UNITED WAMBO OPEN CUT COAL MINE PROJECT

September 2017

RESPONSE TO REQUEST FOR FURTHER INFORMATION

GLENCORE

Peabody ENERGY

umwelt

UNITED WAMBO OPEN CUT COAL MINE PROJECT

Response to Request for Further Information

FINAL

Prepared by
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on behalf of
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Table of Contents

1.0 Introduction 1

2.0 Responses 2

2.1 Noise 2
2.2 Air Quality 5
2.3 Biodiversity 6
2.4 Water Resources 24
2.5 Heritage 28
2.6 Transport 30
2.7 Rehabilitation and Final Landform 31
2.8 Interaction with Coal and Allied Operations 53

3.0 Additional Commitments 54

4.0 References 56

Figures

Figure 2.1 Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act 20
Figure 2.2 Proposed Premises Plan 27
Figure 2.3 Conceptual Micro-relief Final Landform 51
Figure 2.4 Conceptual Ecological Mine Rehabilitation 52

Graphs

Graph 1 United final void water and salinity balance 38
Graph 2 Wambo final void water and salinity balance 38

Tables

Table 2.1 Community Consultation 4
Table 2.2 Stage 1 Offset Package to Meet Credit Requirement for Ecosystem and Species Credits 11
Table 2.3 Staged Credit Requirements 21
Table 2.4 Target PCTs for Mine Rehabilitation 23
Table 2.5 Estimated Volume and Evaporation at Pit Lake Equilibrium 25
Table 2.6 Final Void Options Considered 33
Table 2.7 Changes to Salinity Balance Modelling 36
Table 2.8 Final void salinity of other Hunter Valley mining operations 39
Table 2.9 Void options analysis 40
Table 2.10 Assessment of incremental LSC change due to the Project 47

Appendices

Appendix 1	Noise Compliance Assessment
Appendix 2	United Wambo Joint Venture Noise Assessment Methodology Agreement
Appendix 3	Updated Water Balance Results
Appendix 4	Updated Water Balance Results Peer Review

1.0 Introduction

Under a Joint Venture arrangement, United Collieries Pty Limited (United) and Wambo Coal Pty Limited (Wambo) propose to develop the United Wambo Open Cut Coal Mine Project (the Project) which will involve combining the existing open cut operations at Wambo with a proposed new open cut coal mine at United.

The Environmental Impact Statement (EIS) for the Project was placed on public exhibition from 11 August 2016 to 22 September 2016. A Response to Submissions (RTS) was prepared to address the issues raised in the submissions received during the public exhibition period.

Twelve agencies have responded to the RTS report. Of these, six had no further comments including:

- Australian Rail Track Corporation (ARTC)
- Health NSW
- NSW Rural Fire Service (RFS) – no further comment
- Singleton Council – no further comment, however, noted that other regulators would work through core environmental issues, the determination of the final land use and the extent to which the penultimate void is minimised
- Subsidence Advisory NSW
- Transport for NSW.

Six agencies made comment or raised issues for further consideration including:

- Department of Planning and Environment (DPE)
- Department of Primary Industries (DPI)
- Division of Resources and Geoscience (DRG)
- Environment Protection Authority (EPA)
- Heritage Council
- Office of Environment and Heritage (OEH).

DPE summarised the key outstanding matters identified by agencies and requested additional necessary information. This document responds to the matters raised by DPE and the other agencies as directed by DPE.

2.0 Responses

2.1 Noise

Identification of a robust and enforceable method to monitor noise generated by the joint venture project and the separate Wambo underground, coal handling and processing plant and rail facilities; in a manner which allows straightforward and reliable allocation to one project or the other, for regulatory purposes.

Appendix 1 provides the proposed method to be used to monitor the noise generated by the Project (the open cut SSD Project) and the Wambo mine incorporating the CHPP, train loading facility and underground mine (including MOD 12) and reliably allocate noise between the two mining operations.

The proposed method has been designed to be simple to implement, to allow a compliance assessment to be made in a timely manner and to provide certainty for regulators and the community about compliance with noise criteria from both the Project and Wambo mine. The proposed method includes attended monitoring to determine if the Project and Wambo mine are complying with noise criteria, and sets out a process to determine which operation is responsible for any exceedances of noise limits. The process is clear and will allow any exceedances of noise limits to be identified and reported to government agencies.

United commits to utilising the methodology outlined in **Appendix 1** and will incorporate this into the Noise Management Plan for the Project allowing for the methodology to be refined and further improved over time, subject to agreement from DPE. The Wambo mine also commits to the proposed method and the process for allocation of responsibility for any noise exceedances between the two mining operations. A signed letter from United and Wambo is provided in **Appendix 2**.

United is also happy to further consult with the EPA on any improvements or refinements to the proposed noise monitoring and compliance methodology as outlined in **Appendix 1**.

Confirmation of individual noise contributions from Project and Wambo Underground.

A table of the noise contributions from the Project and Wambo mine at each of the surrounding sensitive receivers is provided in **Appendix 1**.

Update on consultation undertaken with nearby residents, particularly those which have been identified as being eligible for mitigation or acquisition rights as a result of the Project.

United, on behalf of the Joint Venture, has undertaken significant ongoing consultation with the community, including nearby residents. Three rounds of face-to-face meetings have been undertaken with nearby residents. The first round of meetings was held with nearby residents to introduce the Project and to identify perceived issues and opportunities relating to the Project, followed by ranking of perceived issues and opportunities relative to frequency of response.

Following the completion of the environmental assessments for the Project, a second round of meetings was held with nearby residents who were identified as being within the air quality and noise impact zones, and with other nearby residents that had indicated an interest in being consulted throughout the EIS process. At these meetings the landholders were provided with an information sheet that detailed the predicted impacts at their property, along with the proposed management and mitigation measures to be implemented by the Project.

Following EIS exhibition and receipt of submissions on the Project, a third round of meetings were undertaken with nearby residents who made a submission on the Project. These meeting focused on the issues identified through their submissions and the Project's proposed responses. A letter has also been provided to each nearby resident who made a submission providing a response to each of the issues that were raised. Additional meetings have been held as required with some residents.

Table 2.1 provides a summary of the consultation undertaken with each resident located with the Noise Affectation (acquisition) and Active Noise Management (noise mitigation) zones.

Table 2.1 Community Consultation

Residence ID	Eligibility	Meetings Held	Community Information Sessions Attended	Additional Comments
16	Acquisition	1	0	Residence has indicated that they are not interested in acquisition.
17	Acquisition	>3	3	Formal letters provided detailing predicted impacts and management, including acquisition rights.
19	Acquisition	1	0	Formal letters provided detailing predicted impacts and management, including acquisition rights.
28	Acquisition	NA	0	This property has been acquired by the Project.
39	Acquisition	>3	1	Formal letters provided detailing predicted impacts and management, including acquisition rights.
40	Acquisition	NA	0	This property has been acquired by the Project.
43	Acquisition	>3	2	Formal letters provided detailing predicted impacts and management, including acquisition rights.
3	Noise Mitigation	2	0	
25	Noise Mitigation	3	1	
26	Noise Mitigation	2	1	
29	Noise Mitigation	1 (with previous owner)	1 (current owner)	This residence was purchased by a new owner after the EIS was exhibited. The current resident attended the Community Information Night in May 2017 and was provided with information regarding impacts to their property.
30	Noise Mitigation	1	0	
33	Noise Mitigation	3	3	
41	Noise Mitigation	2	2	
42	Noise Mitigation	1	0	
48	Noise Mitigation	1	2	
49	Noise Mitigation	3	2	
50	Noise Mitigation	2	1	
75	Noise Mitigation	2	3	

Residence ID	Eligibility	Meetings Held	Community Information Sessions Attended	Additional Comments
163	Noise Mitigation	3 (1 meeting with current owner, 2 with previous owner)	3 (1 by current owner, 2 by previous owner)	This residence was purchased by a new owner after the EIS was exhibited.
320	Noise Mitigation	>3	3	
343	Noise Mitigation	2	0	
344	Noise Mitigation	3	3	
345	Noise Mitigation	1	2	
346	Noise Mitigation	1	1	
348	Noise Mitigation	1	0	

In addition to the residents in the Noise Affectation and Active Noise Management zones, a number of meetings have been held with other nearby residents. The Project has held a further 24 meetings with 14 other nearby residents over the course of the Project.

In addition to face-to-face meetings, the Project has also consulted through the following mechanisms:

- Five newsletters have been distributed to the local community. The newsletters have provided updates on the progress and assessment outcomes of the Project. Following exhibition of the EIS, a detailed newsletter was released summarising the predicted impacts and benefits to the local community. The most recent version contains details on the Response to Submissions.
- Three community information nights have been held in Jerrys Plains. These information nights have been well attended by the local community and have provided the community details on the Project and communication with the Project team to discuss any issues that they may have.
- The Project has been discussed at both the United Collieries and the Wambo Community Consultative Committee's meetings since the Project was announced. Prior to exhibition of the EIS, a combined meeting was held to discuss the outcomes and findings of the assessment.

In addition to responding to the issues raised in the Response to Submissions Report, United has also provided a letter to each nearby landholder that made a submission on the Project specifically responding to the points in their submission.

2.2 Air Quality

Diesel emissions management and mitigation.

The EPA has recommended that a condition of consent be made that new equipment commissioned by United complies with diesel emission standards by January 2019. This approach is consistent with a measure outlined in the EPA's *Consultation Draft Pollution Reduction Study: Best practice measures for diesel exhaust emissions at coal mines*. Both Glencore and the NSW Minerals Council have made a submission on this draft outlining that there are equipment supply chain challenges that would make meeting this January 2019 deadline impracticable.

Therefore, at this time the Project is not in a position to make a commitment to this recommended condition. It is noted, however, that it is expected that the NSW EPA will implement a Pollution Reduction Program (PRP) as the outcome of the current diesel exhaust pollution reduction study and that this PRP once finalised would be applicable to the Project, if approved, thereby achieving the EPAs objective.

Glencore has existing measures in place to minimise diesel emission across its operations. Glencore has been an early adopter of the latest emissions technology rated engines to the market. Glencore has specified lower emission US Tier 2 engines for all new mining equipment tenders since 2011, and has purchased these engines where available. From this self-nominated specification, over 50% of Glencore's NSW mining equipment fleet comprises of US Tier 2 Engines. The decision to specify the lower emission engines was undertaken with no current national or state obligation in place to move to lower diesel emission engines; however these were adopted as they became available. For any new mining equipment purchased for the Project (not including recommissioned equipment) prior to suitable Tier 4 equipment being available, United will specify US Tier 2 engines, where available.

United is committed to minimising diesel emissions associated with the Project and has made the following commitments to mitigation measures. The measures proposed aim to address the equipment maintenance and engine replacement strategies from the NSW Coal Mining Benchmarking Study: Best practice measures for reducing non-road diesel exhaust emissions (EPA 2014). Specifically, the measures proposed by United include:

- servicing all machinery in accordance with maintenance contracts and adopting original equipment manufacturer recommendations for maintenance
- targeting the maintenance to ensure equipment remains fit for purpose over its whole life cycle
- defining failure modes, effects and criticality
- constructing timelines for downtimes
- purchasing new equipment (not including recommissioned equipment) in accordance with any PRP applied to the Project in relation to Tier 4 engines once this expected PRP is introduced.

2.3 Biodiversity

Copies of plot and transect field data sheets have not been provided.

Umwelt has provided OEH with scanned copies of the floristic and BBAM (2014) transect field sheets for the surveys undertaken within the Project Area and BioBank sites as requested.

Further details on indirect impacts in accordance with Sections 8.4.1.4 (e) and (f) of the FBA.

OEH has requested further information regarding indirect impacts on biodiversity in accordance with Sections 8.4.1.4 (e) and (f) of the FBA (OEH 2014). Section 8.4 of the FBA refers to the demonstration of onsite measures to minimise indirect impacts on biodiversity values.

Section 8.4.1.4 (e) of the FBA relates to onsite measures required for consideration for impacts that are infrequent, cumulative or difficult to measure. Examples of these impacts could include:

Cumulative habitat loss and vegetation clearance impacts on agricultural and mining areas of the Hunter Valley

The Proposed Disturbance Area for the Project is situated in a landscape that is characterised by mining land, grazing land, more intensive agriculture on the Hunter River alluvial zone (cropping and dairying) and some private and public woodland, including areas of National Park to the west. The history of land clearing, agriculture and mining development has resulted in an incremental loss of vegetation and fauna habitat from within and surrounding the Project Area, and within the central Hunter Valley more generally. The Project will result in the loss of approximately 356 hectares of native woodland and forest vegetation.

It is recognised that the Project will remove vegetation and further increase fragmentation and isolation of habitats in the vicinity of the Project, and thus contribute to cumulative habitat loss and vegetation clearance in the locality. To address these impacts, an extensive mitigation and offsetting strategy is proposed including the provision of:

- up to 878 hectares of ecological mine rehabilitation, currently proposed to include 620 hectares of *Central Hunter Valley Eucalypt Forest and Woodland CEEC* and 258 hectares of Bull Oak grassy woodland (refer to **Table 2.4**)
- the delineation of clearance areas to avoid unnecessary impacts and clearance of surrounding vegetation
- habitat enhancement measures such as the installation of nest boxes, salvaged hollows, fallen timber, hollow logs and rocks to supplement retained vegetation and mine rehabilitation areas
- the implementation of a biodiversity offset strategy in accordance with the FBA.

Loss in habitat connectivity and fragmentation

Habitat fragmentation is a common impact arising from development and can result in barriers to movement and dispersal of local flora and fauna species. Habitat corridors may include large expanses of intact native landscapes, river systems and floodplains, networks of habitat patches or scattered paddock trees. The retention of habitat connectivity may help to reduce some of the adverse effects of habitat fragmentation by facilitating dispersal of individuals between patches of remaining habitat. Broadly, the habitats of the locality are already fragmented in a largely agricultural and mining landscape.

Impacts associated with habitat fragmentation and connectivity for the Project include a wide vegetated corridor that runs in a southeast and northwest direction between the New England Highway and the existing United site. This area is currently connected through regrowth woodland vegetation that is majority less than 35 years old (based on historic aerial photography from 1983). This corridor is currently bounded by HVO to the north and the existing United mine in the south. This corridor will be effectively severed by the vegetation clearance required for the Project.

The threatened species recorded in and around the Proposed Disturbance Area are generally mobile and dispersive species that occur in a wide range of habitats. The Project Area and the wider locality contain a range of existing vegetation corridors with differing levels of connectedness, in particular the substantial corridor adjacent to and including Wollemi National Park to the west of the Proposed Disturbance Area. This corridor is currently approved for impact by the approved Wambo mine and would be dissected regardless of the Project.

The fragmentation resulting from the Project is expected to be a short to medium term impact, with up to 2450 hectares of native vegetation mine rehabilitation currently proposed to rehabilitate the post-mining landscape (refer to **Section 2.7**).

It is also noted that the potential loss of local and regional connectivity is factored in to the FBA credit calculations for the Project in that the Assessment Circle and associated Landscape Value Scores take into account the pre- and post-clearing percentage of native vegetation cover (excluding the proposed post-mine rehabilitation).

Changes in fauna behaviour

Behavioural changes in animals can occur in response to the physical presence of a development and include changes in foraging locations and mating behaviour (Gleeson and Gleeson 2012). This may lead to changes in species composition in the landscape, with these impacts resulting from impacts such as fugitive lighting, noise and vibration impacts. Noise impacts can affect fauna physiology and behaviour, particularly by causing disruption to communication including mating calls, territorial calls and alarm calls (OEH 2016). Research into the impacts of altered lighting indicates that it can trigger behavioural and physiological responses including changes in foraging behaviour, disruptions of seasonal day length trigger cues for critical behaviour, disorientation and temporary blindness and interference with predator prey relationships (OEH 2016). Blasting overpressure and vibration has the potential to disturb routine activities of fauna, particularly birds and bats, including disrupting breeding cycles and behaviour patterns (OEH 2016).

Appropriate lighting controls to minimise impacts will be implemented as part of the Project including minimisation of fugitive lighting emissions following Australian Standards. There will be no substantial change to fugitive light emission impacts on the surrounding fauna habitat given that the proposed mine operation is already is part of, and adjacent to, existing mining operations with existing lighting impacts.

There will be no substantial change to noise impacts on fauna given that the proposed mine operation is part of, and adjacent to, an already existing operation with existing impacts. The same applies to vibration with the vibration impacts broadly consistent with the blasting impacts from the existing mining operations.

The interruption of ecosystem processes

Ecosystem processes refer to the processes that sustain a functioning ecosystem. These can include climatic processes, resource productivity, hydrological processes, nutrient cycling, species interactions and fire regimes. The Project has the potential to result in indirect impacts associated with ecosystem processes. While these processes and impacts on them are complex and difficult to quantify, an extensive mitigation strategy is proposed for the Project including:

- implementation of clearing procedures to minimise the impacts of the clearing process and maximise the recovery of any valuable biodiversity resources (e.g. seed collection, re-use of hollow logs and hollows where appropriate)
- feral animal and noxious weed control
- fencing and access control
- management of domestic stock
- bushfire management
- water management systems that seek to minimise the potential for damage to flora and fauna and their habitats from erosion and unnatural flooding events
- control systems to minimise noise, dust, lighting and blasting impacts
- employee education and training.

Should the Project be approved, United will prepare an appropriate biodiversity management plan in accordance with any relevant Development Consent requirements. The project-specific biodiversity management will guide the implementation of the mitigation steps, which are addressed in the following sections. The outcomes of biodiversity monitoring (see below) will also be used to provide for the management plan to be reviewed and adapted in response to new information.

As outlined in Section 4.2 of the FBA report, monitoring is a tool that can be used to assess and inform the ongoing improvement of management actions. The effectiveness and long-term success of mitigation actions will be evaluated against key outcomes, which necessitate regular and appropriately targeted monitoring. This will be achieved by using formal monitoring programs and due diligence assessments that periodically examine measurable changes over time and provide information on impacts and the success or otherwise of mitigation actions. The frequency and level of monitoring will be dependent on the environmental features to be assessed. The techniques proposed to be used will be documented in the Biodiversity Management Plan and will be systematic and repeatable.

Section 8.4.1.4 (f) of the FBA relates to onsite avoidance and minimisation measures required for consideration for impacts related to the operational phase of the Project. Section 4.2 of the FBA report outlines the mitigation measures proposed for the Project for indirect impacts. Where relevant these are expanded upon below.

- ***Trampling of threatened flora species*** – No threatened flora species are known to occur in the Proposed Disturbance Area. The *Acacia pendula* endangered population located south of the Proposed Disturbance Area has been actively avoided by the Project design and will not be impacted as a result of the Project. It is unlikely that any threatened flora species would be trampled during the operational phase of the Project.
- ***Rubbish dumping*** - During the operational phase of the Project, rubbish dumping will be unlikely to occur as suitable fencing and other security measures will be installed to ensure restrictions to access in retained vegetation areas and employee education and training will enforce awareness and stewardship of the mine site by employees and contractors. United will also implement rubbish collection and management facilities.
- ***Noise*** - During the operational phase of the Project, a range of noise reduction actions will be undertaken including noise attenuation on plant and equipment, use of 'silent horns', real-time monitoring with response procedures in place to assist to manage noise with approved noise criteria and designing emplacement areas to create sheltered emplacement locations to minimise noise. These controls will all serve to minimise noise impacts on fauna.
- ***Light spill*** - Appropriate lighting controls to minimise impacts will be implemented as part of the Project including minimisation of fugitive lighting emissions following Australian Standards.
- ***Weed encroachment*** - Weed species could be inadvertently brought into the Proposed Disturbance Area with imported materials, or could invade naturally through removal of native vegetation. Existing weed management controls at United and Wambo will be incorporated into the revised Biodiversity Management Plan and these controls implemented as part of the Project. Weed control will be undertaken in accordance with current mine practices and, for noxious weed species, with NSW control guidelines.
- ***Feral animal encroachment*** - Introduced fauna species such as foxes, rabbits, pigs, dogs and feral cats could change in distribution and abundance in the Proposed Disturbance Area and adjoining areas as future areas are cleared, mined and then rehabilitated. Pest and feral animal controls at United and Wambo will be incorporated into the Biodiversity Management Plan and these controls implemented as part of the Project. Pest and feral animal control will be undertaken in accordance with current mine practices and in consideration of the UHSA mitigation guidelines (OEH 2016).

