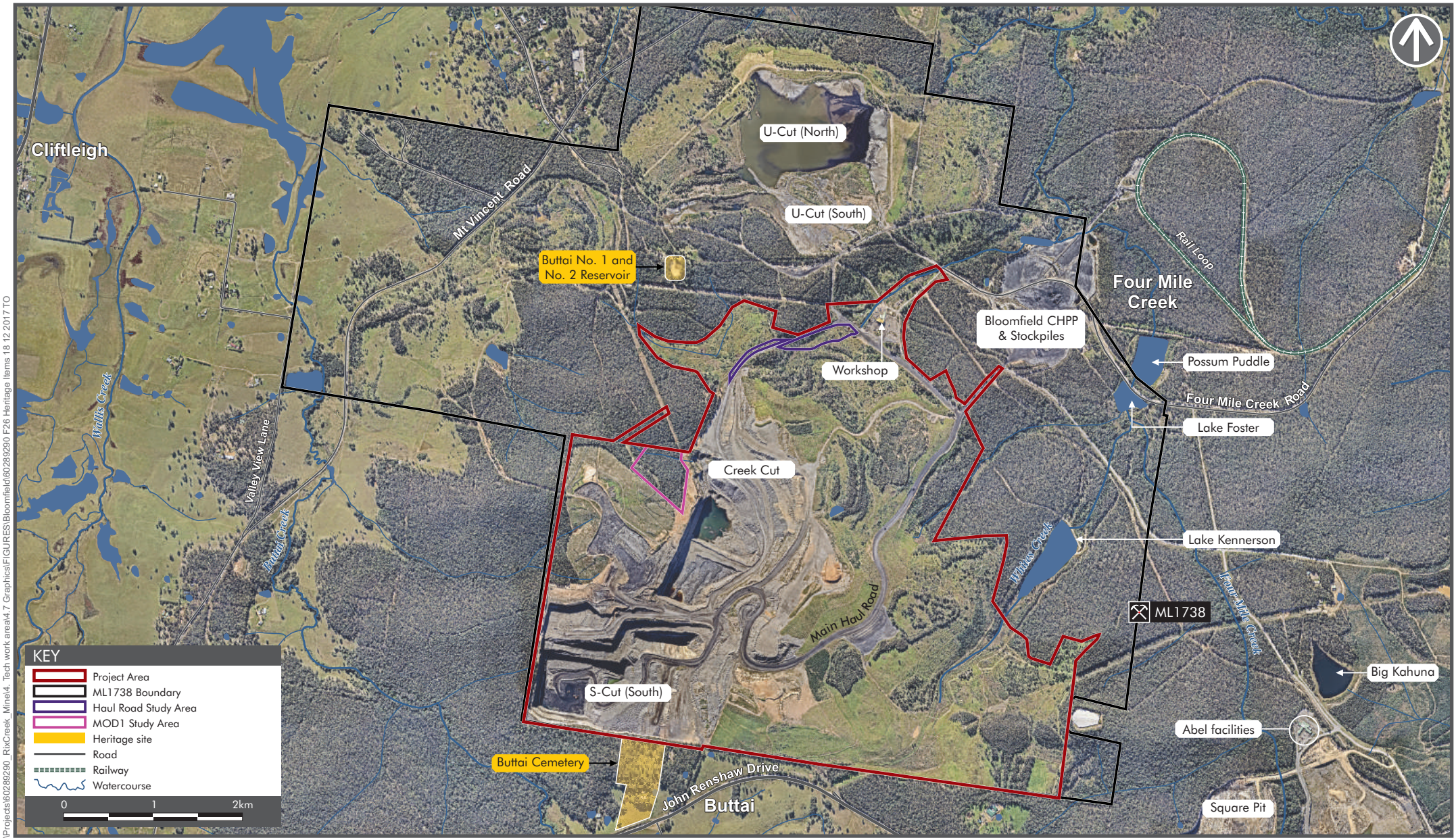
A blast monitoring plan is implemented at the site and blast monitoring is undertaken at four nearby residences for ground vibration and overpressure. The nearest blast monitoring point to the Buttai Cemetery is monitoring point N (refer **Figure 19**), which is located south of the John Renshaw Drive. Review of Bloomfield's AEMRs for the previous five years (2012 – 2016) indicates that blasting results at monitoring point N complied with the EPL criteria.

The 2008 EA included an assessment of potential blasting impacts and concluded that the predicted airblast and ground vibration levels would meet the relevant blasting criteria at all residences surrounding the development during all operational stages of the Project. Monitoring results reported in Bloomfield's AEMRs demonstrate that mean and median ground vibration and overpressure are at or below the levels predicted in the 2008 EA.

It is noted that the most vibration-intensive activities south of the Project area have already occurred, and potential vibration impacts to the Buttai Cemetery would become less likely to occur as mining progresses further north.