- ***Nutrient run-off*** - an Erosion and Sediment Control Plan to be utilised during the construction and operation phases of the Project will be prepared that is consistent with the requirements of Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries, or its latest version. This plan will be part of a broader Water Management Plan that will identify the water management controls to be implemented as part of the Project, including controls to minimise nutrient run-off.
- ***Increased risk of fire -*** The vegetation that will be retained within the Proposed Disturbance Area will require appropriate bushfire management to protect life and property, while supporting appropriate conditions for the significant ecological features identified in the Proposed Disturbance Area. This may include the exclusion of planned bushfire from revegetation and regeneration areas, consideration of the sensitivities of threatened species and threatened ecological communities and the use of ecologically appropriate fire regimes. United has committed to the development and implementation of a Bushfire Management Plan for the Project with this plan to outline the controls to be put in place to manage the risk of fire.

Link the proposed offsets with each vegetation zone in the development footprint, including provision of an updated table that clearly identifies the offset component for each impacted vegetation zone.

Umwelt has provided OEH with a GIS layer showing Stages 1, 2 and 3 subsequent to the above request.

Table 7.16 of the BAR was prepared by grouping plant community types (PCTs) by threatened ecological community (TEC) based on the offsetting approach of prioritising the highest levels of the biodiversity conservation hierarchy (i.e. critically endangered ecological communities, endangered ecological communities, vulnerable ecological communities and then non-threatened communities).

Table 2.2 below shows the vegetation zones impacted by the Project while being consistent with the proposed offsetting approach. As per Table 7.16 of the FBA, the Project currently meets 66 per cent of the offsetting requirement for Stage 1. It is acknowledged that further offsets will be required to offset the impacts of Stage 1.

United is currently investigating a number of local offset sites that contain suitable vegetation and habitats including substantial areas of *Central Hunter Valley Eucalypt Forest and Woodland CEEC.* One proposed offset site has recently executed a contract for sale. This site is approximately 496 hectares and is within approximately 4 km of the Project Area and contains areas of CEEC and other native vegetation communities that provide suitable offsets for the Project. A full biometric survey and the application of the BioBanking Credit Calculator in accordance with BBAM will be undertaken for this site shortly, however, preliminary investigations indicate that with the inclusion of this new offset site, the Project will meet 90 per cent of the offsetting requirement for Stage 1.

There is another suitable local offset site which United is currently investigating which will further contribute to meeting the offset requirements for the Project.

Once the surveys and credit calculations for these additional offset properties are complete, this information and the revised offset credit outcomes for the Project will be provided to OEH and DPE.

Table 2.2 Stage 1 Offset Package to Meet Credit Requirement for Ecosystem and Species Credits

Vegetation Zone Offset Allocation	Justification	Credits Required/Available for Stage 1 (Years 1-7)	Per cent (%) of Credit Requirement for Stage 1
Vegetation Zone 1 **HU812 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter[1]**		**Credits required for Stage 2 only.**	**-**
Conforming to *Hunter Floodplain Red Gum Woodland EEC* under the TSC Act[2]		**N/A**	**-**
Not applicable for Stage 1.	-	-	-
Vegetation Zone 2 **HU816 Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter**		**1,483**	**0%**
Conforming to *Central Hunter Valley Eucalypt Forest and Woodland CEEC* under the EPBC Act		**59**	**0%**
None available.	-	0	0%
Conforming to *Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC* under the TSC Act[2]		**1,424**	**0%**
None available.	-	0	0%
Vegetation Zone 3 **HU869 Grey Box - Slaty Box Shrub - Grass Woodland on Sandstone Slopes of the Upper Hunter and Sydney Basin**		**108**	**100%**
Conforming to Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act		**79**	**100%**
HU618 Slaty Box - Grey Gum Shrubby Woodland on Footslopes of the Upper Hunter Valley, Sydney Basin Bioregion at the Wambo Offset Site	Like for like CEEC	79	100%

Vegetation Zone Offset Allocation	Justification	Credits Required/Available for Stage 1 (Years 1-7)	Per cent (%) of Credit Requirement for Stage 1
Conforming to Hunter Valley Footslopes Slaty Gum Woodland VEC under the TSC Act[2]		**29**	**100%**
HU618 Slaty Box - Grey Gum Shrubby Woodland on Footslopes of the Upper Hunter Valley, Sydney Basin Bioregion at the Wambo Offset Site	Like for like EEC	29	100%
Vegetation Zones 4, 5, 6, 7, 8 **HU905 Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter**		**11,798**	**63%**
Conforming to Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act		**7,410**	**81%**
HU817 Narrow-leaved Ironbark - Bull Oak - Grey Box shrub – grass open forest of the central and lower Hunter at the Wambo Offset Site	Like for like CEEC	772	10%
HU817 Narrow-leaved Ironbark - Bull Oak - Grey Box shrub – grass open forest of the central and lower Hunter at the Wambo Offset Site	Like for like CEEC following restoration of derived native grassland	741	10%
HU618 Slaty Box - Grey Gum Shrubby Woodland on Footslopes of the Upper Hunter Valley, Sydney Basin Bioregion at the Wambo Offset Site	Like for like CEEC	1,583	21%
HU905 Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter restored from mine rehabilitation	Like for like CEEC and same PCT	2,987	40%
Conforming to Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC under the TSC Act[2]		**458**	**100%**
HU905 Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter at the Mangrove Offset Site	Like for like EEC and same PCT	458	100%
Not conforming to threatened ecological communities		**3,931**	**28%**
HU905 Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter at the Mangrove Offset Site	Like for like rules – same PCT	123	3%

Vegetation Zone Offset Allocation	Justification	Credits Required/Available for Stage 1 (Years 1-7)	Per cent (%) of Credit Requirement for Stage 1
HU905 Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter at the Mangrove Offset Site	Like for like rules – same PCT	970	25%
Vegetation Zone 9 **HU906 Bull Oak Grassy Woodland of the Central Hunter Valley**		**6,359**	**82%**
Conforming to Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act		**1,162**	**0%**
None available.	-	0	0%
Conforming to Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC under the TSC Act[2]		**181**	**100%**
HU905 Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter at the Mangrove Offset Site	Like for like EEC	181	100%
Not conforming to threatened ecological communities		**5,016**	**97%**
HU730 White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley at the Highfields Offset Site	Like for like rules – same vegetation class with a higher percent cleared value	3,592	72%
HU714 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion at the Highfields Offset Site	Variation rules – same vegetation formation with a higher percent cleared value	20	0%
HU906 Bull Oak Grassy Woodland of the Central Hunter Valley restored from mine rehabilitation	Like for like rules – same PCT	1,243	25%

Vegetation Zone Offset Allocation	Justification	Credits Required/Available for Stage 1 (Years 1-7)	Per cent (%) of Credit Requirement for Stage 1
Vegetation Zone 10 **HU945 Swamp Oak - Weeping Grass Grassy Riparian Forest of the Hunter Valley**		**2,004**	**76%**
Not conforming to threatened ecological communities		**2,004**	**76%**
HU812 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter at the Mangrove Offset Site[1]	Variation rules – same vegetation formation with a higher percent cleared value	1,449	72%
HU599 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley at the Mangrove Offset Site	Variation rules – same vegetation formation with a higher percent cleared value	106	4%
OVERALL ECOSYSTEM CREDIT REQUIREMENT		**21,752**	**-**
OVERALL ECOSYSTEM CREDIT ALLOCATION		**14,333**	**66%**

1 VIS database quotes 0% cleared for HU812 across the Hunter/Central Rivers CMA. This is likely due to an error/omission of data in the database. Known per cent cleared for HU812 is quoted as around 98% in Peake (2006) and over 90% in the NSW Scientific Committee's Final Determination for Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC (NSWSC 2011).

2 The *Biodiversity Conservation Act 2016* began on 25 August 2017 and replaces the *Threatened Species Conservation Act 1995*.

Appropriateness of 'HU599 - River Red Gum / River Oak riparian woodland wetland in the Hunter Valley' for the vegetation mapped on the Mangrove BioBanking site.

It is acknowledged that some of the PCTs in the Hunter Valley are similar and in this case PCT HU599 and HU712 are similar to the vegetation community recorded at the Mangrove BioBanking site.

To determine the most appropriate PCT for this vegetation, Umwelt used the online OEH VIS database and plant community identification tool to allocate a PCT to the vegetation community recorded.

A comparison of the per cent of native species in common with HU599 was also undertaken using flora plot data. This comparison revealed that 33 per cent (4 from 12 species) of the native species contained in the scientific description for this BVT/PCT were recorded within the Mangrove BioBanking site. A further comparison of the similarity to the similar community HU712 revealed that that 30 per cent (7 from 23 species) of the native species contained in the scientific description for this PCT were recorded within the Mangrove BioBanking site. Is it noted that this vegetation community within the Mangrove BioBanking site is heavily modified and exists as small patches of woodland along Wybong Creek, and has lost key structural and floristic elements. Given the similarity between the two aforementioned PCTs, a review of regional mapping was undertaken to inform the most appropriate fit.

The latest regional mapping for this area is the Greater Hunter Native Vegetation Mapping which was prepared by OEH (OEH 2012). According to the OEH study the riparian vegetation occurring along Wybong Creek up and down stream of the Mangrove BioBank site is mapped as MU215 River Red Gum/ River Oak grassy riparian woodland of the Hunter Valley, which is equivalent to HU599 - River Red Gum / River Oak riparian woodland wetland of the Hunter Valley. Therefore the PCT allocation used for the Project is consistent with the OEH regional mapping.

It is noted that river red gum (*Eucalyptus camaldulensis*), one of the two characteristic canopy species of HU599, has not been recorded within the Mangrove BioBank site. This species may have occurred along Wybong Creek prior to clearing for agricultural purposes. A review of river red gum in the local region found that a population of this species is present along lower Wybong Creek approximately 3 kilometres to the south of the Mangrove BioBank site, according to the study Assessment of Current Status and Recommendations for Management Strategies and Recovery Actions for Endangered Population of River Red Gum (*Eucalyptus camaldulensis*) in the Hunter Valley (Umwelt 2007).

Size of outer assessment circles used for the Mangrove Offset and Highfields Offset.

Umwelt has reviewed the assessment circles provided to OEH and can confirm that the outer assessment circles at the Highfields and Mangrove BioBank sites are correct. As the layers for these sites were provided to OEH on one shape file layer, it is expected that OEH has calculated the outer assessment circle area by excluding the area covered by the inner assessment circle.

For example, at the Mangrove BioBank Site, the inner and outer assessment circles are 100 hectares and 1000 hectares, respectively. The inner circle occurs wholly within the outer circle and 1000 hectares minus 100 hectares is 900 hectares as per OEH's comment. As a result, the landscape value scores for these BioBank sites are correct and the BioBanking Assessments are not required to be re-run.

Umwelt has re-issued the assessment circles in separate GIS layers to OEH to avoid further confusion.

Provision of the credit calculations, GIS shape files and any assumptions made that relate to credit calculations of the post-mine ecological restoration.

Mine rehabilitation credits have been calculated using the Calculator for "Framework for Biodiversity Assessment (FBA) section 12.2: Generating biodiversity credits for ecological rehabilitation of previously mined land" excel calculator as downloaded from the OEH website. This spreadsheet has been provided to OEH subsequent to their request. The preliminary performance indicators and completion criteria outlined in Table 7.14 are reflective of the calculations as required in Table 6 of the FBA.

Confirmation of location of replacement offset for compensatory habitat area.

Condition 45 of the development consent for the former United underground mine (DA-410-11-2003-i) required the establishment of at least 18.5 hectares of compensatory habitat on the surface colliery holding to replace the woodland vegetation removed for the United underground mine development. In accordance with Condition 45, a Compensatory Habitat Area was set aside in the northwest corner of the surface colliery holding. This Compensatory Habitat Area is not subject to any long-term conservation mechanisms and occurs within the disturbance area for the Project.

To replace the existing Compensatory Habitat Area, United proposes to use 18.5 hectares in a proposed offset site to address the requirements of DA-410-11-2003-i to be secured under a BioBank Agreement. Credits associated with the following habitats at the Wambo Offset Site are yet to be allocated in the Biodiversity Offset Strategy and the use of 18.5 hectares of these habitats are considered suitable for replacing the woodland vegetation removed for the United underground mine development as per Condition 45 of DA-410-11-2003-i:

- approximately 115 hectares of HU618 Slaty Box - Grey Gum Shrubby Woodland on Footslopes of the Upper Hunter Valley, Sydney Basin Bioregion
- approximately 12 hectares of HU712 River Oak Riparian Grassy Tall Woodland of the Western Hunter Valley (Brigalow Belt South).

The allocation of 18.5 hectares to replace the Compensatory Habitat Area will be determined following the finalisation of all credit allocations with the inclusion of all additional proposed BioBank sites to adequately cover the credit requirements of the Project.

It is noted that this area of 18.5 hectares will be in addition to the offset requirements for the Project as outlined in Table 6.1 of the BAR. That is, for the avoidance of any doubt, there will be no credits generated for this 18.5 hectares for use to offset the impacts of the Project.

Clarification on impact area of vegetation containing key feed species for the Regent Honeyeater.

The original calculation of habitat suitable for the Regent Honeyeater was undertaken as part of the EPBC Referral prepared for the Project. Since that time, a National Recovery Plan for the Regent Honeyeater (DoE 2016) has been released. The revised habitat area presented in Section 9.2 of the FBA report (29.4 hectares) was undertaken following the guidance in the National Recovery Plan in relation to the presence or otherwise of listed key feed species for the regent honeyeater.

DoEE have since provided further advice on the potential habitat of the species when considering relevant Conservation Advice documents (TSSC 2015a and TSSC 2015b) and the National Recovery Plan. This includes acknowledging that the *Central Hunter Valley Eucalypt Forest and Woodland CEEC* under the EPBC Act can be particularly valuable as a source of winter-flowering eucalypts for transient threatened species such as the regent honeyeater. It is noted from DoEE that the flowering seasons of three of the four main eucalypt species on the site include the winter months when regent honeyeaters may be present in the district. Narrow-leaved ironbark (*Eucalyptus crebra*) flowers between May and January, spotted gum (*Corymbia maculata*) flowers between May and September and grey box (*Eucalyptus moluccana*) flowers between February and August. DoEE considers that the *Central Hunter Valley Eucalypt Forest and Woodland CEEC* on the United Wambo site provides suitable habitat for the regent honeyeater.

Following this advice, Umwelt has re-assessed and updated the impact and offset strategy in Section 9.2 of the FBA report (reproduced below) for the regent honeyeater to satisfy DoEE's assessment requirements.

Impact Assessment

The following areas of habitat in the Development Footprint are considered suitable for regent honeyeater in accordance with the advice provided by DoEE:

- 191.1 hectares of *Central Hunter Valley Eucalypt Forest and Woodland CEEC* containing winter-flowering eucalypt species spotted gum, narrow-leaved ironbark and grey box.

- 28.3 hectares of HU816 Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest of the Central and Lower Hunter (not conforming to the *Central Hunter CEEC*) and containing winter-flowering eucalypt species spotted gum and narrow-leaved ironbark.

- 0.4 hectare of HU869 Grey Box - Slaty Box Shrub - Grass Woodland on Sandstone Slopes of the Upper Hunter and Sydney Basin (not conforming to the *Central Hunter CEEC*) and containing winter-flowering eucalypt species grey box.

- 9.4 hectares of HU905 Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter (not conforming to the *Central Hunter CEEC*) and containing winter-flowering eucalypt species narrow-leaved ironbark and grey box.

Approximately 229 hectares of woodland habitats in the Development Footprint provide potential habitat for the regent honeyeater (note: this area has been updated as per the CEEC mapping amendments described below). While the Project will remove a range of native vegetation communities within the Development Footprint including fragmented eucalypt woodlands, none of the habitats in the Development Footprint have been recorded as being used by regent honeyeater either historically or recently.

Offsetting Outcomes

United is committed to delivering a biodiversity offset strategy that appropriately compensates for the removal of potential habitat for the regent honeyeater as a result of the Project. As outlined in the FBA report, the offsetting for the Project will be undertaken in accordance with the FBA and the NSW *Biodiversity Offset Policy for Major Projects*.

The proposed offset package seeks to balance the protection and improvement of existing high quality habitats along with providing suitable conservation gain by restoring grassland areas to provide suitable woodland habitats for the regent honeyeater and locating offsets in areas under threat of clearance.

The suitable habitats at the offset sites have been identified through the presence of:

- key foraging tree species for the regent honeyeater as outlined in the National Recovery Plan (DoE 2016)
- winter-flowering eucalypt species (as described in Brooker and Kleinig 1999)
- *Central Hunter Valley Eucalypt Forest and Woodland CEEC* or *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC*
- where there are known or nearby (within 15km) records.

The like-for-like offsets currently proposed for regent honeyeater include a total of 931.1 hectares of suitable habitat as part of:

- 314.4 hectares at the Wambo Offset Site including:
    - 140.8 hectares of *Central Hunter Valley Eucalypt Forest and Woodland CEEC* containing winter-flowering eucalypt species narrow-leaved ironbark and grey box
    - 56.7 hectares of grassland able to be restored to contain suitable canopy species as per the *Central Hunter Valley Eucalypt Forest and Woodland CEEC*
    - 116.9 hectares of HU618 Slaty Box - Grey Gum Shrubby Woodland on Footslopes of the Upper Hunter Valley, Sydney Basin Bioregion (not conforming to the *Central Hunter CEEC*) containing winter-flowering eucalypt species narrow-leaved ironbark, grey box and broad-leaved ironbark (*Eucalyptus fibrosa*)
- 421 hectares at the Highfields BioBank Site including:
    - 266.3 hectares of *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* containing key feed species white box hybrids (*Eucalyptus albens – moluccana*), yellow box (*Eucalyptus melliodora*) and other winter-flowering eucalypt species Blakely's red gum (*Eucalyptus blakelyi*), narrow-leaved ironbark and grey box
    - 39.7 hectares of grassland able to be restored to contain suitable canopy species as per the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC*
    - 24.9 hectares of HU821 Blakely's Red Gum - Narrow-leaved Ironbark - Rough-barked Apple Shrubby Woodland of the upper Hunter containing winter-flowering eucalypt species Blakely's red gum and narrow-leaved ironbark
    - 90.1 hectares of HU868 Narrow-leaved Ironbark - Grey Gum Shrubby Open Forest on sandstone ranges of the upper Hunter Valley containing the winter-flowering eucalypt species narrow-leaved ironbark
- 195.7 hectares at the Mangrove BioBank Site including:
    - 15.2 hectares of HU812 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter conforming to *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC* and containing winter-flowering eucalypt species forest red gum (*Eucalyptus tereticornis*) and grey box

- 73.8 hectares of grassland able to be restored to contain suitable canopy species as per the *White Box Yellow Box Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC*

- 20 hectares of HU905 Narrow-leaved Ironbark - Grey Box Grassy Woodland of the Central and Upper Hunter containing winter-flowering eucalypt species narrow-leaved ironbark and grey box

- 86.7 hectares of grassland able to be restored to contain suitable winter-flowering canopy species as per HU905 Narrow-leaved Ironbark - Grey Box Grassy Woodland of the Central and Upper Hunter.

Further to this, the Project will require a further approximate 520 hectares (5,792 credits) of *Central Hunter Valley Eucalypt Forest and Woodland CEEC* like-for-like offsetting to satisfy the FBA requirements. In total, this will result in an overall offset ratio of approximately 6.3:1 of suitable habitat for the regent honeyeater.

Accuracy of Bull Oak Woodland habitat mapped as Central Hunter Valley Eucalypt Forest and Woodland Critically Endangered Ecological Community (CHVEFW CEEC).

At the request of OEH, Umwelt has reviewed the mapping of CHVEFW CEEC within the Project Area in relation to HU906 – Bull Oak Grassy Woodland of the Central Hunter Valley – Moderate to Good condition. In conjunction with field survey data, Umwelt has to date used Aerial Photography Interpretation (API) to identify the extent of the CHVEFW CEEC across the Project Area. Imagery previously used includes high resolution aerial photographs taken in 2012, 2014, 2015 and 2016. As part of this review new imagery was sourced from the online map interface Nearmap. This system allows aerial photography to be viewed at angles using the Multiview Function. This aided in the identification of canopy species within the HU906 – Bull Oak Grassy Woodland of the Central Hunter Valley – Moderate to Good condition, specifically the presence of adequate density of characteristic eucalypts. All areas mapped as HU906 – Bull Oak Grassy Woodland of the Central Hunter Valley – Moderate to Good condition were interrogated for the presence of eucalypt species in sufficient density to form part of the CHVEFW CEEC. Previous correspondence with DoEE clarified that in conjunction with bull oak (*Allocasuarina luehmannii*), there needs to be at least three characteristic eucalypt species per hectare.

As a result of the revised mapping of CHVEFW CEEC, a further 12.1 hectares of HU906 – Bull Oak Grassy Woodland of the Central Hunter Valley – Moderate to Good condition is considered to conform. Adequate densities of characteristic eucalypt species, likely to be *Eucalyptus crebra*, were identified in several areas (refer to **Figure 2.1**). In addition to this, a further 0.2 hectares of derived native grasslands is considered to conform to the CHVEFW CEEC given that it occurs in a gap between two patches which are less than 30 metres apart or at an indent along the edge of the CHVEFW CEEC. This amendment results in a total impact on the CHVEFW CEEC of 201.8 hectares compared to 189.5 hectares quoted in the RTS.

United and Umwelt would be happy to further discuss the mapping of the CHVEFW CEEC with OEH should it have any further comments on the mapping.

The change to CHVEFW CEEC mapping results in an additional 710 credits required specifically for the CEEC over the life of the Project, but no change in credit requirements overall. Table 6.2 of the FBA has been updated as per **Table 2.3** below (red text denotes changes). Furthermore, credit allocations outlined in **Table 2.2** have been updated to reflect these mapping amendments.

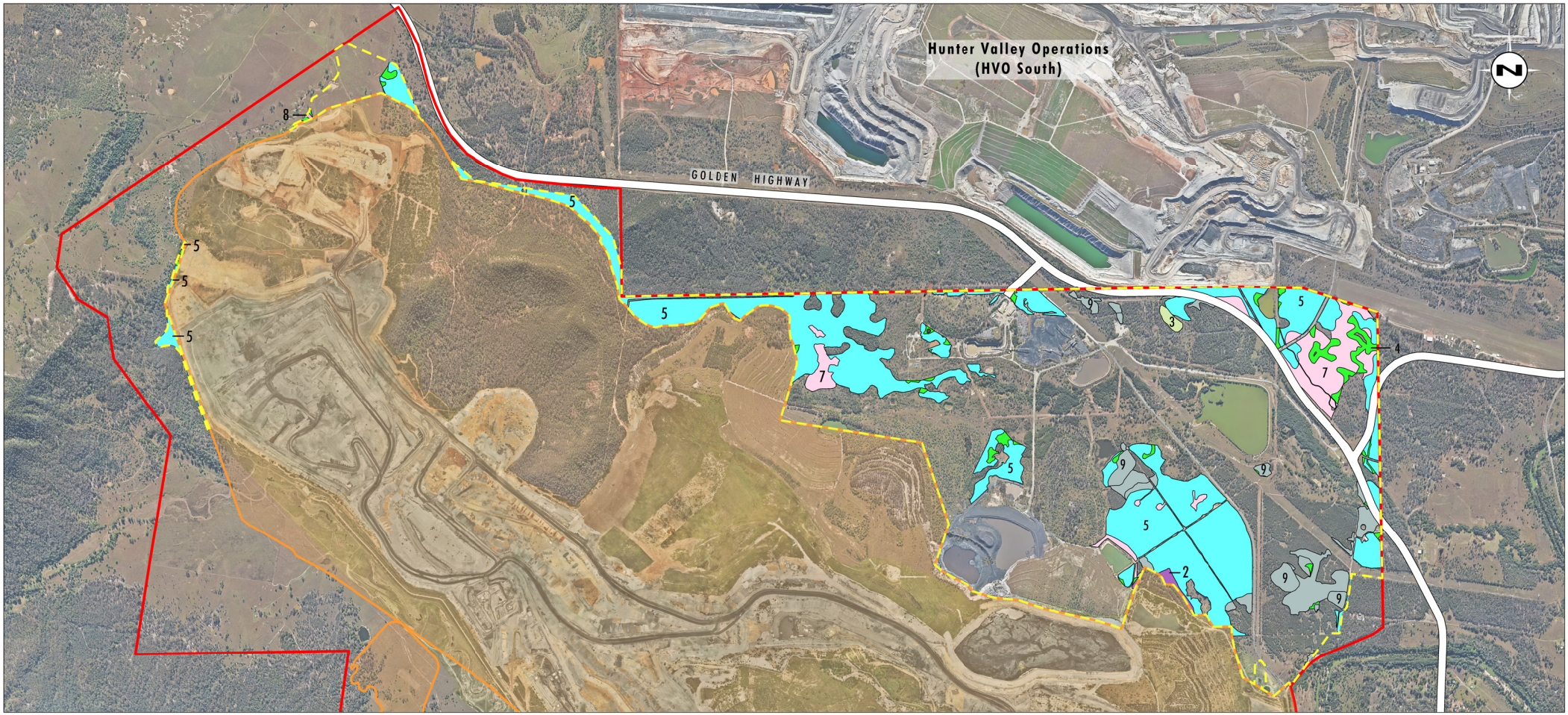

Image Source: AAM (2012), United (2016)
Data Source: Glencore (2014)

0 0.5 1.0 2.0km
1:35 000

Legend

- Development Site
- Development Footprint
- Approved Wambo Surface Development Area
- 2 - HU816 - Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest on Slopes of the Upper Hunter and Sydney Basin - Moderate to Good Condition - Plantation/Rehabilitation
- 3 - HU869 - Grey Box - Slaty Box Shrub - Grass Woodland on Sandstone Slopes of the Upper Hunter and Sydney Basin - Moderate to Good Condition
- 4 - HU905 - Narrow-leaved Ironbark - Grey Box grassy Woodland of the Central and Upper Hunter - Derived Native Grassland
- 5 - HU905 - Moderate to Good Condition
- 7 - HU905 - Moderate to Good Condition - Regeneration
- 8 - HU905 - Moderate to Good Condition - Thinned Canopy
- 9 - HU906 - Bull Oak Grassy Woodland of the Central Hunter Valley - Moderate to Good Condition

FIGURE 2.1

Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act

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Table 2.3 Staged Credit Requirements

Biometric Vegetation Type	Credits to be Retired during Stage 1	Credits to be Retired during Stage 2	Credits to be Retired during Stage 3	Total
Ecosystem Credits				
Threatened Ecological Communities				
Central Hunter Valley Eucalypt Forest and Woodland CEEC^ (including components of HU816, HU869, HU905 and HU906)	8,710	2,407	837	11,954
Hunter Floodplain Red Gum Woodland EEC (HU812 – Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter)	0	20	0	20
Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC (HU816 – Spotted Gum - Narrow-leaved Ironbark Shrub - Grass Open Forest Slopes of the Upper)	1,424	0	0	1,424
Central Hunter Grey Box – Ironbark Woodland EEC (including components of HU905 and HU906)	639	55	17	711
Hunter Valley Footslopes Slaty Gum Woodland VEC (HU869 – Grey Box - Slaty Box Shrub - Grass Woodland on Sandstone Slopes of the Upper Hunter and Sydney Basin)	29	0	0	29
Non-threatened Communities				
HU905 – Narrow-leaved Ironbark - Grey Box grassy Woodland of the Central and Upper Hunter	3,931	815	236	4,982
HU906 – Bull Oak Grassy Woodland of the Central Hunter Valley	5,016	0	357	5,373
HU945 – Swamp Oak - Weeping Grass Grassy Riparian Forest of the Hunter Valley	2,004	114	14	2,132
Total Ecosystem Credits	**21,753**	**3,411**	**1,461**	**26,625**
Species Credits				
southern myotis (*Myotis macropus*)	208	354	0	562
Total Species Credits	**208**	**354**	**0**	**562**

^Note: where the areas of *Central Hunter Valley Eucalypt Forest and Woodland CEEC* under the EPBC Act also conform to TSC Act listed TECs (e.g. *Central Hunter Grey Box – Ironbark Woodland EEC* under the TSC Act), credits have been included in the *Central Hunter Valley Eucalypt Forest and Woodland CEEC* component as this is the higher conservation priority.

Potential subsidence impacts within the proposed Wambo offset.

The OEH comments noted that subsidence impacts may occur on the proposed Wambo offset as a result of proposed underground mining by Wambo as part of the proposed South Bates Extension Modification. The flora impact assessment for the South Bates Extension Modification (FloraSearch 2017) concluded that it was considered unlikely that underground mining would result in a measurable impact to the quality of the native vegetation and habitats in the proposed Wambo Offset Site.

It is noted that monitoring of subsidence impacts on vegetation above the proposed longwall mining area would occur in accordance with an Extraction Plan prepared by Wambo under the Wambo mine development consent (DA 305-7-2003).

In accordance with Table 14A (schedule 4, condition 22) of the Wambo mine development consent (DA 305-7-2003), Wambo's underground mining operations are required to have negligible environment consequence on threatened species, populations or communities. Schedule 4, condition 22 of the Wambo mine development consent also states:

> *If the Applicant exceeds the performance measures in Table 14A and the Secretary determines that:*
>
> *(a) it is not reasonable or feasible to remediate the impact or environmental consequences; or*
>
> *(b) remediation measures implemented by the Applicant have failed to satisfactorily remediate the impact or environmental consequence,*
>
> *then the Applicant must provide a suitable offset to compensate for the impact or environmental consequence, to the satisfaction of the Secretary.*

In the event that Wambo's underground mining operations have an impact on the proposed Wambo Offset Area, United will work with Wambo so that a suitable offsets is provided to compensate for the impact in accordance with schedule 3, condition 22.

It is noted that the establishment of a BioBanking site at the Wambo offset site (as required to generate credits) would require an assessment of the condition of the vegetation as part of calculating the credits. Should Wambo's proposed underground mining be approved, United commits to re-calculating the credits for the offset site after such undermining has occurred to ensure that the credits generated consider any impacts due to the underground mining. Should the number of credits generated reduce, United would work with Wambo to offset these impacts.

Use of post-mine rehabilitation consisting 25 per cent of the 11,244 ecosystem credits required for impact to CHVEFW CEEC.

As noted in the OEH comment, the current drafting of the Upper Hunter Strategic Assessment (UHSA) Biodiversity Plan caps the use of post-mine rehabilitation as an offset at 15 per cent for the CHVEFW CEEC. It is noted that the UHSA is currently in draft and therefore this per cent is currently the subject of further research and discussions and may be subject to change.

Regardless, the biodiversity assessment has been assessed under the FBA where there is no limit to the use of mine rehabilitation and therefore the draft UHSA cap does not apply. United acknowledges the importance of providing a varied offset strategy that includes a combination of offset components including land-based offsets and revegetation programs and despite the FBA not having a cap on use of mine rehabilitation as an offset, United has self-imposed a 25 per cent cap on the contribution of mine rehabilitation in the offset strategy. The 25 per cent allocation provides a significant area of CEEC rehabilitation and is considered appropriate for maximising opportunities to improve the post-mining landscape.

Under NSW government policy, there are a range of safeguard mechanisms in place so that if the ecological rehabilitation does not meet the required standard, the credits cannot be generated and an alternative offset must be provided.

Specific performance measures and completion criteria would be required to be developed and approved by relevant government agencies, and would be applied to ensure appropriate consideration of condition, composition, structure and function of the ecological mine rehabilitation to establish the CEEC. As per Appendix D of the *NSW Biodiversity Offsets Policy for Major Project* (under which the FBA operates), if it becomes clear that the ecological rehabilitation standard for which biodiversity credits have been generated is not able to be achieved, the proponent must instead source and retire these credits from an alternate offset in order to meet its offset requirement. An agreement must be reached between the proponent and NSW government that the objectives and completion/relinquishment criteria are unable to be achieved.

Furthermore, where ecological mine rehabilitation has been used to contribute to an offset requirement a security bond must be provided until the operator of the mine has proven through monitoring that the rehabilitation has established self-sustaining and recognisable plant community types. If the mining company becomes insolvent or doesn't achieve the required outcomes, the bond ensures that sufficient money is available for the rehabilitation works to be completed.

As per the CHVEFW CEEC mapping area and credit edits above, **Table 2.4** below outlines the proposed composition of the ecological mine rehabilitation. Furthermore, credit allocations outlined in **Table 2.2** have been updated to reflect these amendments.

Table 2.4 Target PCTs for Mine Rehabilitation

Natural Distribution in Relation to the Development Site	Area Proposed for Rehabilitation (ha)	Ecosystem Credits Generated	Percent of Total Credit Requirement
PCT1691 (HU905) - Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter Conforming to *Central Hunter Valley Eucalypt Forest and Woodland CEEC*	620	2,987	25%
PCT1692 (HU906) - Bull Oak grassy woodland of the central Hunter Valley Not aiming to conform to any threatened ecological communities.	258	1,243	23%
Total	**878**	**4,230**	**-**

Recommendation that the performance indicators and completion criteria for the ecological rehabilitation undertaken for the Project are consistent with the NSW Biodiversity Baseline Assessment Methodology being prepared in relation to the *Biodiversity Conservation Act 2016*.

The *NSW Biodiversity Baseline Assessment Methodology* referred to in the OEH submission is understood to be being prepared in relation to Section 14.3 of the *Biodiversity Conservation Act 2016* and has not been released. It is therefore not able to be reviewed or considered in the development of completion criteria for the Project.

The criteria outlined in Table 7.14 of the BAR is proposed to be updated in consultation with OEH and DRG as part of the development of a Mining Operations Plan (MOP) for the Project. As part of updating and finalising the criteria, United will consider the contemporary best practice guidance on ecological mine rehabilitation available at that point of time, as well as considering any changes in legislation and policy.

2.4 Water Resources

Provision of accurate and updated list of water licences held by the Applicant, including evidence that the Applicant is the holder of WAL18445 and WAL10541.

The Water Access Licenses WAL18445 and WAL10541 are held by Officers of the Construction, Forestry, Mining and Energy Union (CFMEU) on behalf of United. United is owned 95 per cent by Abelshore Pty Limited, a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore) and 5 per cent by the CFMEU, and is managed by Glencore.

Therefore United can confirm that these licences are held by the applicant and that the list of water licences provided in the RTS is correct.

Update on the plan to monitor private water bore GW060780 so that baseline data readings can commence.

Since the submission of the EIS and RTS, the property at which GW060780 is located has been purchased by United on behalf of the Joint Venture. As the bore is now owned by the Project, it is no longer planned to be monitored. It is also noted that this bore is not operational and had been abandoned by the previous owner.

Detailed groundwater modelling confirms that there will be no exceedance of the Level 1 minimal impact considerations specified in the NSW Aquifer Interference Policy at any other private bores as a result of the Project.

Clarification of the use of GW060750 and, given this use, whether the level of impact is still acceptable.

GW060750 is located on land owned by Coal and Allied. Coal and Allied has advised that the existence of this bore cannot be confirmed and therefore it is not operable or in use. Therefore the Project will not impact on the use of GW060750.

Confirmation that the project would discharge saline water via the Hunter River Salinity Trading Scheme (HRSTS) discharge point currently managed by Wambo and details of how this arrangement would be implemented.

We confirm that the Project proposes to use Wambo's discharge facilities and that no changes are proposed to these existing facilities as part of the Project.

The water management system for the Project will be integrated with the existing water management system at Wambo mine, with water managed across the combined United and Wambo mining complex.

If required, controlled discharges to Wollombi Brook will occur in accordance with Wambo's EPL and the Hunter River Salinity Trading Scheme (HRSTS).

Water Management Plan should include a Trigger Action Response Plan to determine when rehabilitation measures may be required.

The Water Management Plan for the Project will be developed in consultation with DPI Water. United commits that the Water Management Plan will include a Trigger Action Response Plan (TARP) for both surface water and groundwater and that the TARPs will identify when rehabilitation measures may be required.

The TARPs outlined in the Water Management Plan that United has committed to prepare will work by triggering a response by United with the triggers set at a level that is designed to generate this response prior to any harm occurring to the environment. When a trigger occurs (e.g. through an event such as an elevated monitoring result or a dam reaching full capacity) a response would be put in place. This may include actions such as diverting water flows, pumping water to another holding location, water treatment or similar, or it may be a trigger for a more detailed investigation of why a trigger has occurred (e.g. further monitoring or review of a part of the WMS performance with actions to be determined as an outcome of these further investigations). The TARP process will include identifying actions required to prevent environment harm, which may include rehabilitation measures, as required.

Pit lake volumes and predicted annual evaporative loss

For the proposed revised final voids modelled as part of this report, **Table 2.5** provides a summary of the average stored water volume and evaporation rate at equilibrium.

Table 2.5 Estimated Volume and Evaporation at Pit Lake Equilibrium

Final void	Average at Equilibrium	
	Stored Water Volume (ML)	Evaporative Rate (ML/year)
United	41,000	648
Wambo	1,500	244

Premise plan

The proposed premises plan for the initial stage of the Project is shown in **Figure 2.2**. It is noted that the premises plan will change from time to time based on the ongoing progression of the United and Wambo mines.

Provide additional information regarding the details of the proposed clean water separation system including the volumes of water to be diverted

Redbank Creek is an ephemeral fourth order water course that is highly modified due to mining activities and would be intercepted by the proposed United Open Cut. Within the proposed Project Area, Redbank Creek currently flows into United's Dam 1, a by-wash dam which has been designed and licenced to overflow back into Redbank Creek. Dam 1 is proposed to be removed to allow open cut mining to progress in the United Open Cut.

United propose to capture clean water which would otherwise flow into the proposed mining areas in a series of clean water dams designed as part of the Water Management System (WMS) as described in the EIS and where possible pump the clean water back into Redbank Creek downstream of the United Open Cut via a pipeline around the mining operation. The water will be discharged into an energy dissipating structure that will be designed in accordance with the *HEC-14 Hydraulic Design of Energy Dissipaters for Culverts and Channels* guideline to minimise any erosion associated with the water re-entering Redbank Creek. Further scour protection will be implemented as required downstream of the energy dissipating structure. In preference to the extraction of clean water under licence from Wollombi Brook, clean water will also be pumped to Wambo Box Cut MIA Dam (refer to Figure 6.14 of the EIS) for use in the Wambo Underground operation.

The largest total clean water catchment that could be pumped around the mining area within Redbank Creek during the Project, based on the conceptual WMS, is approximately 423 hectares in Year 2. Based on 100 per cent capture of runoff at the regional runoff rates (refer to www.farmdamscalculator.dnr.nsw.gov.au) of 0.7 ML/hectare/year, this equates to capture of approximately 296 ML during Year 2 from the Lower Wollombi Water Source.

Clean water proposed to be redirected back into the downstream environment will be tested for water quality and will comply with the Environment Protection Licence (EPL) water quality criteria as approved by the EPA prior to being released.

United have sufficient water licences (WAL18445 and WAL18549) under the Hunter Unregulated and Alluvial Water Sources 2009 Water Sharing Plan to account for this capture of water.

Provide metering information relating to WAL 18437

Water extraction under WAL 18437 is reported in Wambo's Annual Review. The Wambo Annual Review can be accessed on the Peabody website.

The average extraction associated with WAL 18437 between 2012 and 2016 was 291.4 ML. During 2016 a total of 271 ML was extracted.