Mitigation Measures

Existing management measures would adequately manage potential impacts to Aboriginal heritage items. Mining operations would continue to be undertaken in accordance with the approved ACHMP and relevant legislative requirements. Bloomfield would continue to consult with the Aboriginal community groups and regulatory authorities as per the procedures set out the ACHMP. Blast monitoring would continue to be conducted to confirm that airblast and ground vibration levels meet relevant blasting criteria. The existing EMS and relevant management plans would be updated to incorporate the Project.



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AECOM

HERITAGE ITEMS
Bloomfield Project

FIGURE 26

8.8.2 Hazard and Risk

Existing Environment

Potential hazards and risks associated with operation of the existing Colliery include the storage of hazardous goods, hydrocarbon contamination, bushfire, spontaneous combustion and mine subsidence.

Storage of Hazardous Goods

Bloomfield has submitted a dangerous goods notification to SafeWork NSW (formerly known as WorkCover NSW) and holds a licence to store and handle explosives in accordance with Work Health and Safety (WHS) legislation for substances stored on site. The notification covers depots for explosives, distillate, gas cylinder stores, sodium hydroxide and methyl isobutyl carbinol (MIBC) reagent.

Explosives are stored in an explosive magazine located on site. The magazine complies with the relevant standards for storage of explosives. Bulk materials are also stored on site in a hopper for loading into a mobile mixing unit. This area is enclosed within concrete bunding and spillages are directed into a collection tank for periodic evacuation by a licensed contractor.

A bunded fuel farm, designed in accordance with Australian Standard *AS 1940: 2004 The storage and handling of flammable and combustible liquids*, is used for bulk distillate storage at the open cut workshop. Spill protected racks are used for small volume oil and lubricant storage. Distillate, MIBC and sodium hydroxide used for coal processing in the CHPP are stored in tanks contained in bunded enclosures.

ChemAlert is an online Material Safety Data Sheet (MSDS) database service and is used to provide current MSDS information. If new chemicals are introduced to site, they must comply with system requirements and be approved by the Mine Manager.

Hydrocarbon Contamination

There are no areas of hydrocarbon contamination previously identified within the Colliery mining lease area. Existing management practices therefore focus on prevention of contamination. Bulk hydrocarbon storages are located within bunded areas with a volume capable of containing greater than 110 per cent of the largest storage tank.

All machinery is fitted with quick fill mechanisms. The inlets and outlets, at the refuelling bay and mobile tanker are positively closed with an automatic cut off when full. This refuelling method is quick and minimises any potential for spillage during the refuelling operation.

Hydrocarbon storage infrastructure at the CHPP and open cut is inspected regularly and documented maintenance check sheets are completed quarterly. A dedicated contaminated soil land farming area is established on-site to treat hydrocarbon contaminated soils due to accidental spills.

Bushfire

A Bushfire Management Plan for Bloomfield Colliery was prepared in consultation with representatives of the NSW Rural Fire Service (RFS). The plan divides the site into 44 fire management sectors, describes fire risk levels across the site, and outlines site features relevant to fire management such as vegetation type, access trail locations, asset locations, and water supplies. Periodic inspections are undertaken in conjunction with the RFS to identify areas requiring bushfire control measures.

Weather conditions permitting, hazard reduction burns are conducted periodically by the RFS. Selection of burn location is based on risk levels, as determined by fuel load assessment and location of assets/asset protection zones. Hazard reduction clearing/slashing is also undertaken by Bloomfield along fire trails, asset protection zones and the mine boundary, in consultation with the RFS.

Spontaneous Combustion

Historically, the Colliery site does not have a problem with spontaneous combustion. Routine mine inspections include monitoring for spontaneous combustion. As reported in the last three AEMRs submitted by Bloomfield, no major spontaneous combustion incidences were recorded, with only a small area of spontaneous combustion identified in an overburden dump. Management practices include capping with clay to seal off the available air supply.

Mine Subsidence

Areas of the Bloomfield mining site (CCL 761 and ML 1738) are undermined by historic underground workings, some relatively shallow. Sink holes associated with shallow workings are infrequent, but have previously been identified. In the event that sink holes are identified, the standard management procedure is to flag off and isolate the sink hole from access, back fill the holes and monitor for further subsidence. Once deemed stable, the area is rehabilitated and period inspections are undertaken.

Impact Assessment and Mitigation

The Project is not seeking changes to the intensity or general extent of mining, and does not involve changes in the mining equipment fleet or mining method compared to existing operations. Therefore the Project is not expected to pose additional hazards and risks above those associated with the existing operation of the Colliery. These aspects would continue to be managed through implementation of the existing mine management framework.

The hazardous goods required for the Project would be the same as those currently required for the Colliery operations, and the storage of hazardous goods would continue to be managed under the existing management procedures.

The Project would not result in increased risk of bushfire. As the mine plan progresses and final landform levels are reached, rehabilitation would result in the progressive increase in vegetation. Initially this would comprise grasslands with those areas marked for greater vegetation coverage progressively rehabilitated. Revegetation and existing grassland areas would be subjected to ongoing management (e.g. cattle grazing or slashing) to minimise fuel levels. The Colliery would also continue to undertake hazard reduction burns in accordance with existing procedures and in consultation with the RFS to manage fuels load.

The Project would not result in an increased risk of contamination as a result of fuel or hydrocarbon spills. The potential impacts of contamination to the receiving environment would be mitigated through the continued implementation of existing plant maintenance schedules, management systems and protocols. Incidents and emergencies would continue to be managed in accordance with the Bloomfield Incident Management System, the Bloomfield Mining Operations Incident Notification Procedure and the relevant Hazard Management System.

Given the historically low potential for spontaneous combustion at the Colliery, the ongoing mining within the same coal seams is not likely to increase the potential for spontaneous combustion within spoil material in emplacement areas. Monitoring for spontaneous combustion would continue to be undertaken as part of routine mine inspections.

Mining activities proposed as part of the Project would be within the existing approved extraction area, and the mine plan has been developed with consideration of previous underground workings. Existing procedures for monitoring, remediation and rehabilitation of subsidence would continue to be implemented where required.

8.8.3 Waste

Existing Environment

Wastes generated at the Colliery are classified and separated in accordance with the EPA's Waste Classification Guidelines (EPA, 2014) and managed in accordance with Bloomfield's Waste Management System. Waste volumes generated in 2015 and 2016 at the Colliery are provided in **Table 27**, as reported in the respective AEMRs for the Colliery (Bloomfield, 2015; 2016).

Table 27 Waste Volumes Generated

Waste Stream	2015	2016
ROM coal produced	1,220,000	1,245,000
Waste rock (bank cubic metre)	5,912,000	5,918,000
Processing waste (tonnes)	477,000	498,000
Waste oil (litres)	74,000	81,000
Waste oil filters (tonnes)	4	3
Waste metal (tonnes)	210	254
General waste (tonnes)	45	41
Waste paper and cardboard (tonnes)	10	9

Waste oil filter, general waste, paper and cardboard and paint waste are collected by licensed contractor for disposal. Wastes are recycled where possible.

Waste oil from scheduled maintenance of mining equipment and the workshop oil separator is collected in a storage tank and periodically evacuated for reprocessing and re-use by a licensed waste oil contractor. The waste contractor re-synthesises the waste oil to a fuel oil product for re-use in ammonium nitrate – fuel oil (ANFO) explosive for blasting operations.

Bloomfield has a well implemented scrap metal recycling program, and has a high rate of onsite re-use of suitable steel. If no longer suitable for re-use, scrap metal is collected in designated skips and sold for recycling.

As there is no recycling process available for heavy earthmoving machinery types, waste tyres are used on site wherever possible for the protection of the base of concrete plinths and metal columns located in areas where heavy vehicles are operated. Surplus tyres are disposed of progressively in the open cut void, then backfilled with overburden and rehabilitated in accordance with rehabilitation procedures.

Waste generated on site, consisting of domestic waste from bathhouses, administration offices and associated amenity areas, passes through a Cessnock City Council approved anaerobic waste water treatment system.

The management and disposal of process waste from the CHPP, which includes reject material and fine tailings, is approved under the Abel Project Approval and therefore does not form part of this Project.

Impact Assessment and Mitigation

The Project does not involve an increase in production levels at the Colliery and therefore are not expected to increase the wastes generated. Typical waste volumes generated by the Project would be similar to existing levels as shown in **Table 27**. Waste management procedures currently implemented at the Colliery are considered to be sufficient to manage potential waste impacts associated with the Project and as such additional waste mitigation measures would not be required.

Waste Resource Exemptions

As advised by the EPA, Bloomfield must take into consideration the disposal of mine wastes, including tailings and course rejects, pursuant to any relevant resource recovery order and exemption. Two exemption orders have been identified as potentially applicable to the Mine, being:

- The coal washery rejects order and exemption; and
- The coal washery rejects (coal mine void) order and exemption.

Process waste from the CHPP, including coarse rejects and tailings emplacement, is managed under the conditions of EPL 396. As the process waste from the CHPP would remain within the same EPL premises, these exemptions are not applicable to the Project. Current waste management practices would continue to be implemented for the Project.

8.8.4 Traffic and Transport

Existing Environment

The Colliery is located north of John Renshaw Drive, east of Buchanan Road, and west of the New England Highway. The nearest public road to the Project area is the John Renshaw Drive, which provides a critical connection between the M1 Pacific Motorway, the Hunter Expressway and the New England Highway.