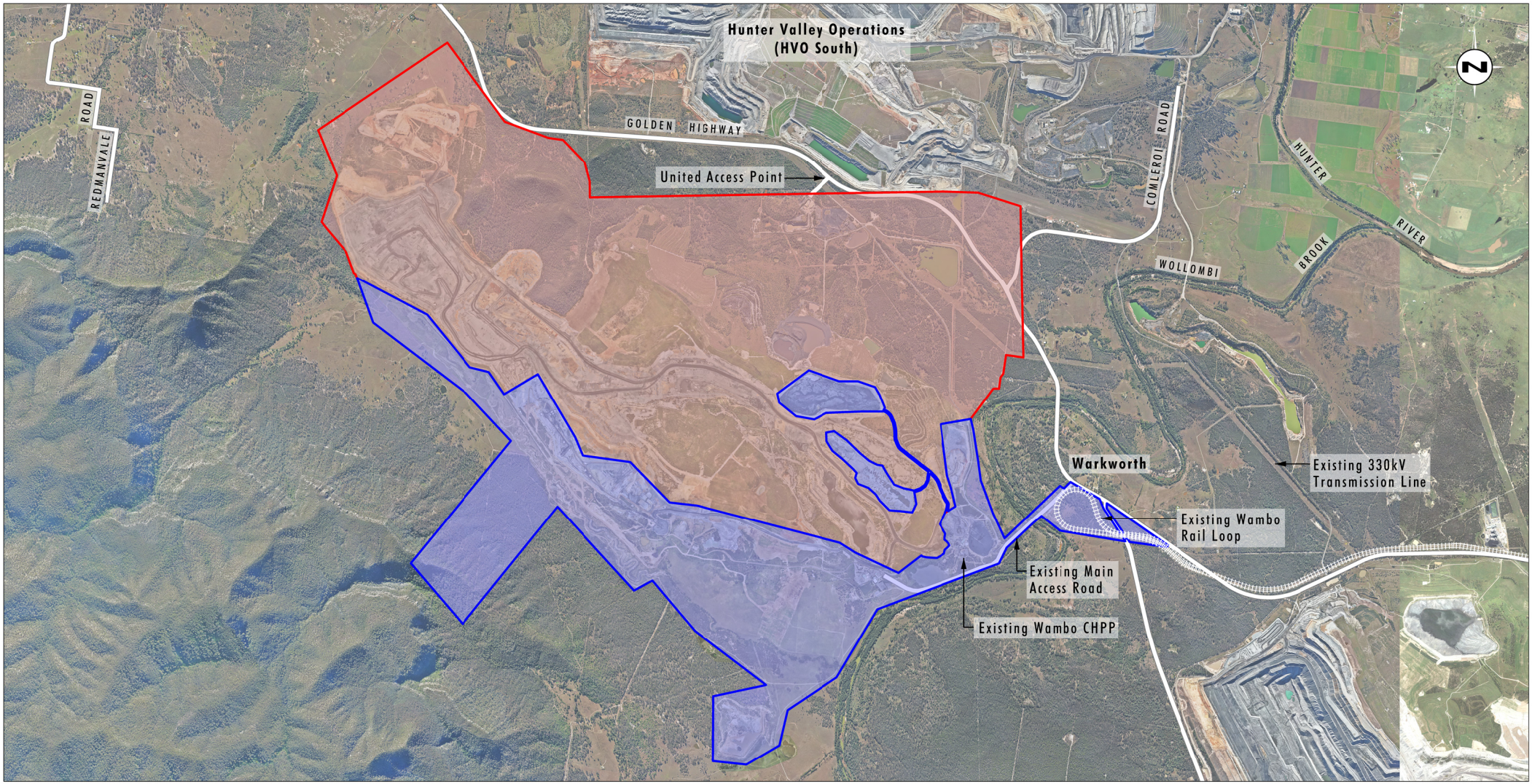

Image Source: AAM (2012), United (2016)
Data Source: Glencore (2017)

0 1.0 2.0 3.0km
1:60 000

Legend

- United EPL Boundary
- Wambo EPL Boundary

FIGURE 2.2

Proposed Premises Plan

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Provide additional information regarding volumetric water extraction requirements associated with the proposed extraction of water from the United underground workings

The maximum amount of water predicted to be extracted from the United underground workings as per the Project water balance completed as part of the EIS is 2122ML in a 12 month period. Glencore has sufficient groundwater licences in the Sydney Basin – North Coast Groundwater Source to account for this water take.

2.5 Heritage

Timing of management measures associated with the Dog-leg fence.

The Heritage Branch commented that the proposed additional research for the Dog-leg fence should occur prior to the harm occurring to clarify and understand the significance of the Dog-leg fence and the suitability or not of the harm proposed to it. As discussed below, it is considered that the proposed management measures for the Dog-leg fence can be appropriately undertaken post approval in accordance with a development consent condition and do not need to be completed to inform the assessment process.

It is noted that the portion of the dog leg fence within the Project Area is not anticipated to be disturbed until approximately Year 11 of the Project, providing ample time for the completion of the proposed mitigation measures prior to any impact to the fence associated with the Project.

Although the condition of the Dog-leg fence has been assessed as being poor, the Dog-leg fence was assessed to be of State significance as it is a unique example of a rare and endangered type of fence. A detailed assessment of the fence was undertaken as part of the Heritage Impact Statement including obtaining expert advice from a heritage fence specialist. The additional research proposed as a management measures was proposed to gain greater information about the fence, if possible. This information is proposed to be gathered as part of mitigating the impact to the fence and is not considered necessary to inform the assessment of impact.

United has committed to:

- undertaking detailed recording of the fence following OEH guidelines within two years of approval
- undertaking additional research as part of the detailed recording to gain more information (if available) about the history of the fence
- develop and implement an interpretation strategy for the Dog-leg fence.

Due to the nature of the Dog-leg fence and the susceptibility to damage, detailed recording of the full length of both sections of the Dog-leg fence is considered the only practicable option. Recording the full surviving alignment of the Dog-leg, including the section located outside the Project Area, will ensure all surviving physical aspects of the fence are identified and documented prior to any disturbance as a result of the Project or everyday natural threats such as bush fires, termite attack and decay. The proposed detailed archival recording will ensure that a full understanding and record of the Dog-leg fence will be available for future generations and United commits to undertaking this work within two years of approval which is nine years ahead of the proposed disturbance of the fence.

In addition to the detailed recording, United has committed to the development and implementation of an interpretation strategy for the Dog-leg fence. The interpretation strategy will identify the appropriate approach to convey information about the Dog-leg fence to the community. Creating a permanent interpretation feature at the site is not possible because of the nature of the mine site. However, the stone blocks could be salvaged and combined with logs cut from within the Project Area, when it is cleared as part of site preparation works for the open cut, to reconstruct a section of Dog-leg fence. There is also the opportunity for interpretive signage which would provide opportunities to highlight the heritage significance in a way that the general community can identify with.

The location of the proposed reconstruction could, if practicable, be at the entrance to the mine site or within a community space / park in Jerrys Plains or Warkworth. Consultation will be undertaken with the community, local historical society and Singleton Council when preparing the interpretation strategy for the Dog-leg fence.

Further details on the archaeological excavation of the former House site.

The Heritage Division on behalf of the Heritage Council have requested further details on the documentation of the proposed fieldwork for the Former House Site in a final archaeological report and who would be nominated with the professional experience to direct this activity.

United has committed to the following management measures for the Former House Site:

- Prior to the commencement of works that impact on this site, including ground preparation/clearing works, archaeological investigation of the Former House Site will be undertaken to relevant professional standards
- An archaeological methodology and research design will be prepared and submitted to the Heritage Division for approval prior to works progressing on site (as part of the Heritage Management Plan).

The methodology and research design is proposed to be prepared in consultation with the Heritage Division prior to works progressing on site and United would be comfortable with a condition of consent which requires this consultation to be undertaken.

The nominated professional to complete this work will be subject to a tender process which has not been completed at the time of drafting this report. To date, Tim Adams, Principal Archaeologist Umwelt, has been providing advice on heritage components for the Project. Tim meets the Heritage Division/Heritage Council Archaeological Excavation Director criteria and has demonstrated experience in all aspects of historical archaeological excavation of both state and locally significant sites, including as on-call archaeologist during construction programs.

United will ensure that an appropriately qualified and experienced consultant will be engaged to undertake this work.

Heritage significance of the shearing shed and creamery.

The Heritage Division have indicated that the RTS did not investigate and report on the potential for archaeological relics to be present at the Shearing Shed and Creamery sites and how to manage the resource.

The Historic Heritage Assessment did not identify that archaeological relics were expected at the Shearing Shed and Creamery sites. However, it did commit to a management measure that if they were identified, they would be appropriately investigated and managed. This is a cautious approach as a contingency measure for any unexpected finds.

The site was assessed as being at most of local significance, primarily based on its social significance due to being visible structure located at the junction of two roads. Should there be any archaeological relics, the research undertaken as part of the Historic Heritage Assessment has identified that consistent with the significance of the standing structures they would be at most, of local significance.

United will commit to undertaking further investigations of the potential for relics as a mitigation measure prior to any disturbance of the site, to ensure any relevant heritage values are recorded. Based on the significance of the site as being at most local significance it is considered these works can be appropriately undertaken as a pre-disturbance mitigation measure and are not required to inform the assessment of the Project.

This site has been recorded as part of the preparation of the Historic Heritage Assessment. The photographic record is considered to be a sufficient record of the site.

Management and condition of the Montrose Property.

The Heritage Division has indicated that the ongoing management of the Montrose Property is a requirement of the Wambo Open Cut project, irrespective of ownership and irrespective of approval of the Project. They also noted that the last assessment of this property's condition was conducted fourteen years ago, in 2003.

The Montrose Property is located to the northwest of the Project Area approximately 750 metres from proposed extension to the northwest corner of the approved Wambo Open Cut. The Montrose Property has no statutory listing and has previously been assessed as having local significance (Umwelt, 2016).

It is noted that mining at Wambo is ongoing and that the Project will not involve mining any closer to the Montrose Property than the currently approved Wambo mine.

United notes the Heritage Division's request for an updated condition assessment of the property and commits to undertaking a structural assessment of the property prior to any blasting associated with the Project.

The Montrose Property, and in particular the Shearing Shed, may be susceptible to damage from ground vibration. As a result, United has committed to photographic/archival recording of the shearing shed in accordance with Heritage Division, OEH guidelines Photographic Recording of Heritage Items Using Film or Digital Capture (2006) prior to any blasting being undertaken as part of the Project that may exceed 5mm/s.

The photographic record in the Historic Heritage Assessment is considered to be a sufficient record of the main house on the Montrose Property.

2.6 Transport

Provide an update on consultation undertaken with RMS regarding the proposed realignment of the Golden Highway.

United has been in consultation with RMS regarding the realignment of the Golden Highway since July 2015. Design commencement meetings were held with RMS in May and September 2017, RMS is currently reviewing its internal Works Authority Deed process to allow for consultation on the detailed design phase.

2.7 Rehabilitation and Final Landform

Further information has been requested in relation to the proposed final landform and post-mining land uses. In particular, DPE has requested discussion on opportunities to improve the final landform and rehabilitation outcomes for the site. A discussion of the proposed land use and final landform is discussed below followed by specific responses to further issues raised in the DPE correspondence.

Land use

The proposed final land use for the Project Area is predominantly biodiversity conservation with small areas of agriculture at suitable locations within the Project Area with better topography, soil and access to water. As discussed below, the proposed final land use is driven by three key factors:

- meeting Wambo's existing rehabilitation commitment, including those of the Wambo EPBC Act approval
- providing an area of ecological rehabilitation as part of the biodiversity offset strategy for the Project and to re-establish key ecological communities that will be impacted by the Project
- with the balance of the land, providing areas of agricultural land in response to community feedback.

The indicative final voids, final landform and land use were presented to DRG and Singleton Council and were the subject of a community workshop. The feedback from these stakeholder engagement processes influenced the final landform considerations and the closure commitments. This included feedback on aspects such as:

- the balance between biodiversity offset requirements, woodland areas and land for agricultural purposes as part of the final land use and revegetation plan
- the desire to minimise the number and size of the final voids, where practicable
- the desire for the incorporation of natural landform design principles into the design of the final landform for the Project.

The approach to the completion of the final landform/revegetation strategy involves the revegetation of the site into three broad categories:

- ecological rehabilitation (woodland conforming to the CHVEFW CEEC as part of the biodiversity offset strategy for the Project and to provide ecosystem functions in the rehabilitated landscape)
- grassland with pockets of woodland vegetation
- agricultural pasture land.

The proposed base case mine closure strategy for the Project has been developed in consideration of the opportunities and constraints associated with the existing local and regional environment, input from the community and government stakeholders, and operational considerations. The proposed rehabilitation strategy also aligns with key commitments previously agreed through the approval of Wambo and United.

A minimum of approximately 878 hectares of ecological rehabilitation, including approximately 620 hectares of CHVEFW CEEC, and a further approximately 1570 hectares of native open woodland vegetation will be established in the rehabilitated landform. The commitment to reinstate at least 620 hectares of CHVEFW CEEC is directly related to the additional ecological impacts associated with the Project. The establishment of approximately 1570 hectares of additional native open woodland vegetation maintains the existing rehabilitation commitments under the Wambo Development Project approval under the EPBC Act (EPBC 2003/1138). In all, approximately 2450 hectares of native woodland (approximately 80 per cent of the total Project Area) will be established in the rehabilitated landform.

The rehabilitated area will provide native vegetation corridors linking surrounding remnant vegetation areas, including future vegetation areas planned on rehabilitated mining land to the north and east. Key linkages will include:

- from the Wollemi National Park through the Project Area to the proposed native rehabilitation areas of HVO South mine to the north
- to the northeast of the Project Area, through to the proposed native rehabilitation area of the Warkworth mine
- to the southeast of the Project Area.

In response to the community request for provision of agricultural land as part of the final land use, areas of agricultural land are proposed for the north western portion of the site in the area where better quality soils, including a small area of BSAL, has been recorded. Agricultural land is also proposed for the southwestern portion of the site near North Wambo Creek and adjacent to existing agricultural land to the west of the site boundary.

The proposed final land use for the Project Area has been developed in consideration of a number of factors, including Wambo's existing development consent conditions and commitments, the existing land capability and feedback from the community. The existing land capability across the Project Area is generally moderate to moderate-low and not suitable for certain land uses and has limitations for agricultural use. Based on the existing land capability, the Project Area is suited to grazing, some horticulture, forestry or nature conservation land uses. These existing land capabilities have been considered in the development of the final land use which includes nature conservation and agricultural uses. Agricultural uses have been prioritised for area of better classes of land that can sustain such activities without resulting in degradation of the land.

Native vegetation and conservation land uses with some areas of agriculture were considered the most suitable final land use for the Project Area based on the need to meet existing commitments and the compatibility of ecological rehabilitation with the site conditions.

It is also noted that the final landform will retain a number of small dams and drainage lines developed following natural landform principles that will retain water. As a result, the final landform will have water available for agricultural purposes or for utilisation by fauna as required. Agricultural pursuits and fauna will not be reliant on the water within the final voids.

Final Land Form and Voids

Several different mine plan options were considered for the Project. A key determining factor in the selection of the final Project mine plan was that it resulted in an improved final landform outcome across the United and Wambo mining areas compared to some of the other options considered. Some of the options considered resulted in an additional final void, while others resulted in poor final landform outcomes. In particular, some of the final landform options considered resulted in a higher emplacement area at United with little assimilation of this landform with the approved final landform at Wambo, with a large un-natural valley occurring between the United and Wambo open cut areas. This resulted in a lack of landform integration across the United and Wambo mining areas and a subsequent landform that was un-natural looking and did not blend in well with the surrounding landscape.

Detailed consideration was given to the final void outcomes for the Project. United investigated the option of having no final void or a single final void but found that this would make the Project uneconomic.

The existing Wambo Open Cut mine plan is approved to retain two final voids. The Project adds another mining area and therefore had the potential to add another void from the United Open Cut; however, the Project has been designed to restrict the number of final voids to two, reducing the number of voids at Wambo to one. The Joint Venture arrangement between United and Wambo allowed this outcome, otherwise there may have been three final voids. The retention of a void within each open cut mining area at completion of the Project was determined by United to be necessary from a Project viability perspective as mining further to join the voids was not economic and as discussed below, refilling the voids was also found to be uneconomic. A selection of the key final void options considered is provided in **Table 2.6**.

The groundwater assessment also determined that with a final void in place, the voids would act as a long-term groundwater sink reducing the discharge of poorer quality water from the coal seam aquifers into the Wollombi Brook. This discharge occurred prior to mining and contributes poor quality water into the Brook. With a void in place this groundwater would instead seep into the void and while it results in a loss of some groundwater flow into the Wollombi Brook alluvium, this loss is of higher salinity water with the void acting as a long term salt sink. The salt would accumulate into the void over time but not be released into the surrounding environment.

Table 2.6 Final Void Options Considered

Final Void Option	Description	Determination
No void(s)	Rehandling material from the overburden emplacement areas (or sourcing additional fill material) to fill voids.	Not selected – it was determined that this option was not economically viable. Cost estimates to fill both voids are in the order of $450million. United identified that this would be cost prohibitive to the Project and if this option was pursued the Project would not be economically viable.
Three final voids	Retain the two approved final voids at Wambo with an additional final void at United.	Not selected – Mine planning determined that it was feasible to design the Project to reduce the number of final voids to two which was considered a better outcome.
Back filling one final void to leave only one void	Rehandling material from the overburden emplacement areas back into a void.	Not selected – It was determined that this activity would incur prohibitive costs such that it would affect the overall viability of the Project. Cost estimates to fill the Wambo void is in the order of $120million. This is considered cost prohibitive to the Project and if this option was pursued the Project would not be economically viable.
Two final voids with United void near Wollombi Brook	Two final voids, one at Wambo and one at United. United final void located at the southernmost end of the mining area near Wollombi Brook.	Not selected – Concern about risk of long-term stability due to proximity and potential connectivity to Wollombi Brook.
Two final voids, with United void at western end of proposed open cut	Two final voids, one at Wambo and one at United. Mining in United undertaken from east to west with final void furthest away from Wollombi Brook.	Selected – Mine planning provides for an integrated final landform and final voids located in appropriate positions for rehabilitation and long term landform stability.

Based on these considerations, it was determined by United that the Project could be designed to maintain the number of voids at two, but that designing the final landform to result in one or no final voids was not feasible. Cost estimates to fill both voids are in the order of $450 million and approximately $120 million to fill the Wambo void. United identified that this would be cost prohibitive to the Project and if this option was pursued the Project would not be economically viable.

Treatment and use of voids

Following United's determination that final voids are necessary to allow the Project to be economically viable, United focussed on the design of the voids, committing to designing them to be safe, stable, non-polluting and sustainable. These overarching commitments are further described as:

- Safe – associated with safe access and egress into pits by people and animals, and in the case of specific water quality issues, related to safe access and use of that water (in the pit void).
- Stable – associated with the risk of geotechnical wall failures, slips and similar mass movement or high erosion rates.
- Non-polluting – associated with geochemical risks and water quality impacts on important aquifers, creeks or surrounding ecosystems. The baseline and existing condition of the receiving waters is to be considered when determining acceptable water quality standards.
- Sustainable – associated with the ability to remain a stable system that supports some stabilising vegetation cover (where planned) and can satisfy the desired outcomes of safety, stability or that of not polluting into the future.

United has established several design principles which will be applied to the final voids developed as part of the Project. These criteria build on United's overall commitment to make the voids safe, stable, non-polluting and sustainable. The design principles include:

- slopes within zones of weathered strata and final slopes of emplaced materials will be battered to achieve final slopes of 9 to 18 degrees
- highwalls will have slopes between 63.5 and 80 degrees
- regardless of the above slope criteria, all final void rock slope angles will be determined by geotechnical investigations to ensure they are safe and stable
- highwall bench widths of 10 to 20 metres
- within the void, overburden will be placed against all exposed coal seams including those that will ultimately be covered by water within the void
- a safety berm will be established along the top of each highwall
- the safety berm and associated drainage will be designed to prevent runoff flowing over the face of the highwall
- the void slopes and highwall benches will be revegetated
- final internal corners of the mine highwalls are proposed to be rounded in areas above the final predicted water level to provide a more natural, less geometric form to the void sides.

The proposed use of the final voids is as a long-term salinity sink. The voids will prevent saline discharge to the surrounding natural environment. As a long-term salinity sink that does not spill to the environment, the final voids will eventually become hypersaline. It is acknowledged that ultimately the portion of the void containing the saline water will be unlikely to be suitable for other uses. As discussed in the following sections, the void water will be useable for more than 500 years as salinity will remain substantially below the salinity of seawater after 500 years.

Further to this, United was requested as part of the RTS to discuss other uses for voids and such discussion of options was included. It should be noted that the proposed use of the final voids is as described above, that is a long-term salinity sink located within a native vegetation and biodiversity conservation area, and that other optional uses are not proposed as part of the Project.