Access to the Colliery is via Four Mile Creek Road off the New England Highway. A secondary access point is available via Buttai Road, however this is not used as a daily access point and is restricted with a locked gate.

There are a number of internal mine roads within the Project area which provide access to active mining areas and link major infrastructure components of the Colliery (e.g. the workshop, CHPP and ROM coal stockpile).

Saleable coal is transported via rail to the Port of Newcastle for export. Operation of the rail loading facility is approved under the Abel Project Approval and does not form part of this Project.

Potential Impacts

The Project would not result in an increase in traffic movements or transportation of materials. The Project would utilise the existing workforce and there would be no increase in traffic movements associated with site personnel. Transport of materials within the Project area would remain consistent with existing approved operations. As such, additional traffic mitigation measures would not be required.

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9.0 Cumulative Impacts Summary

Cumulative impacts result from the aggregation and interaction of impacts on a receptor and may be the product of past, present or future activities (Franks, et al. 2010). There are two separate levels of cumulative impacts considered:

- Localised cumulative impacts of the Project on the Project area. This includes the interaction of Project impacts that in combination can cause increased effects on the environment or sensitive receptors; and
- Regional interaction with other mining developments in the area. This includes the contribution of the Project to other impacts occurring at a regional scale.

Specific consideration of cumulative impacts of the Project has been incorporated into the impact assessment for the following environmental aspects;

- Air quality (**Section 8.3**);
- Noise, vibration and blasting (**Section 8.2**); and
- Water resources, including groundwater (**Section 8.5**) and surface water (**Section 8.4**).

The impact assessments for these environmental aspects concluded that the cumulative impacts of the Project would be unlikely to represent a significant impact. While there is some potential for cumulative impacts to occur, the use of reactive and predictive mitigation systems would reduce the likelihood of these impacts occurring. For example, predictive meteorological modelling software can be used to identify weather conditions that may exacerbate dust impacts from planned operations, and therefore operational procedures can be amended to prevent these impacts from occurring.

The interaction between Abel Underground Mine operations has also been incorporated into the assessment of potential impacts. While Abel Underground Mine is currently in care and maintenance, this EA has assessed the potential impacts of the Project with the operation impacts from the Abel Underground Mine included. This has provided a conservative estimate of potential impacts and incorporates the potential for Abel Underground Mine to resume operations in the future.

9.1 Conclusion

As the impact of the individual factors of the Project are minimal, no significant cumulative impact is anticipated for the Project provided the measures presented in **Section 10.2** are implemented. The cumulative impact of the Project with other known projects currently operating or proposed for the area as described above, is also considered to be minimal.

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10.0 Statement of Commitments

10.1 Environmental Management and Monitoring Program

10.1.1 Operation Environment Management System

The Mine currently operates under the EMS discussed in **Section 4.2.11**. Management plans that form the basis of the EMS have been developed to identify, analyse, evaluate and manage all significant potential and actual risks and impacts of activities and operations on the environment and the community. The EMS would continue to be adopted during the Project and would be updated and augmented where required to incorporate additional environmental management requirements.

10.2 Mitigation Measures

Management and mitigation measures outlined in this section would be implemented throughout the detailed planning, construction and operational phases of the Project, should it proceed. These safeguards would minimise any potential adverse impacts arising from the Project on the surrounding environment. The management and mitigation measures recommended for the Project are summarised in **Table 28**.

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Table 28 Summary of management and mitigation measures

Ref#	Management and Mitigation Measures	Timing
Biodiversity		
1	**Existing measures** The Colliery has established clearing practices in place as part of its EMS. These include minimisation of disturbance areas, pre-clearance surveys, salvaging and reusing material on site for habitat enhancement, conserving and reusing topsoils and weed management. These clearing practices would continue to be implemented for the Project in accordance with the approved EMS.	Duration of the Project
2	**Pre-clearance surveys** Pre-clearance surveys of the forest to be removed would be conducted within 24 hours prior to commencement of clearing to identify any fauna species or habitat within areas of impact. Where clearing of vegetation and fauna habitat occurs, clearing protocols would be put in place, including checking trees for the presence of arboreal fauna prior to felling. Where feasible, animals found to be occupying trees would be safely relocated into nearby forest that would not be disturbed. Where feasible, transportable habitat features such as large logs and boulders would be placed in adjacent retained areas or in areas ready for seeding, to allow their continuation as potential fauna refuge sites.	Prior to clearing activities
3	**Regent Honeyeater and Swift Parrot** In addition to these general fauna pre-clearance methods, the following measures would be implemented to mitigate potential impacts on habitat for the Regent Honeyeater and Swift Parrot: · A qualified ecologist would undertake a targeted pre-clearance survey within 24 hours prior to the commencement of removal of potential foraging habitat for the Regent Honeyeater and Swift Parrot (potential foraging habitat includes the entire 6.12 ha study area); · Pre-clearance surveys would be undertaken over a period of two days and surveys would be undertaken in the morning (i.e. within 3 hours of sunrise) to target the species highest activity period. Dependent on the clearing schedule, the survey effort would comprise: - 20 minute searches in areas up to 5 ha; or - 40 minute searches in areas of 6 – 30 ha. · If Regent Honeyeaters or Swift Parrots **are not found** within the clearance area, then searches for Regent Honeyeater or Swift Parrot habitat trees (foraging trees) are not required; · If Regent Honeyeaters or Swift Parrots **are found** within the clearance area, targeted searches for Regent Honeyeater or Swift Parrot habitat trees would be undertaken by a qualified ecologist; · If habitat trees are found within the clearance area, a qualified ecologist would mark the trees with flagging tape and spray paint (e.g. with a 'H', denoting habitat tree); · The two stage clearance protocol for habitat trees comprises: - Stage 1: Non-habitat trees would be cleared 24 hours prior to any habitat trees being cleared, to encourage	Prior to and during clearing activities

Ref#	Management and Mitigation Measures	Timing
	Swift Parrots to move out of the habitat area; and - Stage 2: When Stage 1 is complete, habitat trees can be removed.	
4	**Weed control, microhabitat retention and demarcation** Other management strategies would include: · Appropriate weed controls to avoid incursion of exotic weed species into the remaining surrounding forest; · Salvaging microhabitat features, such as woody debris and logs, within adjacent suitable habitat, where possible to mitigate potential impacts to ground-swelling fauna; and · Habitat adjacent to the proposed clearing would be demarcated to avoid accidental clearing. Vegetation clearing would be minimised and avoided where possible. Where opportunities for reduction in clearing extents occur, these would be implemented and micro-habitat features retained.	Duration of the Project
5	**Construction of Haul Road Upgrade** Additional mitigation measures to be implemented during construction of the haul road upgrade would include: · Appropriate exclusion fencing would be installed around vegetation to be retained directly adjacent to the development footprint; - Appropriate signage such as 'No Go Zone' or 'Environmental Protection Area' would be installed; - The location of any 'No Go Zone' would be identified in site inductions; - Fencing would be secured with star pickets and would use high visibility bunting; · All material stockpiles, vehicle parking and machinery storage would be located within cleared areas or areas proposed for clearing, and not in areas of retained native vegetation; · A licenced wildlife salvage team would be on-site during vegetation removal to catch and relocate (if appropriate) wildlife encountered; · Where appropriate, native vegetation cleared from the development site would be mulched for reuse on the site, to stabilise bare ground; · Temporary stormwater controls would be implemented during construction to ensure that discharges to the drainage channels are consistent with existing conditions; and · Sediment and erosion control measures would be implemented prior to construction works commencing (e.g. silt fences, sediment traps), to protect drainage channels. These would conform to relevant guidelines, would be maintained throughout the construction period and would be carefully removed following the completion of works.	During haul road upgrade works
6	**Biodiversity Offset Strategy** Ten ecosystem credits would be required to offset the impacts arising from the Project, and Bloomfield would pay the required offsetting cost (currently estimated to be $22,007.08 including GST) into the Biodiversity Conservation Trust.	Duration of the Project

Ref#	Management and Mitigation Measures	Timing
Noise		
7	Bloomfield would continue to implement noise and blasting management measures in accordance with the Noise Monitoring Plan and the Blasting Monitoring Program currently utilised at the Colliery to minimise the noise and vibration impacts to surrounding receivers. This includes scheduling of mining operations with regard to predicted weather conditions. During reduced night-time operations under prevailing weather conditions, potential noise impacts at Location M would be minimised by undertaking coal haulage via the alternate haul road (that is, Scenario 2). The Noise Monitoring Plan and Blasting Monitoring Program would continue to be implemented for the duration of the Project and would be updated to reflect the Project as required.	Duration of the Project
Air Quality		
8	Bloomfield would continue to implement air quality management measures currently used at the Colliery, including the predictive management system, to mitigate air quality emissions from its operations as discussed in **Section 8.3.3**. This includes a reactive dust mitigation strategy and forecast management system. Bloomfield would continue to monitor and report its GHG emissions in accordance with the ESAP and legislative requirements. The Air Quality Monitoring Program and Blast Monitoring Program would continue to be implemented for the duration of the Project. Existing management plans and procedures would be updated to reflect the Project as required.	Duration of the Project
Soils and Water		
9	**Mine Water Management** The existing Water Management Plan would be reviewed and revised to incorporate the Project and ensure that the management of soil and water continues to: · Stay current and consistent with relevant guidelines and best practice; · Account for projected changes in operation; and · Update water balance modelling and projections on the basis of observed results (i.e. variations in mine water make, groundwater monitoring). At such time that Abel returns to production, reconsideration of the water balance would be undertaken as part of the ongoing management plan review process. This would enable and support appropriate planning to ensure mine water and tailings would continue to be contained on site.	Duration of the Project
10	**Catchments** Rehabilitated catchments would continue to be managed as per the existing Water Management Plan and Rehabilitation Management Plan, in accordance with the following principles: · Rehabilitated landform would be progressively rehabilitated; · Runoff from areas undergoing rehabilitation would be managed with appropriately designed water and sediment management structures (contour banks, drains, and drop structures); and · Ongoing monitoring of the landform would be carried out to repair and restore areas of erosion or instability. Discharge of water from the final landform would not occur to Four Mile Creek or Buttai Creek and its tributaries until	Duration of the Project