United commits to undertake further investigations to determine whether there are additional potential uses for the final voids which may provide a commercial opportunity for the voids. One such opportunity is the installation of a pumped-storage hydroelectricity generation facility. The proposed location and nature of the final voids, that is, the close proximity and elevation differences, provides a potential opportunity for such an installation. The feasibility of such an undertaking will be investigated during the life of the Project.

Updated Final Void Water and Salinity Balance Modelling

Questions have been raised regarding the predicted salinity of the final voids for the Project. In particular, questions regarding the Wambo void which was predicted in the EIS to reach hyper-salinity relatively quickly. In response to these questions further work has been undertaken on final void salinity with the results discussed below.

It is noted that the Wambo void will be an outcome of the approved mining at Wambo and will occur in a similar location to that planned for the Project regardless of whether or not the Project proceeds. Therefore, the issues raised in relation to the Wambo final void will occur regardless of whether or not the Project proceeds. Based on the additional work on final void options outlined later in this section, the Project provides an opportunity to improve the final void outcomes and water quality and United is committed to investigate and implement suitable options.

In response to the queries regarding final void water quality, the Project's water balance specialist Hydro Engineering and Consulting (HEC) has undertaken a review of the previous final void modelling it completed for the EIS and has confirmed that the original model contained a number of overly conservative salinity assumptions which resulted in unrealistically high modelled salinity in the Wambo void after 500 years. Following this review, HEC focussed on improving the accuracy of the predicted salinity by undertaking more detailed modelling of the final voids. The outcomes of this revised modelling are provided in **Appendix 3** with a summary provided below.

The revised modelling indicates a significantly lower salinity level in the Wambo void after 500 years and also a reduction in the United void salinity level. Given the extent of change, United commissioned a third party technical peer review of the updated modelling to confirm if it was accurate and completed in accordance with industry standards. This review was undertaken by Andrew Vitale, Principal Water Resources Engineer at Engeny Water Management and is provided in **Appendix 4**. The technical peer review indicated that the original EIS final void model was resulting in unrealistically high long term salt concentrations in the final voids and concluded in regard to the revised modelling that:

- *The revised final void modelling has been performed using current industry practice methods for final void modelling.*

- *Input data and assumptions used for the development of the revised final void model are reasonable, fit for purpose and based on the best information available at the current time.*

- *The revised final void modelling results and trends are reasonable and make physical sense based on the assumptions and data used for the modelling.*

- *An independent verification of the revised final void modelling results has been performed and indicates that the water and salt balance calculations have been correctly implemented within the final void model.*

In addition to being a more complex model with more accurate inputs related to factors such as catchment runoff salinity, the updated final void modelling has also incorporated changes to the void designs and catchments resulting from changes to the final landform that have been proposed as part of the RTS process. The key changes made to the model are outlined in **Table 2.7**.

Table 2.7 Changes to Salinity Balance Modelling

Change	Justification for Change	Why not Originally Included	Resultant Change in Salinity
Categorise surface water inflows into the voids into groupings that more accurately represent the expected catchment makeup and allocate salinity levels for each category of inflow	The previous model was based on a simplistic assumption where a consistent salinity was applied to all surface water falling onto or flowing into the void. The original salinity value was 4000 mg/L based on salinity values monitored in minewater at Wambo. This was a very conservative assumption as this value is based on an active mine and this level of salinity is not expected in runoff from a rehabilitated catchment such as would occur for the final void. It is also noted that this salinity level was applied to all water, including rainfall falling directly into the void (which would be fresh water) and runoff from natural catchments areas which will not be affected by mining showing that this was a very coarse and unrealistic assumption. The revised modelling splits catchment runoff into several different categories (e.g. rainfall falling directly into the void, rainfall falling on rock on void walls, rainfall on rehabilitated catchment, rainfall on natural catchment) and applies a salinity level to each category based on monitoring results from these landform categories at the site and on the results of geochemical testing. The range of salinities applied is discussed in **Appendix 3**. These new modelling inputs are more accurate.	The original model contained overly simplistic and highly conservative assumptions. These more detailed categorisations could have, and should have, been included but were not, resulting in a more 'coarse' modelling outcome.	United void salinity decreased by approximately 22,000mg/L. Wambo void salinity decreased by approximately 286,000mg/L.

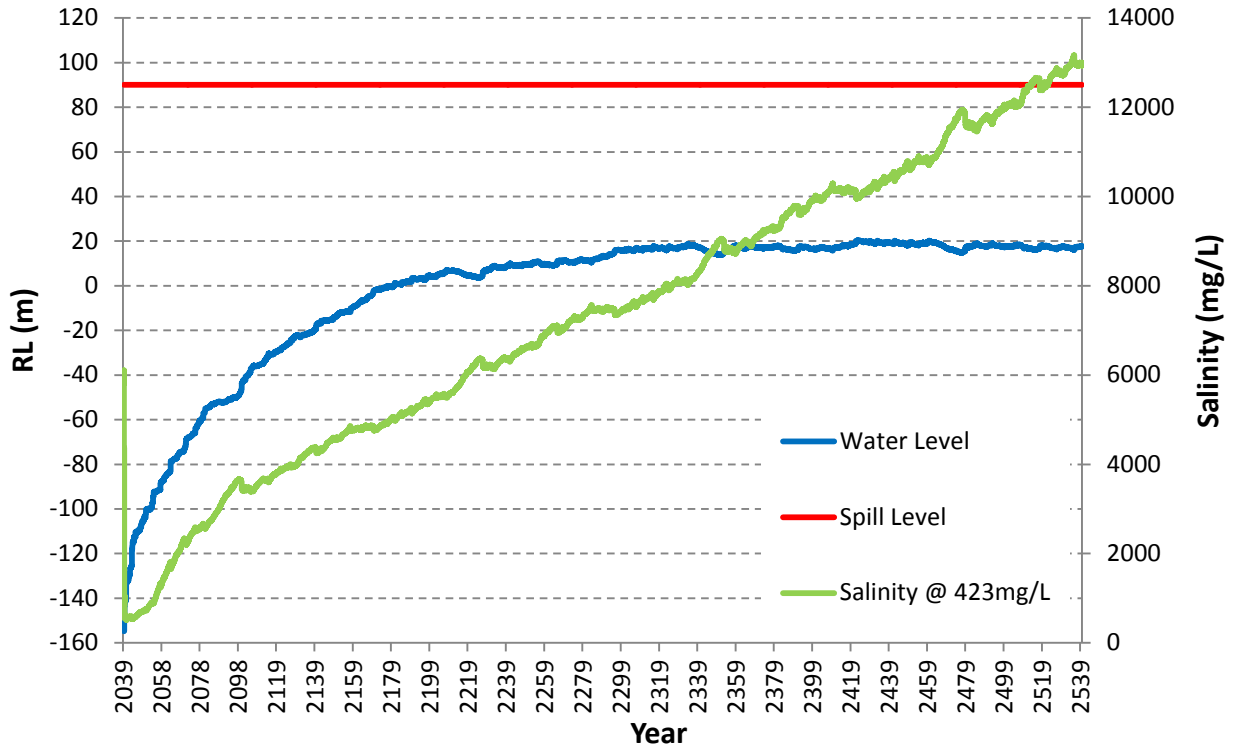
Change	Justification for Change	Why not Originally Included	Resultant Change in Salinity
Revised final void catchments and final void designs	The catchments for the final voids have been updated as these changed with the changes in design of the final landform and voids as part of the response to submissions and request for additional information. The designs of the final voids have been modified since the EIS to have more rounded corners and other changes based on feedback on the concept designs provided in the EIS. These modifications have changed the void water storage characteristics (volume to surface area etc.) which have resulted in minor changes to final void water level and salinity outcomes.	The landform and void designs have changed since the EIS based on stakeholder input so could not have been included at EIS stage.	No substantive change to United void salinity. Wambo void salinity increased by approximately 4,000mg/L.
Varied evaporative loss over time as salinity increases	The evaporative loss over time has been varied as salinity increases based on formulas derived to account for the effect of salinity on evaporation.	This is a more accurate representation of what is predicted to occur but only makes a minor change to the overall result and thus was not included in the original model.	No substantive change to United void salinity. Wambo void decreased by approximately 1,000mg/L.

Based on this revised modelling, the final void water levels and quality have been re-predicted. This updated modelling has identified that the level of salinity in both final voids after 500 years will be less than that predicted in the EIS, substantially so for the Wambo void, being:

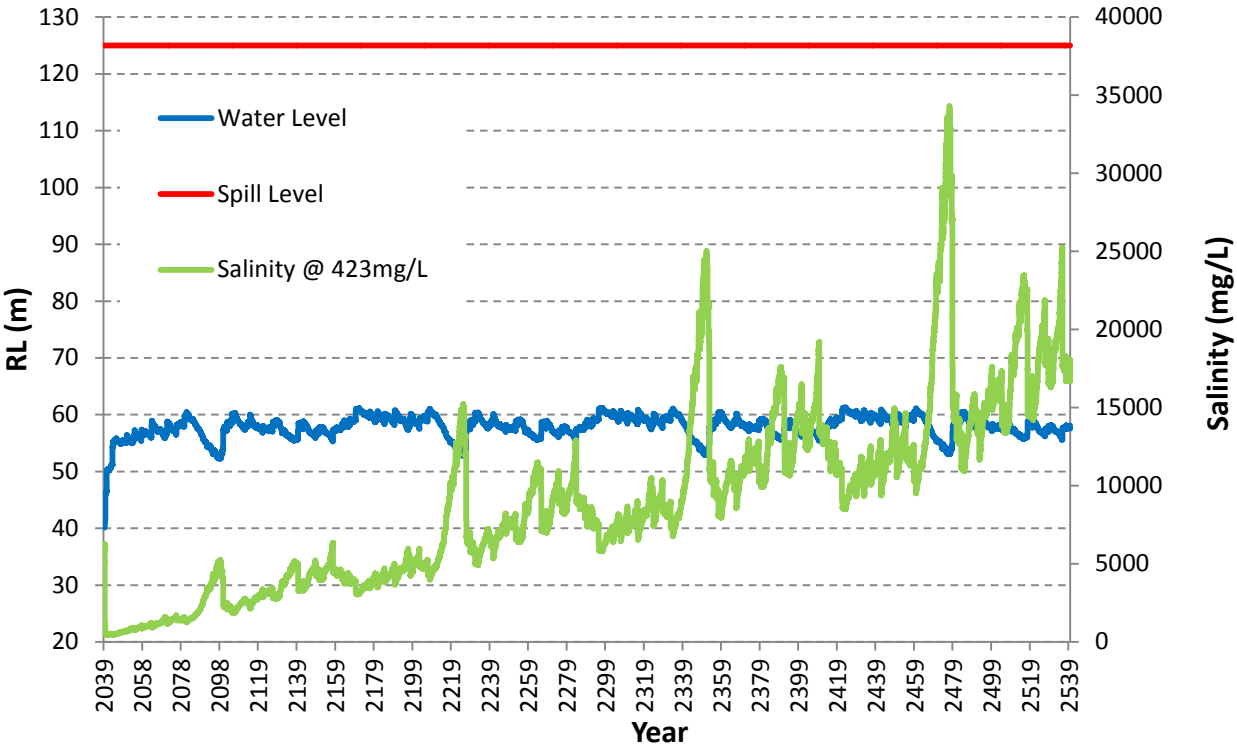
- final void salinity in the United void of approximately 13,000mg/L after 500 years
- final void salinity in the Wambo void of approximately 17,000mg/L after 500 years.

The EIS predicted that the United and Wambo void salinity would be approximately 35,000mg/L and 300,000mg/L, respectively. By way of comparison, the salinity of seawater is approximately 35,000mg/L. As can be seen in the revised results, the predicted salinity in the Wambo void has significantly reduced, while it has approximately halved in the United void. As discussed above, the original HEC final void modelling has been identified as providing unrealistically high salinity levels after 500 years and the revised modelling, which has been subject to technical peer review, provides a more accurate prediction of void salinity.

The results of the revised modelling are presented in **Graphs 1** and **2**. The spikes in salinity in **Graph 2** are the result of drought periods where there is higher evaporation and reduced rainfall. Historical rainfall data was used in the simulation which is why the spikes in the graph are consistently spaced.



Graph 1 United final void water and salinity balance



Graph 2 Wambo final void water and salinity balance

As shown in **Table 2.8**, the predicted final void salinities for the Project are broadly consistent with those predicted for other approved mining operations in the Hunter Valley.

Table 2.8 Final void salinity of other Hunter Valley mining operations

Mine	Salinity Level	Specified Timing
Mount Owen	North Pit - 6,000mg/L Bayswater North – 500mg/L	500 years
Warkworth	19,200 mg/L	1,000 years
Bengalla	12,800 mg/L	1,000 years
HVO South	12,800 mg/L	Not specified
Rixs Creek	20,000 mg/L	2,000 years

Note: Levels taken from relevant Surface Water Assessment, EIS or RTS documentation.

Alternative Final Void Options Analysis

As discussed above, the Project proposes two final voids, one at Wambo and one at United. The Project proposed long term sinks to minimise catchment reporting to the voids which maximises return of water to the natural system. Having voids as long term sinks will result in salt capture which will ultimately become hypersaline over time, however, it is noted that the water quality in both voids is predicted to be approximately half that of seawater after 500 years. As discussed above the Wambo void will be an outcome of the approved mining at Wambo and will occur in a similar location to that planned for the Project regardless of whether or not the Project proceeds.

In response to the issues raised in relation to final voids, United has identified and evaluated a number of conceptual options to reduce the salinity levels in the final voids. The options considered water quality outcomes, landform structural integrity and stability outcomes, and the environmental and social impacts of the options, including downstream impacts.

Based on the revised, and more accurate, final void salinity modelling completed for the Project and discussed above, the predicted salinity levels in the final void are now much lower. Based on these lower salinities, although a range of options have been investigated and are discussed below, United proposes to maintain the final voids as long-term salinity sinks. As discussed at the end of the options analysis, United will continue to consider alternative final void outcomes as part of the ongoing detailed mine and closure planning process over the life of the mine.

The final void options considered are outlined in **Table 2.9** along with a discussion on the potential advantages and disadvantages associated with each of the options identified as potentially being feasible. There were also some options that were considered by United but found not to be feasible. These options are also discussed in **Table 2.9**, with an outline of why they are not feasible.

Table 2.9 Void options analysis

Void Options Analysis	
Base Case: Voids acting as long-term salinity sinks	
United Assessment Outcome	• This option is feasible and was the option proposed in the EIS.
Description	• Voids designed as long-term salinity sinks with minimised clean water catchments, maximising return of runoff from final landform to natural drainage system.
Void Level and Salinity	• United void: o Equilibrium water level of approximately 18m RL, approximately 71m below spill level o Final void salinity of approximately 13,000mg/L after 500 years o Void does not spill • Wambo void: o Equilibrium water level of approximately 58m RL, approximately 67m below spill level o Final void salinity of approximately 17,000mg/L after 500 years o Void does not spill
Advantages	• Provides long-term salt sink, with groundwater reporting to the United void and the voids containing the salt. Prevents discharge of saline groundwater to Wollombi Brook or other natural drainage lines. • Minimised clean water catchments for the voids, maximising runoff to the surrounding natural environment and minimising loss of runoff to saline void.
Disadvantages	• As long-term salt sinks, the water bodies in the voids will ultimately have limited uses.
Comments	• The United and Wambo voids maintain a salinity of less than sea water for more than 500 years making them available for a range of uses (e.g. aquaculture) and providing ability to provide some biodiversity habitat for this period. As a long-term salt sink, the voids will ultimately become hyper-saline.

Void Options Analysis	
Option 1 (A, B and C): Increasing catchment areas reporting to the final void(s)	
United Assessment Outcome	• This option is feasible.
Description	• 3 options: 1A: Increase the catchment area reporting to the United void only 1B: Increase the catchment area reporting to the Wambo void only 1C: Increase the catchment area reporting to both voids • Seeks to improve void water quality in medium to long term through increased surface water inflow. • Option 1A o Additional catchment of 3.1 km^2 added to the United final void – total catchment of 6.7 km^2 (originally 3.6km^2). The increase in void catchment results in an equivalent loss of catchment to the Hunter River catchment. • Option 1B o Additional catchment of 1.8 km^2 added to the Wambo final void – total catchment of 4.6 km^2 (originally 2.8 km^2). The increase in void catchment results in an equivalent loss of catchment to the Hunter River catchment. • Option 1C – both of the above increases with total additional catchment of 4.9 km^2 added resulting in catchment of 11.3km^2.
Effect on Void Level and Salinity	• Would increase the water levels in both voids due to increased surface water inflows. • Salinity would likely decrease in the voids in the medium term as there would be additional surface water inflows from rehabilitated catchments, however, this decrease has not been quantified. As the voids are long-term sinks the water would ultimately end up hypersaline. • Average 340 ML/year additional runoff to the voids based on the increased catchments (154 ML/year Wambo void and 186 ML/year United void)
Advantages	• Reduced void water salinity after 500 years than for the base case.
Disadvantages	• Increased catchment runoff reporting the void would result in loss of catchment to the surrounding environment. This loss would be in-perpetuity as the voids would not spill and therefore would be a long-term sink. The loss of water from the Hunter River would be on average 340 ML/year. • Increased long-term water licencing requirements (or retirement) to cater for increased take of water from the catchment. • Landform would be less 'natural looking' as much of it would not drain to the natural surrounding drainage system. • As voids would remain long-term sinks, the salinity would increase over time and the water in the voids would ultimately become hyper-saline, although the timeframe for this to occur would likely be increased compared to the base case.
Comments	• Substantive landform changes would be required to redesign the overburden emplacement areas to drain into the voids.

Void Options Analysis	
Option 2: Same catchments as Base Case but final voids connected to allow them to equilibrate	
United Assessment Outcome	• This option is not feasible. • This option was investigated when the salinity in the Wambo void was much higher than that in the United void. Connecting the two voids would equilibrate the salinity levels in the voids. As the predicted salinity levels after 500 years are now similar, this option is no longer beneficial.
Description & Intended Outcome	• A pipeline or channel (or other similar connection) constructed between the two voids at the low point of the Wambo void (approximately RL 35m) to a similar level in the United void. • Water levels and salinity levels would equilibrate between the two voids. As noted above, as the salinity levels in the two voids are now predicted to be similar, this outcome is no longer beneficial. • Voids do not spill so remain a long term sink. • The pipeline could be replaced with a channel (significant landform implications) or placement of coarse spoil between the two voids allowing seepage between the voids.
Reasons Not Feasible	• Establishing a safe, stable and in-perpetuity subsurface connection between the two voids is not considered to be feasible. There is a high cost and significant risk of failure in the long terms due to failure of the connection due to issues such as pipeline collapse or blockage. A commitment for a pipeline connection to work in perpetuity would not be able to be made due to this high risk of failure. • Public safety risk due to the leaving of an open pipe or drain in the landform in perpetuity. Although safety measures such as steel bars to block access could be included, a commitment could not be made that these would work in-perpetuity as these controls could fail over time. Also such safety controls would likely contribute to blocking of the pipeline entrance with debris over time, again contributing to pipeline failure. • Constructing a channel would have significant landform impact and affect long-term stability due to depth of channel. To construct this channel in a manner that met United's commitment to developing a safe, stable and natural looking final landform would require extensive changes to the proposed final landform and would result in significant increases to the height of overburden emplacement areas (or footprint of emplacement areas or both) to accommodate the overburden emplacement needs of the Project. • As the voids do not spill, they will become hyper-saline and therefore the risks and additional costs above do not change the long-term outcomes.