Ref#	Management and Mitigation Measures	Timing
	the catchment is considered 'rehabilitated' in accordance with the Rehabilitation Monitoring Plan and associated regulator sign-off and approvals.	
11	**Surface Water Quality** Potential impacts to receiving waters would be mitigated through implementation of the mine water management system, which includes: · Runoff from undisturbed and rehabilitated areas would be directed away from operational areas and mine water storages via diversion banks and channels; and · Mine and sediment water would be collected for treatment before discharge via Lake Kennerson, Lake Foster and sediment basins to intercept runoff from disturbed areas. Surface water monitoring would continue to be undertaken in accordance with Bloomfield's EPL 396. The existing monitoring program would be periodically reviewed to ensure the program continues to be adequate and consistent with current guidelines and policy requirements.	Duration of the Project
12	**Erosion and Sediment Control** The erosion and sediment control plan would continue to be implemented to ensure that the discharge of all water from the site is managed and meets appropriate quality standards. Key elements of the erosion and sediment control plan include: · Coordination of mining to minimise exposure to disturbed soils; · Separation or diversion of clean water catchments from disturbed areas to minimise sediment laden and mine water volumes for management; · Collection and management of runoff sediment control devices; · Appropriate storage and handling of topsoil materials; · Revegetation of disturbed areas following site disturbance; and · A maintenance program for control structures.	Duration of the Project
Groundwater		
13	**Monitoring** Ongoing quarterly monitoring of the onsite piezometer network and monthly surface water monitoring would continue to be implemented to monitor the drawdown effects from depressurisation of the regional aquifer. The installation of additional monitoring points would be considered where areas of predicted drawdown are significantly different to that of actual drawdown. The frequency of water level measurements within the pit should be compatible with evaporation rates obtained from the site's weather station which will allow refinement of model calibration and inflow predictions.	Duration of the Project
14	**Management** Bloomfield has an existing Water Management Plan (WMP) which details the monitoring and management measures which are currently in place for the management of groundwater (and surface water) at the Colliery. The WMP would be reviewed and updated in accordance with the conditions of consent to monitor groundwater levels in monitoring	Duration of the Project

Ref#	Management and Mitigation Measures	Timing
	wells and in the pit. Groundwater discharge would be monitored to quantify pit inflows to ensure the discharge licence conditions are satisfied. The monitoring data collected from groundwater and surface water systems enables management of groundwater by: · Establishment of groundwater and surface water trigger levels based on the beneficial use of each water body; · Development of mitigation measures which may include the provision of 'make good' measures in bores where excessive drawdown may be experienced. This could involve deepening a water supply bore or providing an alternative water supply. No surface water mitigation measures are proposed due to the minimal predicted impacts; · Plotting of groundwater level data as hydrographs and comparing to rainfall; and · Collation of the results of the groundwater monitoring program on an annual basis and presenting in an annual report as required under the conditions of consent.	
Visual Impacts and Rehabilitation		
15	The Colliery has established rehabilitation and monitoring procedures as part of its RMP and MOP for the site. These rehabilitation methods would continue to be implemented for the duration of the Project. Geotechnical investigations would be conducted by qualified geotechnical specialists to guide the tailings emplacement strategy and capping requirements and management strategies recommended would be implemented for the Project. Existing management plans and procedures, including the RMP and MOP, would be updated to reflect the Project as required. Any changes to the final landform would be subject to discussion with the relevant agencies (including DRG).	Duration of the Project
Social and Economic		
16	Bloomfield currently undertakes a number of monitoring, management and mitigation activities in relation to identified community concerns, which include noise, blasting and air quality monitoring; rehabilitation of land to minimise visual impact; manning of a 24 hour community hotline; and regular meetings of the CCC. It also contributes to wider community needs through the Bloomfield Foundation and other programs. These programs and protocols would continue to be implemented throughout the life of the Project which would ensure that social amenity impacts are minimal and community benefit is maximised. No additional mitigation measures related to social and economic impacts would be required for the Project.	Duration of the Project
Aboriginal and Historic Heritage		
17	Existing management measures would adequately manage potential impacts to Aboriginal heritage items. Mining operations would continue to be undertaken in accordance with the approved ACHMP and relevant legislative requirements. Bloomfield would continue to consult with the Aboriginal community groups and regulatory authorities as per the procedures set out the ACHMP. Blast monitoring would continue to be conducted to confirm that airblast and ground vibration levels meet relevant blasting criteria. The existing EMS and relevant management plans would be updated to incorporate the Project.	Duration of the Project