Void Options Analysis	
Option 3: Increased catchments as per Option 1 and final voids connected to allow them to equilibrate	
United Assessment Outcome	• This option is not feasible for the same reasons as Option 2.
Description & Intended Outcome	• Seeks to improve void water quality in medium to long term through increased surface water inflow and connection of voids to allow them to equilibrate. • A connection would be established between the two final voids as per Option 2. • Increased catchments as per Option 1. • Voids do not spill so remain a long term sink.
Reasons Not Feasible	• Same as for Option 2.
Option 4: Increasing catchment areas reporting to the final voids and directing North Wambo Creek flows above a given threshold into the Wambo void, establishing a connection between the two voids to allow flow of water and with spill occurring from the United void to Wollombi Brook	
United Assessment Outcome	• This option is not feasible.
Description & Intended Outcome	• A fill and spill concept with the two voids connected. Route water from North Wambo Creek through the voids to provide for eventual spill into Redbank Creek, creating a lake system. • Increased void catchments and connection of the two voids as per Option 3. • Constructing a stable channel connecting North Wambo Creek to the Wambo final void to allow high flows to be directed into the Wambo void. • Constructing a stable overflow path for spill from the United final void to Redbank Creek and then Wollombi Brook.
Reasons Not Feasible	• Same as for Option 2 in regard to connecting the two voids to provide for filling and flow-through of water. • Public safety risk due to the leaving of an open pipe or drain in the landform in perpetuity. • Option 4 would have implications for the proposed final landform. Significant changes to the proposed mine plan and final landform would be required in order to accommodate the required channels and ensure the final landform with these channels was safe and stable. This would result in a less favourable landform, including higher elevations and less micro-relief features and would likely significantly constrain mine design. As discussed above, to construct a connecting channel in accordance with United's landform design commitments would result in significant increases to the height of overburden emplacement areas (or footprint of emplacement areas or both) to accommodate the overburden emplacement needs of the Project. • To fill voids would require majority (80-90%) of North Wambo Creek flow for approximately 85-100 years resulting in significant loss of flow in downstream sections of North Wambo Creek. Also significant water licencing requirements. • Significant landform changes required and risks to long-term stability due to channel from North Wambo Creek to Wambo void.
Comments	• Salt that would otherwise be captured within the final void (if a long-term sink) would be exported.

Void Options Analysis	
Option 5: Increasing catchment areas reporting to the final United void and construction of a flood flow channel to direct flood flows from Wollombi Brook into United void. Wambo void would remain long-term sink	
United Assessment Outcome	• This option is potentially feasible but would require further consideration from a safety, environmental and engineering feasibility perspective, along with stakeholder engagement to assess desirability.
Description & Intended Outcome	• 'Fill and spill' concept involving directing a portion of flood flows from Wollombi Brook into the United void via an overland flow established to the void and with removal of the flood protection levee that will be in place during the operational life of the mine. • Increased catchment for United void to allow for spilling from the void once it has been filled by flood flows from Wollombi Brook. • Wambo void would operate as a long-term sink.
Advantages	• Fill and spill option for the United void would maintain water quality at a better quality allowing the void lake to be used for a wide variety of uses and having higher ecological values. • The United void would not become hyper-saline. • Filling of the void would occur from catchment runoff and flood flows. Take of water during flood flows would not result in adverse impacts on downstream water users but could assist in mitigating flood peaks depending on the volume taken.
Disadvantages	• Further work would be required to confirm the engineering and safety feasibility and desirability of capturing flood flow from Wollombi Brook in the United void. • Uncertainty of United void filling timeframe as it would rely on flood flows. • Increased catchment runoff reporting to the void would result in loss of catchment to the surrounding environment until the United void is full and spills. The loss of water from the Hunter River due to the increased catchment of the United void prior to it reaching fill and spill would be on average 186 ML/year. There would also be some loss of water from the Wollombi Brook flood flow, however, this is not considered significant as it would only occur during flood flow events and would not adversely impact downstream water users. • Increased long-term water licencing requirements (or retirement) to cater for increased take of water from the catchment. • Salt that would otherwise be captured within the United void (if a long-term sink) would be exported.
Comments	• If pursued further and if found to be feasible from an engineering perspective, the environmental and social impacts associated with this option would require further assessment. This work could be completed as part of the detailed closure planning for the Project.

Based on the above assessment of final void options, United has identified that two options are feasible and one option is potentially feasible:

- feasible - both voids as long-term sinks as proposed in the EIS (proposed option)
- feasible - both voids as long-term sinks with larger catchments than proposed in the EIS resulting in improved water quality in the medium to long-term prior to the voids ultimately reaching hyper-salinity. This option could be to increase the catchment of either void or both depending on the outcomes sought (not proposed – alternative option)
- potentially feasible – maintaining the Wambo void as a long-term sink and having the United void fill using flood flows from Wollombi Brook and ultimately having a fill a spill solution for the United void (not proposed – alternate option).

As discussed above, based on the revised, and more accurate, final void salinity modelling completed for the Project which predicts lower salinities United proposes to maintain the final voids as long-term salinity sinks as outlined in the base case. United also commits to further investigate the above three options, along with any other viable options that are identified during the life of the Project as part of a detailed final landform and final void strategy for the Project. This strategy would be prepared as part of the initial MOP for the Project and then updated over the life of the Project so that it is responsive to any changes in the mining operation.

As part of developing the detailed final landform and final void strategy, United would consult further with key agencies and the community to establish their views on the feasible options for the Project. The final strategy would be developed five years before the planned end of mine life of the Project and would inform the detailed closure strategy.

Opportunities to improve final landform and rehabilitation outcomes for the site to create a safe, stable and natural looking final landform.

One of the key features of the Project was establishing a final landform that is safe, stable and sustainable. United has committed to implementing an approach to the design and development of the final landform for the Project to achieve a more natural looking and functioning landform. United has committed that the final landform will be designed to:

- be safe, stable and non-polluting
- incorporate micro relief
- incorporate drainage lines consistent with topography and natural drainage where reasonable and feasible
- sustain the intended land use for the post-mining domains
- minimise the visual impacts of the development
- be in keeping with the natural terrain features of the area
- be integrated with the rehabilitated landforms of surrounding mines where practicable.

Discussion on the proposed final landform and rehabilitation outcomes are outlined in detail above. United has committed to the use of natural landform design principles as part of rehabilitation of the mine. Further discussion on the revised final landform, including integration of micro-relief principals and a revised conceptual final landform addressing stakeholder feedback on the Project is provided in a subsequent response.

Economic considerations and implications of final void options.

The potential void options considered for the Project are outlined in **Table 2.4**. The review of void options included consideration of a number of factors, including:

- operational constraints
- environmental outcomes
- social impacts and opportunities
- economic outcomes.

Based on these considerations, it was determined by United that the Project could be designed to maintain the number of voids in the United and Wambo open cut area at two as currently approved for the Wambo mine, but that designing the final landform to result in one or no final voids was not feasible. Cost estimates to fill both voids are in the order of $450 million and approximately $120 million to fill the Wambo void. United identified that this would be cost prohibitive to the Project and if this option was pursued the Project would not be economically viable.

As discussed above, the voids are proposed as long-term salinity sinks to contain salt and present the release of this salt into the surrounding environment.

Ecological value outcomes of hyper-saline final void waters and post-mining land uses of voids retained on site.

The RTS does not claim that the hyper-saline final void waters would support “high ecological value outcomes”. The reference was made in regards to the United void which was assessed in the EIS as reaching salinity broadly consistent with seawater after approximately 500 years. As discussed above, the revised final void modelling has found that the voids will have salinity levels of approximately 17,000 mg/L (Wambo) and 13,000 mg/L (United) which is well below seawater.

It is acknowledged that hyper-saline voids will have limited ecological value and that ultimately based on the proposed strategy of having voids that are long-term salinity sinks, the voids will ultimately be hypersaline. Ecological value is not the objective of voids, rather the availability of the voids for use by a range of species over the 500 years (or more) post mining may assist in mitigating impacts of the voids.

Voids with salinity up to comparable to seawater may provide ecological value in terms of habitat for migratory bird species and aquaculture. Final voids can provide habitat for a number of common water bird species. Species known to regularly utilise large open waterbodies locally include pacific black duck (*Anas superciliosa*), chestnut teal (*Anas castanea*), grey teal (*Anas gracilis*), Australian wood duck (*Chenonetta jubata*), Australasian grebe (*Tachybaptus novaehollandiae*), hoary-headed grebe (*Poliocephalus poliocephalus*), Eurasian coot (*Fulica atra*), hardhead (*Aythya australis*) and musk duck (*Biziura lobata*). Large, deep, open waterbodies also provide drought refuge habitat for inland deep-diving duck species including threatened species such as the blue-billed duck (*Oxyura australis*) and the freckled duck (*Stictonetta naevosa*). Both of these species occur in the Hunter region during inland drought conditions

and have been recorded in other artificial waterbodies including Lake Liddell. Where the waterbody also contains fringing vegetation and shallow banks, other bird species including crakes, swamphen and snipes can also utilise these habitats.

United commits to further investigate the potential to stock the United void with suitable fish species that could also provide an ecological value outcome. As discussed above, the United void has a predicted salinity of approximately 13,000mg/L after approximately 500 years (based on the proposed design and void treatment) and could provide suitable habitat for a range of species over this period. This could include salt tolerant species such as golden perch (*Macquaria ambigua*), Australian bass (*Percalates novemaculeata*), estuary perch (*Percalates colonorum*), eel-tailed catfish (*Tandanus* tandanus) and longfinned eel (*Anguilla reinhardtii*). Additional species of fish may be suitable for stocking during the initial post mining phase when salinity levels are much lower. The introduction of organisms, such as crustaceans (shrimp and yabbies) and other macroinvertebrates, to provide a food source for the fish would also be beneficial. Suitable investigations will be undertaken prior to mine closure.

Justification for reinstating Class 3-5 land and soil capabilities to much lower Class 6-8 land and soil capabilities

The EIS contained an assessment of the land and soil capability of the conceptual additional disturbance area (that is, the area of additional disturbance resulting from the Project). As requested by DPE, the land and soil capability discussion provided in the RTS related to the entirety of the Project Area. The RTS assessment includes the Wambo Open Cut which is approved for disturbance and has an approved rehabilitation plan. The impact on this area is not a result of the Project as this area has already been approved for disturbance and a significant portion has been mined at the date of this report. To provide context on the incremental change on land and soil capability resulting from the Project, further information is provided below to respond to the DPE query. As the entirety of the Project Area will not be disturbed, the results provided in **Table 2.10** are focussed on the area that is currently approved for disturbance (the approved Wambo disturbance area) and that additional area proposed for disturbance (the conceptual additional disturbance area for the Project).

Table 2.10 provides the pre-mining and currently approved land and soil classification within the approved Wambo disturbance area and conceptual additional disturbance area for the Project, based on regional mapping. This is then compared to the indicative post closure land and soil classification with the Project, providing an analysis of the incremental impacts resulting from the Project.

It is noted that the pre-mining regional mapping is not currently an accurate representation of the existing land and soil capability across the Project Area as the area has been highly modified due to historical land uses.

Table 2.10 Assessment of incremental LSC change due to the Project

LSC Class	Pre mining	Post Closure		
	Pre mining Present within Wambo disturbance area and additional disturbance area (based on regional mapping)	Current Approved Indicative considering Wambo approved disturbance – No Project	Indicative Post Closure – Project Case	LSC Class Change from Current Approved to Project Case
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)				
1	0 hectares	0 hectares	0 hectares	0 hectares
2	0 hectares	0 hectares	0 hectares	0 hectares

LSC Class	Pre mining	Post Closure		
	Pre mining Present within Wambo disturbance area and additional disturbance area (based on regional mapping)	Current Approved Indicative considering Wambo approved disturbance – No Project	Indicative Post Closure – Project Case	LSC Class Change from Current Approved to Project Case
3	Approximately 12.4 hectares	11.2 hectares	Approximately 12.4 hectares	Approximately +1.2 hectares
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)				
4	Approximately 598.1 hectares	Approximately 57.7 hectares	Approximately 54.4 hectares	Approximately -3.3 hectares
5	Approximately 1807.0 hectares	Approximately 1414.6 hectares	Approximately 1251.0 hectares	Approximately -163.6 hectares
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)				
6	Approximately 91.4 hectares	Approximately 1239.7 hectares	Approximately 1362.8 hectares	Approximately +123.1 hectares
Land generally incapable of agricultural land use (selective forestry and nature conservation)				
7	Approximately 248.5 hectares	0.6 hectares	0 hectares	Approximately -0.6 hectares
8	0 hectares	Approximately 33.0 hectares*	Approximately 40.1 hectares*	Approximately +7.1 hectares*

* Void areas

The Project has sought to minimalise the incremental change to land and soil capability from the existing approved situation. Approximately 12.4 hectares of Class 3 land is proposed to be disturbed by either the existing Wambo operations or the Project. As a result of the comments received, United commit to no net loss of high capability land (Class 1 to 3) as a result of the Project. Approximately 12.4 hectares of Class 3 land will therefore be included in the rehabilitation strategy. There is also minimal change (-3.3 hectares) to Class 4 land.

As shown in **Table 2.10**, there will be a reduction in Class 5 land and a corresponding increase in Class 6 land. Given the proposed final land use of the majority of the land as native vegetation, the change from Class 5 to Class 6 is not considered as significant change.

United will continue to refine the post mining land and soil capability as part of the detailed rehabilitation planning process. The outcome of this detailed planning process will be detailed in the MOP to be prepared and approved by DRG.

Optimising final land use opportunities through overburden and topsoil management, including justification for any area that would not be returned to a land use capability comparable with the pre-mining environment.

Further discussion on the land and soil capability is provided above, including an assessment of the incremental change due to the Project. The Project has attempted to replicate existing land and soil capability as far as practicable, with no significant changes to higher class land and soil capabilities (class 1-4). There will be an overall reduction in Class 5 land and increase in Class 6 land. This decrease will occur in

lower land and soil capability classes which already have severe limitations for agricultural uses. As noted above, these areas are proposed for native vegetation and the proposed land and soil capability class is considered appropriate for this proposed land use.

Topsoil is limited across most of the Project Area as the Project Area has been highly modified due to historical land uses. United will recover and maximise reuse of available topsoil across the Project Area. Since the EIS was exhibited, further studies of available topsoil resources has been completed by United to gain an understanding of the soil resources present on site with the intent of determining topsoil and stripping depths and material quality and availability for post mining rehabilitation phases. This information will be considered in detailed mine and rehabilitation planning to maximise recovery of suitable topsoil for reuse to maximise post mining land and soil capability.

Detailed final landform maps incorporating micro-relief, and hydrologically and geomorphologically designed landform features.

United's proposed process for the implementation of the conceptual final landform will utilise a natural landform design incorporating micro-relief principles. The process will be undertaken as part of the detailed mine planning process completed through MOPs for the operation. The key objectives of such an approach will include:

- the drainage density of the final landform is to reflect the nature of the drainage patterns in surrounding landforms
- steeper slopes are to be located higher in the catchment (that is, where water flows are smallest), with slope gradients flattening out downstream
- drainage lines will have both channel and floodplain components to provide stability during frequent flood events
- gentle flow transitions which emulate natural transitions and maintain a balance between scour risk and sediment load.

The micro-relief design process also results in a more natural looking landform, which reduces the visual impact of the final landform. The detailed design of the natural landform will be developed progressively as part of the detailed mine planning process and will be included in the staged rehabilitation plans in the MOP. The progressive development of micro-relief in the landform as part of the progressive detailed mine planning process is necessary to ensure that overburden material is efficiently handled and the drainage system of the rehabilitated final landform works effectively as part of the mine water management system.

United has committed to the use of natural landform design principles as part of rehabilitation of the mine. **Figure 2.3** presents a conceptual final landform for the Project incorporating micro-relief design features. This conceptual final landform will continue to be refined over the life of the Project to respond to geological conditions and detailed mine planning; however, the natural landform design principles will be applied to any refinements to the final landform.

Location of woodland community types to be reinstated across the site, including consideration of how these communities align with the reinstated topography.

The conceptual location of woodland community types to be reinstated across the site is presented in **Figure 2.4**. The conceptual plan considers the proposed final landform, including topography.

Opportunities and constraints to the feasibility of potential future land uses.

The proposed final land use is native woodland areas with areas of agricultural use. The existing commitments to revegetation from the Wambo mine development consent are being maintained as well as utilising mine rehabilitation for offsetting requirements. The substantial commitments to revegetation and conservation limit the potential future land uses, with the remaining areas proposed for agricultural land in response to community input which requested prioritisation of agricultural land where practical, possible and sustainable.

The proposed future land uses are considered achievable with current technology and are considered to have a high likelihood of being successfully achieved.

Building on the proposed future land uses, there are a range of other potential land uses that may be compatible. These may include more intensive agricultural land uses in the proposed agricultural land use areas, and activities such as active recreational uses (e.g. mountain bike, hiking etc.) in native vegetation areas. As it is conducive to the proposed final land use, United commits to including features to allow for active recreational uses such as hiking / bike trails and picnic areas within the land landform.

In regard to further potential recreational uses, as discussed above, United commits to further investigate the potential to stock the United void with suitable fish species that could also provide recreational fishing opportunities.

United also commits to further investigating supplementary post mining land uses, including potential uses for the final voids, as part of developing the detailed closure plan for the mine. As discussed above, this may include the installation of a pumped-storage hydroelectricity generation facility.

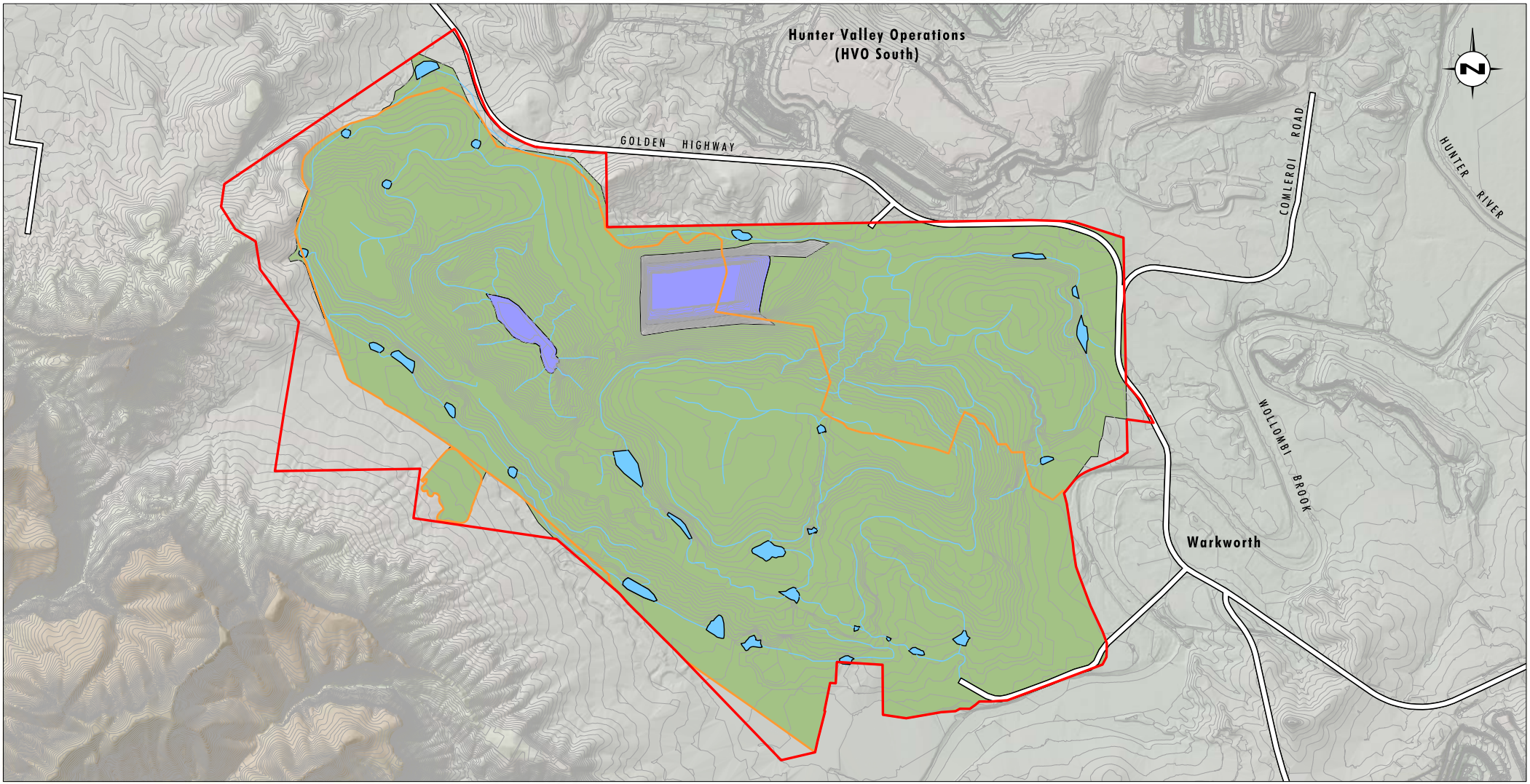


Image Source: United LiDAR (2015)
Data Source: Glencore (2015)
Note: Contour Interval 5m

0 1.0 2.0 2.5km
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Legend

- Project Area
- Approved Wambo Surface Development Area
- Rehabilitation
- Final Void

FIGURE 2.3

Conceptual Micro-relief Final Landform

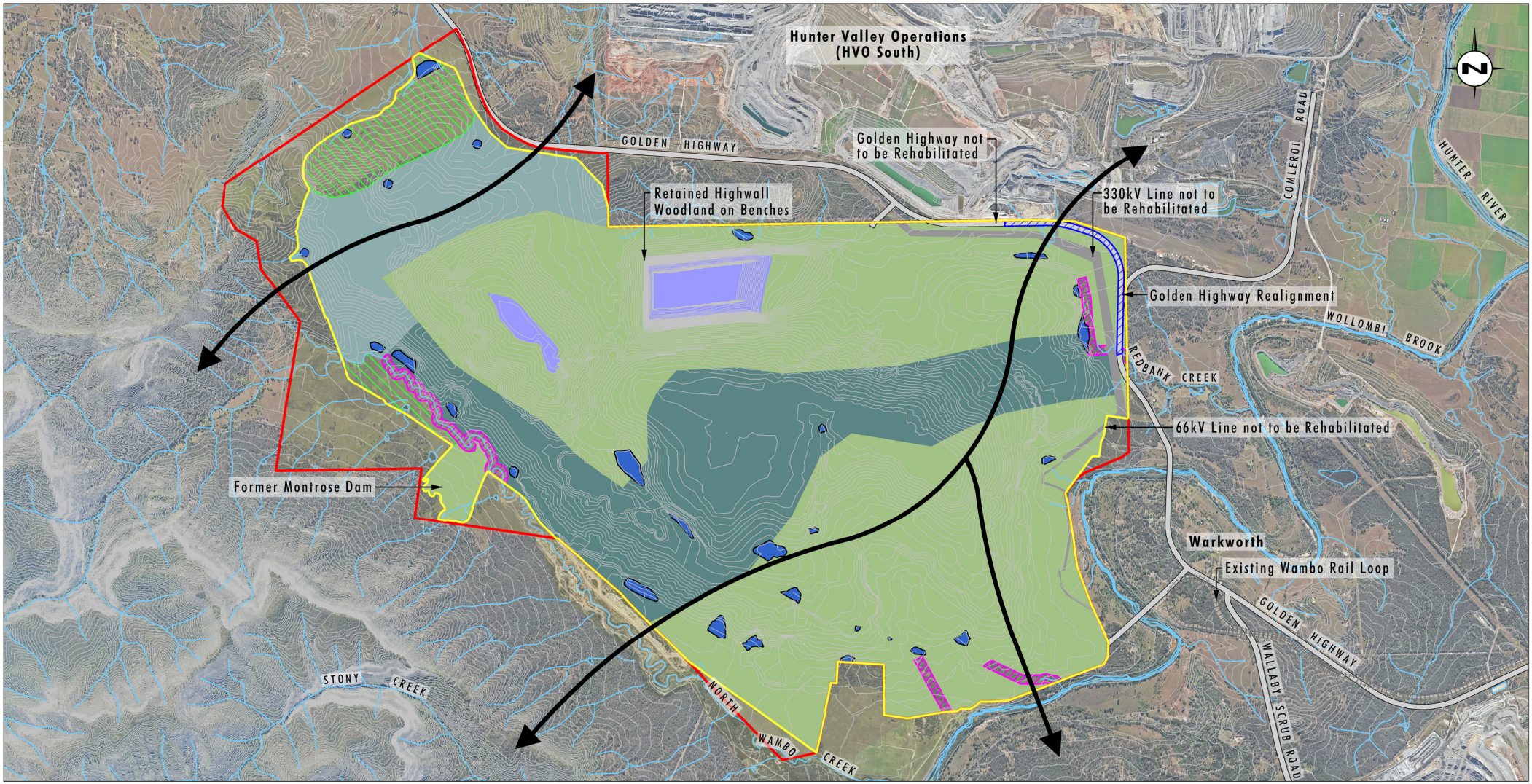

Image Source: AAM (2012), United (2015)
Base Data Source: Glencore (2015), LPI (2009)
Note: Contour Interval 10m

0 1.0 2.0 2.5km
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Legend

- Project Area
- Conceptual Rehabilitation Area
- Habitat Corridors (existing and proposed vegetation)
- Riparian Vegetation
- Grassland (Agricultural)
- HU905 - Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter conforming to *Central Hunter Valley Eucalypt Forest and Woodland CEEC*
- HU906 - Bull Oak grassy woodland of the central Hunter Valley
- Woodland/Open Woodland

FIGURE 2.4

Conceptual Ecological Mine Rehabilitation

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2.8 Interaction with Coal and Allied Operations

Interaction and potential impacts of proposed Golden Highway realignment and transmission line relocation with Coal and Allied's approved operations.

United has been in consultation with Coal and Allied (HVO South) since 2014 regarding the proposed Project and the potential impact on HVO South's approved mine plan. It is noted that HVO South's 2008 Approval had approved development within United Coal Lease CCL775 and on land owned by the United Joint Venture. HVO South's Modification 5 Development Application submitted in February 2017 does not propose development within CCL775 or on land owned by the United Joint Venture. Potential interaction between the Project and HVO South with regard to the location of infrastructure associated with the Project has been the subject of ongoing consultation and can be effectively managed as part of the Project. Key considerations include:

- United will reinstate access to the current access road that HVO South uses as part of constructing the realignment of the Golden Highway
- the route of the proposed Golden Highway realignment has considered the approved and proposed HVO South operations and maintained appropriate separation distances. It is noted that the separation distance between the HVO South mining area and the realigned highway will be no closer than HVO South currently mines from the existing highway
- As outlined in the EIS, United has committed to work with HVO South to minimise the frequency of road closures due to blasting.

3.0 Additional Commitments

As a result of submissions received on the RTS, United has committed to additional environmental management and monitoring measures and refined some of the measures outlined in the EIS and RTS. These additional or refined measures are outlined below.

Noise

- United will implement the noise monitoring and compliance assessment process outlined in **Appendix 1**.

Air Quality

- For any new mining equipment purchased for the Project (not including recommissioned equipment) prior to suitable Tier 4 equipment being available, United will specify US Tier 2 engines, where available.
- Purchasing new equipment (not including recommissioned equipment) in accordance with any PRP applied to the Project in relation to Tier 4 engines once this expected PRP is introduced.

Biodiversity

- Should Wambo's proposed underground mining beneath the proposed Wambo offset site be approved, United commits to re-calculating the credits for the Wambo offset site after such undermining has occurred to ensure that the credits generated consider any impacts due to the underground mining. Should the number of credits generated reduce, these credits will be sought and retired using other offsets.
- The preliminary completion criteria outlined in Table 7.14 of the BAR will be updated in consultation with OEH and DRG as part of the development of a Mining Operations Plan (MOP) for the Project. As part of updating and finalising the criteria, United will consider the contemporary best practice guidance on ecological mine rehabilitation available at that point of time, as well as considering any changes in legislation and policy.
- United will retire the biodiversity credit requirements for the Project as outlined in **Table 2.3**.

Water

- The Water Management Plan prepared for the Project will include a Trigger Action Response Plan (TARP) for both surface water and groundwater. The TARPs will identify when rehabilitation measures may be required.

Heritage

- United will commit to undertaking further investigations of the potential for relics at the shearing shed and creamery site as a mitigation measure prior to any disturbance of the site, so that any relevant heritage values are recorded.
- United will undertake a structural assessment of the Montrose Property prior to any blasting associated with the Project.
- The proposed detailed archival recording and other management measures for the Dog-leg fence will be undertaken within two years of approval.
- United will ensure that an appropriately qualified and experienced consultant will be engaged to undertake heritage works for the Project.

Rehabilitation, Final Landform and Land Use

- United commit to no net loss of high capability land (Class 1 to 3) as a result of the Project. Approximately 12.4 hectares of Class 3 land will be included in the rehabilitation strategy.
- United commits to including features to allow for active recreational uses such as hiking / bike trails and picnic areas within the land landform and to investigate the potential to stock the United final void with fish for recreational fishing purposes.
- United commits to further investigating supplementary post mining land uses, including potential uses for the final voids, as part of developing the detailed closure plan for the mine. This will include a review of the potential suitability of the voids to install a pumped-storage hydroelectricity generation facility. United commits to further investigate potentially feasible final void options during the life of the Project as part of preparing a detailed final landform and final void strategy for the Project. This strategy would be prepared as part of the initial MOP for the Project and then updated over the life of the Project so that it is responsive to any changes in the mining operation.

  As part of developing the strategy, United would consult further with key agencies and the community to establish their views on the feasible final void options for the Project. The final strategy would be developed five years before the planned end of mine life of the Project and would inform the detailed closure strategy.

4.0 References

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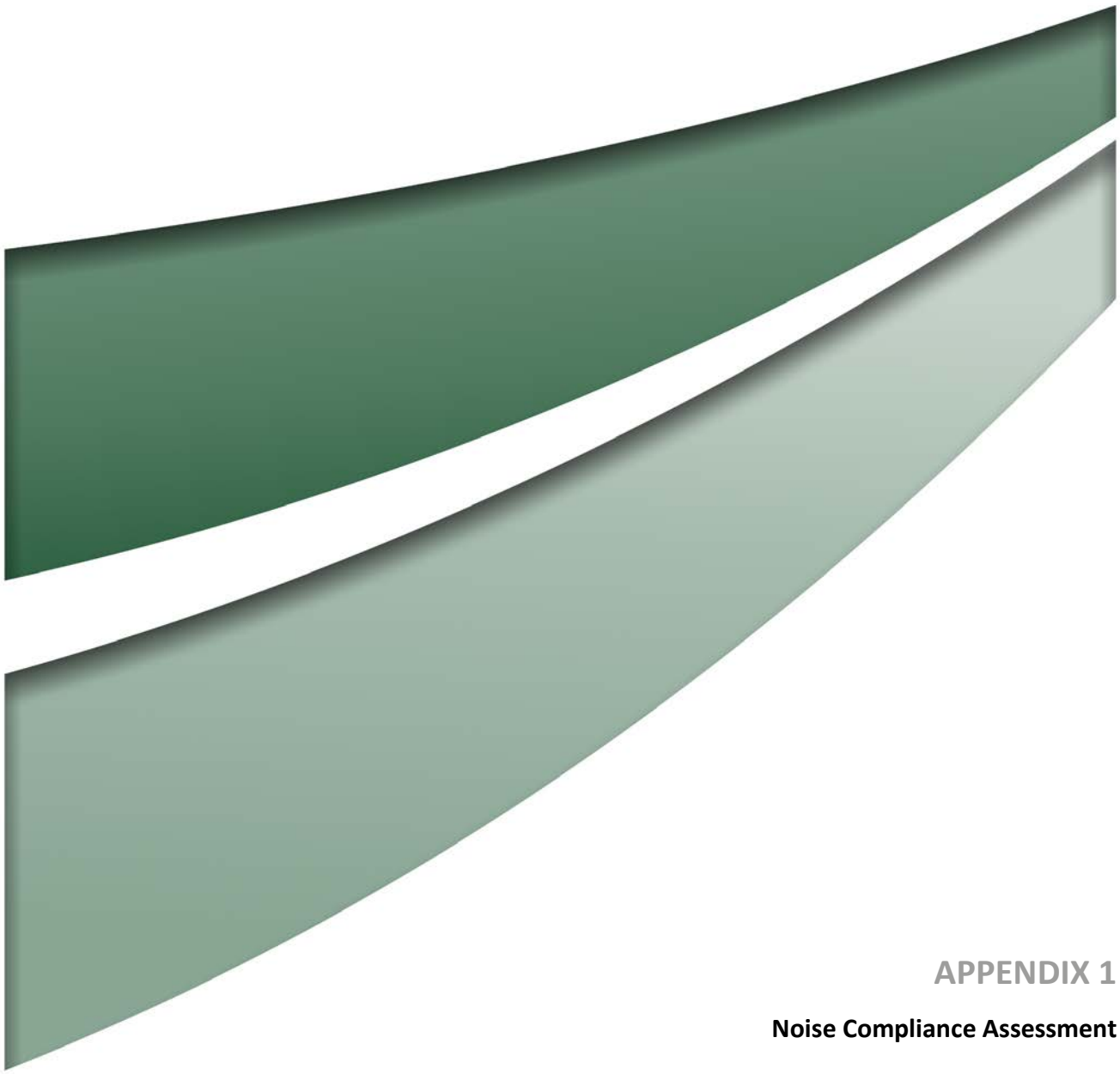
Threatened Species Scientific Committee (TSSC) (2015a). Approved Conservation Advice for Anthochaera phrygia (Regent Honeyeater). Canberra: Department of the Environment.

Threatened Species Scientific Committee (TSSC) (2015b). Approved Conservation Advice for Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community. Canberra: Department of the Environment.



APPENDIX 1

Noise Compliance Assessment

Appendix 1

Two questions have been raised by DPE and EPA with respect to noise:

1. Identification of a robust and enforceable method to monitor noise generated by the joint venture project and the separate Wambo underground, coal handling and processing plant and rail facilities; in a manner which allows straightforward and reliable allocation [of noise] to one project or the other, for regulatory purposes.

2. Confirmation of individual noise contributions from the Project and Wambo Underground.

Section 1.1 addresses question 1 and provides a methodology for the assessment of the noise generated by the Project (the open cut SSD Project) and the Wambo mine incorporating the CHPP, train loading facility and underground mine (including MOD 12).

It is noted that in some locations surrounding the Project the contribution of the Project to the noise environment will be readily discernible as it will be the key industrial noise source, while at some locations the separation of the noise contribution from the Project and Wambo mine will be more challenging as the noise from both mines will appear to be from approximately the same direction. There are also other mining operations in the region surrounding the Project that contribute to the acoustic environment. This situation is not uncommon throughout the Hunter Valley where a number of mine and mining facilities are located proximate to each other.

Section 1.2 addresses question 2 and provides a summary of maximum predicted 10^{th} %ile noise level from the Project and the Wambo mine (incorporating the CHPP, train loading facility and underground mine) as requested by EPA and DPE.

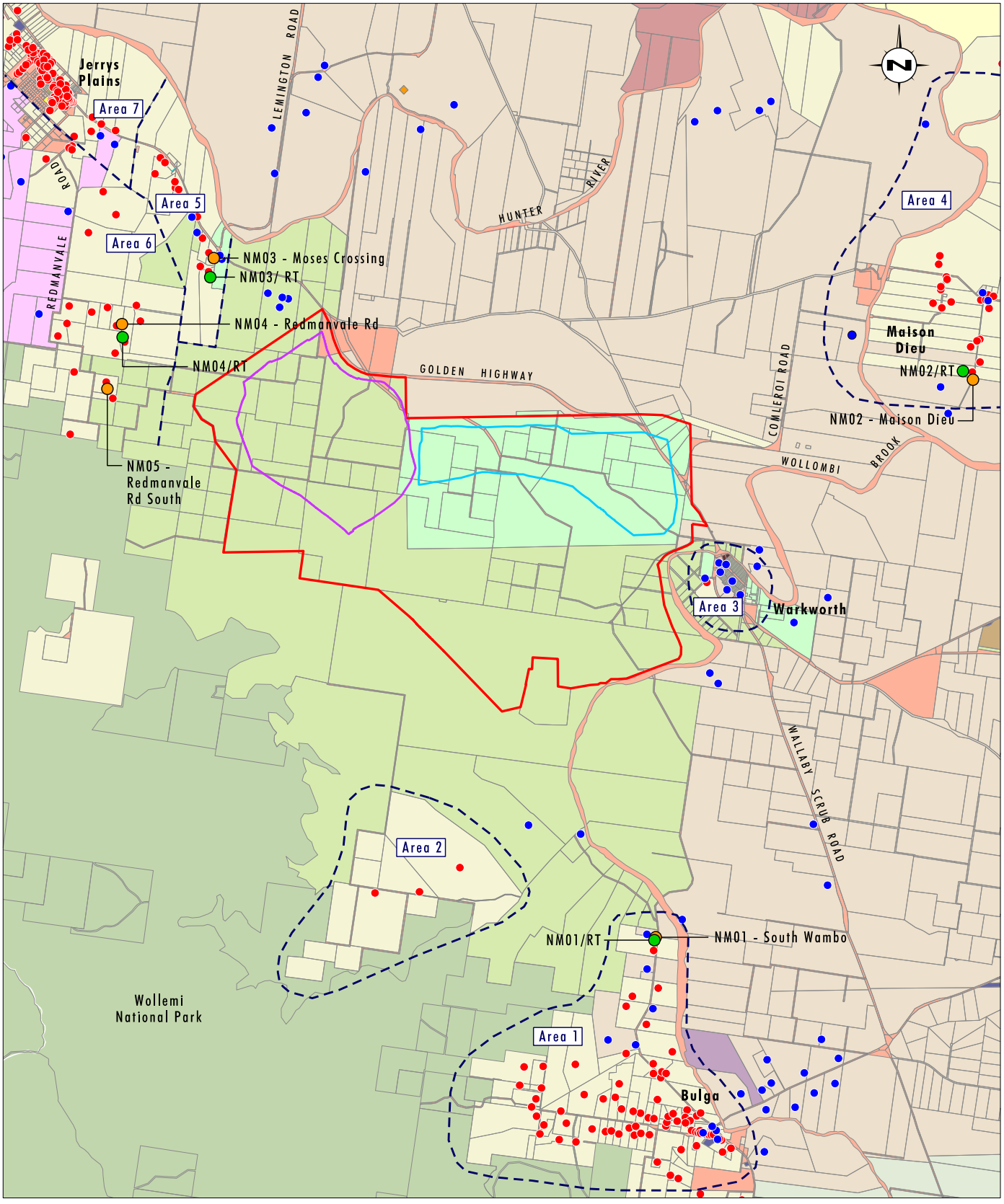
1.1 Noise Compliance Assessment Methodology

The Noise compliance assessment methodology for the Project and Wambo mine will include noise monitoring at key locations in the region surrounding the operations and analysis of the monitoring results for each area according to a set of rules to determine the source of the noise and allocate a noise contribution to the Project and Wambo mine. The proposed compliance monitoring program and the rules to determine source are outlined below.

Proposed Compliance Monitoring

The acoustic environment in the region surrounding the Project and Wambo mine is a combination of multiple noise sources including mining operations, noise from other land uses and noise from the natural environment (e.g. birds and insects). Assessment of compliance with industrial noise limits is based on the measurement of the $L_{Aeq.15minute}$ noise level. In the following discussion, the contributions from the sources of interest (i.e. from the Project and the Wambo mine) are referred to as the intrusive $L_{Aeq.15minute}$ noise level. To assess compliance with Project and Wambo mine noise limits, the intrusive $L_{Aeq.15minute}$ noise level from a source of interest is determined through attended monitoring. The proposed attended monitoring program will include monitoring at sites selected to assess compliance with noise limits in Areas 1, 2, 4, 5, 6 and 7 (refer to **Figure 1**). These areas were identified in the Noise Impact Assessment as being the representative receiver locations surrounding the Project.

It is proposed that compliance noise monitoring will occur at the five (5) representative locations shown on **Figure 1**.



Data Source: LPMA (2009), Department of Natural Resources (2005)

0 1.0 2.0 4.0km
1:90 000

Legend

- Project Area
- Proposed Conceptual United Open Cut Pit
- Proposed Conceptual Wambo Open Cut Realignment
- Receiver Area
- Real-time Monitoring Locations
- Attended Monitoring Locations
- Mine Owned (Ashton)
- Mine Owned (Bulga)
- Mine Owned (Coal and Allied)
- Mine Owned (Doyles Creek)
- Mine Owned (Glencore)
- Mine Owned (Integra)
- Mine Owned (Peabody)
- Mine Owned (Ravensworth)
- Mine Owned (Wambo)
- AGL Energy
- Ausgrid
- Bulga Community Centre
- Government Authority (Federal, State or Local)
- Department of Education and Communities
- Diocese of Newcastle
- Wanaruah Local Aboriginal Land Council
- National Parks and Wildlife Service
- Private
- Redbank Energy
- Singleton Council
- Telstra
- Private Residence
- Mine Owned Residence

FIGURE 1

Receiver Areas and Monitoring Locations

File Name (A4): R22/3509_609.dgn
20170829 11.21

The monitoring will be undertaken monthly for 30 minutes (i.e. two (2) 15 minute interval) during the night time period (between 9pm and 7am with commencing at 9pm approved by the EPA in existing Environment Protection Licences).