Ref#	Management and Mitigation Measures	Timing
Hazard and Risk		
18	Hazards and risks would continue to be managed through implementation of the existing mine management framework: · The storage of hazardous goods would continue to be managed under the existing management procedures. · The Colliery would continue to undertake hazard reduction burns in accordance with existing procedures and in consultation with the RFS to manage fuels load. · The potential impacts of contamination to the receiving environment would be mitigated through the continued implementation of existing plant maintenance schedules, management systems and protocols. · Incidents and emergencies would continue to be managed in accordance with the Bloomfield Incident Management System, the Bloomfield Mining Operations Incident Notification Procedure and the relevant Hazard Management System. · Monitoring for spontaneous combustion would continue to be undertaken as part of routine mine inspections. · Existing procedures for monitoring, remediation and rehabilitation of subsidence would continue to be implemented where required.	Duration of the Project
Waste		
19	Current waste management practices would continue to be implemented for the Project.	Duration of the Project

11.0 Justification for Approval

11.1 Introduction

11.2 Biophysical, Economic and Social Considerations

Pursuant to Schedule 2, Clause 7(f) of the EP&A Regulation, the Project is justified in terms of biophysical, economic and social considerations as described below.

11.2.1 Biophysical

An assessment of the potential biophysical impacts of the Project has been undertaken as provided in **Section 8.0** of this EA. Assessment of potential biodiversity impact has demonstrated that the Colliery site is void of significant threatened biodiversity and the Project is unlikely to result in impacts to any listed species populations or communities. Assessment of potential surface and groundwater impacts identified that potential impacts would be minor and easily managed in accordance with current and proposed management practices.

11.2.2 Economic

The economic assessment addressed the potential impact, both positive and negative that the Project may have on a local, regional, State and national scale. This assessment concluded that the economic benefits far outweigh any potential negative economic benefits. The Project would support the ongoing employment of the mine existing workforce.

11.2.3 Social

The existing Colliery has a well-established relationship with the local community and surrounding areas. As the Colliery has been operating since the 1960s, its ongoing operation into the future does not represent a significant new disruption to the local community or the wider Hunter Region. The Project would have negligible impact on social aspects such as employment opportunities, housing, the provision of social services or impacts to social infrastructure. In fact, the Colliery would support the community through Bloomfield's ongoing support of various community, environmental and education groups, and the Bloomfield Foundation. Community participation regarding the Colliery is provided through the CCC, which would continue to be provided throughout the Project.

11.3 Ecologically Sustainable Development

Schedule 2 of the EP&A Regulation establishes four primary principles of ecologically sustainable development (ESD): the precautionary principle; intergenerational equity; biological diversity and ecological integrity; and valuation and pricing of environmental resources. The application of these principles to the assessment of the Project is discussed below.

11.3.1 Precautionary Principal

The Precautionary Principle, in summary, holds that where there are threats of serious or irreversible environmental damage, the lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

A precautionary and conservative approach to development of the MOP has been employed to avoid or minimise potential impacts to the environment and community, including the following:

- Identifying sensitive environmental and manmade (John Renshaw Drive) features of the Project area and avoiding impacts to these features where possible and otherwise implementing measures to minimise unavoidable impacts; and
- Implementing predictive noise and air quality models to identify potential impacts ahead of time allowing operations to be modified and impacts avoided where possible.

A detailed understanding of the issues and potential impacts associated with the Project has been obtained through consultation and assessment to a level commensurate with the scale of the Project, industry standards, the level of environmental risk and the legislative framework under which the

Project is permitted. Specialist assessments, including the use of engineering and scientific modelling, have previously been undertaken to aid the design of the mine and for impacts relating to, air quality, noise and vibration, ecology, groundwater, surface water, biodiversity, Aboriginal heritage, European heritage, traffic, and visual to be understood. Assessment has also been undertaken for other issues, including social, economic, waste, hazards, and rehabilitation. To this end, there has been careful and thorough evaluation undertaken in order to recognise the potential for and then avoid where possible, serious or irreversible damage to the environment.

11.3.2 Intergenerational Equity

Intergenerational Equity is centred on the concept that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations. There is a moral obligation to ensure that today's economic progress, which would benefit both current and future generations, is not offset by environmental deterioration.

The primary objective of the Project is to allow continued operation of mining and maintain the continuity of coal production from existing and proposed mining areas, optimising resource recovery for the life of mining in an environmentally and socially responsible manner. The engagement of suitably qualified and experienced consultants has ensured that the planning, design and environmental assessment phases of the Project have been transparent. The contents of this EA (including appendices) has enabled the potential implications of the Project to be understood, and Bloomfield has committed to management strategies, mitigation measures and monitoring activities to ensure potential impacts are appropriately minimised.

11.3.3 Biological Diversity and Ecological Integrity

The principle of Conservation of Biological Diversity and Ecological Integrity should be a fundamental consideration for development proposals. The potential environmental impacts of the Project, including upon ecological communities and habitat values, and measures to ameliorate these potential impacts are described within this EA.

The Project has initially aimed to avoid and minimise potential impacts on ecological values during mine planning. A detailed ecological assessment undertaken for the Project in combination with the body of ecological knowledge obtained during the operation of the Colliery over the previous 25 years was used to provide a high level of certainty regarding the ecological constraints of the Project area. The ecological assessment concluded that the Project is unlikely to have a significant impact on any listed species, population or ecological community. Further to provide for the ongoing sustainability of regional ecology, impacts to native vegetation would be compensated for through the acquisition of offset areas as well as through the rehabilitation of native vegetation at appropriate locations within the Project areas.

11.3.4 Improved Valuation and Pricing of Environmental Resources

The principle of Improved Valuation and Pricing of Environmental Resources is based on environmental factors being included in the valuation of assets and services. The cost associated with using or impacting upon an environmental resource is seen as a cost incurred to utilise that resource.

As the Project seeks approval for the continuation of an existing mining operation with established mining infrastructure, no significant draw on resources is required to enable the Project to proceed. Therefore there would be negligible impacts to the price and value of resources as a result of the Project proceeding.

In order to mitigate the potential impacts of the Project, Bloomfield acknowledges and accepts the financial costs associated with all the measures required to avoid, minimise, mitigate and manage potential environmental and social impacts for the Project. For example, the cost of rehabilitation activities undertaken to minimise impacts to land resources following the completion of mining.

11.3.5 Climate Change and Greenhouse Effect

The Colliery would be operated in accordance with an ESAP that would drive a reduction in energy use in operations over time. With efficiency measures in place, the Colliery would be operated in a manner that reduces GHG production to the extent possible.

12.0 Conclusion

The Project seeks to extend the life of the existing Bloomfield open cut mining operation until 31 December 2030. The Project would allow the Colliery to continue its open cut mining operations and use existing mine infrastructure to process up to 1.3Mtpa of ROM coal within existing approved extraction areas.

The 'do nothing' alternative is also deemed unacceptable as it would involve closure of the Colliery and the loss of 93 jobs and other employment opportunities. Closure of the Colliery would mean that a large portion of the 13 million tonnes of ROM coal identified within the approval area would remain undeveloped and the potential economic benefits would not be realised for the community or local economy. The Project is considered to present the best balance for the community and environment as opposed to any alternative as it would utilise existing infrastructure for continued extraction of a valuable resource, provide continued employment for an additional nine years for the existing 93 personnel, support the local economy through indirect employment, servicing of contracts, and community engagements and sponsorship.

This EA has assessed the potential impacts of the Project in accordance with the EARs for the Project (issued on 16 November 2015 and subsequently revised on 22 March 2017). All relevant regulatory requirements and the findings from the consultation program undertaken for the Project have also been considered in its preparation.

The Project as designed, after considering all options, would maximise the continued social and economic benefits from the extraction of this coal resource. At the same time it would minimise any impacts to the natural environment. This EIS has assessed the Project against the requirements of the EP&A Act and the principles of ESD. This assessment has concluded that the Project is consistent with the objective of the Act and principles of ESD.

A range of positive benefits associated with the development have also been identified including the economic benefits to the local, regional and State economies including ongoing employment for the established workforce, royalties and benefits to local and regional governments and flow on spending within the local and regional communities. Specifically the Project would:

- Utilise existing mine infrastructure to continue resource extraction within an established operation;
- Provide continued employment for 93 existing site personnel;
- Contribute to the local and regional economy through ongoing contracts to a range of longstanding suppliers and contractors, servicing of existing customer contracts and payment of royalties and taxes;
- Facilitate increased spending in other sectors, stimulating the demand for goods and services; and
- Provide other social benefits which flow from community engagement and sponsorships programs.

The benefits of the Project would outweigh its potential impacts, with the implementation of the proposed management, mitigation and offset measures, as recommended by this EA, in place. It is considered that it is appropriate and in the public interest to approve the Project.

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