It is noted that in addition to this proposed compliance monitoring program the Project will have several real-time noise monitoring locations which will be used as part of the noise performance management program for the Project (refer to **Section 1.2**). As discussed in **Section 1.2**, the data from the real-time noise monitors will be used by the mine operators to manage the mine to minimise noise impacts and may also be used to assist in the interpretation of compliance monitoring results, where relevant. The locations of the real-time noise monitors are shown on **Figure 1**.

The proposed monitoring program will include:

- The monitoring will be based around periods of 15 minute attended noise monitoring at each location for the durations noted above, where the following information will be recorded:
    - name of monitoring personnel
    - monitoring location
    - dates and times that monitoring began and ended at each location
    - height of the microphone above the ground and, if relevant, distances to building facades or property boundaries
    - quantitative meteorological data such as temperature, wind speed (including the measurement height above ground), wind direction and humidity
    - qualitative meteorological information such as cloud cover, fog, rainfall and presence of temperature inversions
    - instrument type and calibration details before and after the monitoring period
    - the $L_{Aeq,15minute}$ noise level for the 15-minute period. This is representative of the total acoustic environment to which the Project and the Wambo mine contribute
    - statistical noise level descriptors over the 15-minute interval: L_{Amin}, L_{A90}, L_{A10}, L_{A1} and L_{Amax}
    - $L_{A1,1minute}$ noise levels (to allow comparison with the relevant sleep disturbance criteria)
    - notes identifying the noise sources that contribute to the maximum noise levels and the overall noise environment or for periods of time when a specific noise source is audible
    - an estimate of the noise contribution from operations at the Project, the Wambo mine or from other identifiable noise sources
    - measurements in one-third octave bands from 25 Hz to 12 kHz inclusive (or a broader range of bands) for the 15-minute interval to assess if any of the noise sources exhibit tonal characteristics that may require application of modifying factors
    - data suitable for assessing the relative contribution of mine-generated noise to the overall noise being measured by using a low-pass (i.e. consideration of frequencies up to and including 630Hz to 1000Hz)

- An assessment of the forecast meteorological conditions so that the attended noise monitoring can be programmed for conditions likely to enhance propagation of noise from the source to the respective receiver locations where these conditions occur in the season and time period being monitored

- The assessment of modification factors (refer to Section 4 of the NSW INP) to be applied to the measured noise levels where relevant. This includes the currently approved method for determining the impact of low frequency noise and the inclusion of a 5 dB correction if the difference between the C-weighted and A-weighted level is 15 dB or more. Where, changes to the approved method are adopted by the EPA, the method for assessing low frequency noise will also be updated to reflect the change in the policy/guideline.

- An estimate of the intrusive $L_{Aeq.15minute}$ noise level attributable to the combined Project and Wambo mine, with an estimate of the intrusive $L_{Aeq.15minute}$ noise level attributed to the Project and the Wambo mine separately.

Determination of Contributions from Each Mine

This section outlines the method that is proposed to be used to determine the contribution to the acoustic environment of the Project and the Wambo mine.

It is anticipated the noise limits for the Project and for the Wambo mine will be set based on the maximum predicted intrusive 10^{th} %ile presented in the table in **Section 1.2**.

As noise from both operations contribute to the acoustic environment there may be times when the summation of the noise from the two operations exceeds the individual project noise limits, but both mines may still be compliant. An example is provided in **Table 1.1**. In this example, both mines are operating in compliance, but the measured industrial noise level is higher than each individual mines noise limit meaning that determination of the contribution of noise from each mine is needed to determine compliance.

Table 1.1 Example of Noise Contribution Analysis

Project Noise		Wambo Mine Noise		Total Measured Industrial Noise Level at Monitoring Location
Limit	Measured	Limit	Measured	
36	35	37	35	38

The upper intrusive noise limit for the combined operations would be equivalent to the summation of the $L_{Aeq.15minute}$ noise limits for each operation. When monitoring in the field, this combined noise limit will be used as a first pass indicator of a compliance issue, as should this combined noise limit be exceeded by industrial noise from the direction of the Project/Wambo mine, it would indicate that one or both mines are exceeding their noise limits.

The following discussion provides a method that that is proposed to be implemented to identify the contribution from each operation to the acoustic environment in Areas 1 to 7 (refer to **Figure 1** for locations). Normally, the estimated attributable intrusive $L_{Aeq.15minute}$ noise level from a source of interest relies on the judgement of an independent acoustician. When assessing a potential non-compliance the acoustician may talk to, or visit the site, to validate the operation of the approved activities. To assist in

this process, it is proposed that a checklist will be used to confirm the activities of both operations at the time of monitoring.

The checklist and associated protocol and metrics used to record surface mining activities, mobile fleet numbers, ancillary fleet numbers, if the CHPP is operating, if the train loading facility is operating and the operation of the underground ventilation system are presented in **Figures 2** and **3**. Initially, this checklist would seek to exclude noise sources from the Wambo mine that are unlikely to be the potential source of any measured non-compliance. As many of the noise sources from the Wambo mine are static (e.g. CHPP, train facility, ventilation facilities etc.) the noise impacts of these sources can be readily defined and have been shown via noise models to allow compliance with the noise limits. There are some Wambo mine noise sources that are dynamic (e.g. number of trucks taking ROM coal to the CHPP) and metrics based on modelled equipment numbers have been developed for these noise sources so that they can be ruled in or out as potential contributors to any exceedance.

Where a noise level is measured that is above the noise limit for the Project or Wambo mine, the checklist shown in **Figure 3** will be used to determine if there is the potential for a non-compliance with the limit due to equipment usage or the failure of noise controls.

Noise Management Plan - Attended Noise Monitoring

Section 1 - Monitoring Results

Date: | Time:

Name: | Location: | Period:

Microphone height: | Distances building facade:

Noise meter calibration: | /property boundary:

Meteorological data:

Temperature: | Wind Speed: at ___ m | Wind Dir.: at ___ m | Humidity:

Cloud cover: /8ths | Fog: | Temp Inv.: | Rain:

Measured Noise Levels

$L_{Aeq,15min}$: | $L_{A90,15min}$: | $L_{A10,15min}$:

$L_{Amin,15min}$: | $L_{Amax,15min}$: | $L_{A1,15min}$:

$L_{Ceq,15min}$: | Estimated Cwt - At for mine noise: | Penalty:

Estimated noise level from the Project and Wambo Mine (ink penalty): $L_{Aeq,15min}$

Section 2 - Assessment Protocol

Q1. Is the estimated noise Level from the Project and Wambo Mine:

1a. Greater than the Project criterion? $L_{Aeq,15min}$: Criterion — Yes / No

1b. Greater than the Wambo Mine criterion? $L_{Aeq,15min}$: Criterion — Yes / No

NO for both operation => Both operations are compliant with respective criterion, no further action

YES for <u>one</u> operation => Review 'Operational Status Checklist' for Operation with lower criterion

YES for <u>both</u> operations => Review 'Operational Status Checklist' for both Operations <u>and</u> go to Q2

Q2. Is the estimated noise level from Project and Wambo Mine greater than the summation of the Project and Wambo Mine criteria?

Summation of $L_{Aeq,15min}$ Criteria : — Yes / No

If YES Q2 => at least one of the operations is non-compliant with respective criteria. Actions to be implemented:

- Inform operations of potential non-compliance
- Confirm 'Operational Status Checklist' with both operations
- Relocate to an intermediate location to observe dominant noise sources
- If required, request strategic relocation of shutdown of observed dominant noise sources
- Re-monitor within 75 minutes

Section 3 - Statement of Compliance

Contribution from the Project

$L_{Aeq,15min}$: | Observed sources:

Criterion:

$L_{A1,1min}$: | Observed sources:

Criterion:

Project Compliant with:

$L_{Aeq,15min}$: Yes / No

$L_{A1,1min}$: Yes / No

Contribution from Wambo Mine (CHPP, train loading facility and underground mine)

$L_{Aeq,15min}$: | Observed sources:

Criterion:

$L_{A1,1min}$: | Observed sources:

Criterion:

Operational Status Checklist

Operational Status Wambo Mine

Operating

Equipment Description	Activity	approx 2019	approx 2023	approx 2028	Year _____
CHPP	Running	✓	✓	✓	Running Yes/No
ROM Loader	Running	1	1	1	Running Yes/No
Clean Coal Dozers	Running	2	2	2	Running Yes/No
Train Loading Facility	Train Loading	✓	✓	✓	Running Yes/No
South Bates U/G	Ventilation	✓	-	-	Running Yes/No
	Mining	✓	-	-	Running Yes/No
	Coal Trucks	4	-	-	No. _____
South Wambo U/G	Ventilation	-	✓	✓	Running Yes/No
	Mining	✓	-	-	Running Yes/No
	Coal Trucks	-	4	4	No. _____

Is Wambo Mine operating with equipment numbers specified above? Yes / No

If Yes, Wambo is likely to be operating within the Consent/EPL noise limits unless there is a failure in equipment noise control

If No, describe additional activities. Are there any failures of noise control measures evident?

Area 1 Compliance Assessment

Area 1 is located to the south-south east of the Project Area and to the south of the Wambo operations (refer to **Figure 1**). In Area 1 four (4) properties are predicted to experience 10th %ile noise levels above 35 dB(A). These properties are presented in **Table 1.2**.

Table 1.2 Predicted Maximum Predicted 10th %ile Noise Levels above 35 dB(A) in Area 1

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level		Summation of the Maximum Predicted Intrusive 10th %ile Noise Levels
		SSD – United Wambo Project	Wambo CHPP / Train Loading Facility / MOD12 Underground	
Area 1 - R003	Day	**38**	**36**	**40**
	Evening	33	**36**	**38**
	Night	**36**	**38**	**40**
Area 1 - R006	Day	**37**	34	**39**
	Evening	32	33	**36**
	Night	35	35	**38**
Area 1 - R007	Day	**36**	**36**	**39**
	Evening	30	35	**36**
	Night	35	**37**	**39**
Area 1 - R379	Day	**36**	**36**	**39**
	Evening	30	35	**36**
	Night	34	**37**	**39**
Area 1 - R380	Day	35	32	**37**
	Evening	30	32	34
	Night	34	33	**37**

It is noted that the summation of the maximum predicted intrusive 10th %ile noise levels contributing to the acoustic environment in Area 1 from the two operations do not exceed a $L_{Aeq.15minute}$ noise level of 40 dB(A).

The compliance assessment methodology for Area 1 is outlined in **Table 1.3**.

Table 1.3 Compliance Assessment Methodology for Area 1 and 2

Rule	Estimated Attributable Intrusive $L_{Aeq.15minute}$ Noise Level (as determined via attended monitoring)	Compliance Assessment.
1	The estimated attributable intrusive $L_{Aeq.15minute}$ noise level from the combined Project and Wambo operation is above the summation of the noise limits for the two operations.	One or both of the operations could be exceeding their respective noise limits. In this case the contribution from each operation needs to be determined. **Step 1:** The operation exceeding its noise limit is to be identified by an independent acoustician using the protocol and checklist in **Figures 2** and **3**. The protocol and checklist will either confirm compliance or identify the potential for a non-compliance. **Step 2:** Where a potential non-compliance is identified the checklist and protocol may allocate responsibility (to either the Project or Wambo mine). At this stage the assessment may also include moving to an intermediate location between the monitoring location, discussing the operations with the mine site or visiting the mine site. The review of the results from the real-time directional noise monitoring units can assist in the identification of other non-related noise sources. **Step 3:** Where any uncertainty regarding the source of the noise exceedance remains, the acoustician will advise the open cut mine (Project) contact of the potential that an exceedance has been identified and request the Project to modify its operations for a period of 15 minutes (e.g. shut down part of the fleet) so the contribution from the open cut (most dynamic noise source) to potential exceedance can be determined and confirm responsibility for the exceedance.
2	The estimated attributable intrusive $L_{Aeq.15minute}$ noise level from the combined SSD Project and Wambo operation is: 1. less than the summation of the noise limits for the two operations; 2. greater than one or both of the maximum individual of the noise limits for the two operations.	One of the operations could be exceeding its noise limit or both operations could be compliant. In this case, the operation exceeding its noise limit is to be identified by an independent acoustician using the protocol and checklist in **Figures 2** and **3**. The assessment may also include moving to an intermediate location between the monitoring location and the mine and discussing the operations with the mine site.

Rule	Estimated Attributable Intrusive $L_{Aeq.15minute}$ Noise Level (as determined via attended monitoring)	Compliance Assessment.
3	The estimated attributable intrusive $L_{Aeq.15minute}$ noise level from the combined SSD Project and Wambo operation is: 1. less than the maximum of the noise limits for the two operations; 2. greater than the minimum of the noise limits for the two operations	The contribution from the operation with the lower noise criteria needs to be identified by an independent acoustician using the protocol and checklist in **Figures 2** and **3**.

Area 2 Compliance Assessment

Area 2 is located to the south-south east of the Project Area and to the south of Wambo mine (refer to **Figure 1**). In Area 2 the two (2) properties are predicted to experience 10th %ile noise levels above 35 dB(A). These properties are presented in **Table 1.4**.

Table 1.4 Predicted Maximum Predicted 10th %ile Noise Levels above 35 dB(A) in Area 2

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level		Summation of the Maximum Predicted Intrusive 10th %ile Noise Levels
		SSD – United Wambo Project	Wambo CHPP / Train Loading Facility / MOD 12 Underground	
Area 2 - R025	Day	**39**	**39**	**42**
	Evening	**38**	**38**	**41**
	Night	**38**	**39**	**42**
Area 2 - R035a	Day	**37**	**37**	**40**
	Evening	**37**	35	**39**
	Night	**36**	**37**	**40**
Area 2 - R035b	Day	34	35	**38**
	Evening	34	34	**37**
	Night	35	35	**38**

It is noted that the summation of the maximum predicted intrusive 10th %ile noise level contributing to the acoustic environment at R025 in Area 2 from the two operations could exceed a $L_{Aeq.15minute}$ noise level of 40 dB(A).

The rules for compliance assessment presented in **Table 1.3** for Area 1 are also applicable to the assessment of the measured noise levels in Area 2.

Area 3 Compliance Assessment

Warkworth village is designated as Area 3 and is located to the north east of the Project area and to the north the Wambo mine. In Area 3 the last privately owned property (R019) has acquisition rights under the Wambo consent. The property is also predicted to experience 10th %ile noise levels above 35 dB(A) from the Project during the first couple of years of operation in the United open-cut. The maximum predicted 10th %ile noise level at R019 are presented in **Table 1.5.**

Table 1.5 Maximum Predicted 10th %ile Noise Levels above 35 dB(A) in Area 3

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level		Summation of the Maximum Predicted Intrusive 10th %ile Noise Levels
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / MOD 12 Underground	
Area 3 - R019	Day	**57**	**58**	**61**
	Evening	**54**	**57**	**59**
	Night	**57**	**59**	**61**

No compliance assessment rules are proposed for Area 3.

Area 4 Compliance Assessment

Area 4 is located to the north-north east of the Project Area and the Wambo mine. In Area 4, 19 properties are predicted to experience 10th %ile noise levels above 35 dB(A). The modelling results presented in **Table 1.6** indicate the contribution to the acoustic environment from the Project (assessed based on the maximum predicted 10th %ile noise level) is typically 5 to 6 dB above the contribution from the Wambo mine. The maximum predicted 10th %ile noise levels in Area 4 are presented in **Table 1.6**.

Table 1.6 Maximum Predicted 10th %ile Noise Level above 35 dB(A) in Area 4

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level		Summation of the Maximum Predicted Intrusive 10th %ile Noise Levels
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / MOD 12 Underground	
Area 4 - R474a	Day	**37**	31	**38**
	Evening	35	30	**36**
	Night	**37**	32	**38**
Area 4 - R474b	Day	**36**	30	**37**
	Evening	**35**	30	**36**
	Night	**37**	31	**38**
Area 4 - R485	Day	**37**	31	**38**
	Evening	**36**	31	**37**
	Night	**38**	32	**39**
Area 4 - R486a	Day	**36**	< 30	**37**
	Evening	34	< 30	35
	Night	**37**	30	**38**
Area 4 - R486b	Day	**36**	< 30	**37**
	Evening	34	< 30	35
	Night	**37**	30	**38**
Area 4 - R487a	Day	**36**	< 30	**37**
	Evening	35	< 30	**36**
	Night	**37**	31	**38**
Area 4 - R487b	Day	**36**	30	**37**
	Evening	35	30	**36**
	Night	**37**	31	**38**
Area 4 - R487c	Day	**37**	31	**38**
	Evening	**36**	31	**37**

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level		Summation of the Maximum Predicted Intrusive 10th %ile Noise Levels
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / MOD 12 Underground	
	Night	**38**	32	**39**
Area 4 - R487d	Day	**37**	31	**38**
	Evening	**36**	31	**37**
	Night	**37**	32	**38**
Area 4 - R488	Day	**37**	30	**38**
	Evening	**36**	30	**37**
	Night	**37**	31	**38**
Area 4 - R489	Day	**37**	30	**38**
	Evening	**36**	30	**37**
	Night	**37**	31	**38**
Area 4 - R490	Day	**37**	30	**38**
	Evening	**36**	30	**37**
	Night	**37**	31	**38**
Area 4 - R491	Day	**37**	30	**38**
	Evening	**36**	30	**37**
	Night	**37**	31	**38**
Area 4 - R492	Day	**37**	30	**38**
	Evening	**36**	30	**37**
	Night	**37**	31	**38**
Area 4 - R493a	Day	**38**	31	**39**
	Evening	**36**	31	**37**
	Night	**38**	32	**39**
Area 4 - R493b	Day	**38**	31	**39**
	Evening	**36**	31	**37**

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level		Summation of the Maximum Predicted Intrusive 10th %ile Noise Levels
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / MOD 12 Underground	
	Night	**39**	32	**40**
Area 4 - R495	Day	**37**	32	**38**
	Evening	**36**	32	**37**
	Night	**38**	32	**39**
Area 4 - R496	Day	**38**	31	**39**
	Evening	**37**	31	**38**
	Night	**39**	32	**40**
Area 4 - R497	Day	**36**	32	**37**
	Evening	34	32	**36**
	Night	**36**	33	**38**

The compliance assessment methodology for Area 4 is outlined in **Table 1.7**.

Table 1.7 Compliance Assessment Methodology for Areas 4, 6 and 7

Rule	Estimated Attributable Intrusive $L_{Aeq.15minute}$ Noise Level	Compliance Assessment.
4	The estimated attributable intrusive $L_{Aeq.15minute}$ noise level from the combined Project and Wambo mine is above the noise limits for the Project.	The contribution from the Project is to be confirmed by an independent acoustician using the protocol and checklist in **Figures 2** and **3**. The exceedance will be attributed to the Project unless: 1. the protocol and checklist indicates the non-compliance is not associated with the Project; or 2. another, non-related contributing noise source is clearly identifiable. The review of the results from the real-time directional noise monitoring units can assist in the identification of other non-related noise sources.

Area 5 Compliance Assessment

Area 5 is located to the north-west of the Project area and the Wambo mine. In Area 5, 10 properties are predicted to experience 10th %ile noise levels above 35 dB(A) from the project. A number of these properties would be provided with acquisition rights if the Project is approved. The modelling results presented in **Table 1.8** indicates the contribution to the acoustic environment from the Project (assessed based on the maximum predicted 10th %ile noise level) is greater than 10 dB above the contribution from the Wambo mine. The maximum predicted 10th %ile noise levels in Area 5 are presented in **Table 1.8**.

Table 1.8 Maximum Predicted 10th %ile Noise Level above 35 dB(A) in Area 5

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level		Summation of the Maximum Predicted Intrusive 10th %ile Noise Levels
		SSD – United Wambo Project	Wambo CHPP / Train Loading Facility / MOD 12 Underground	
Area 5 - R016	Day	**41**	< 30	**41**
	Evening	**40**	< 30	**40**
	Night	**42**	< 30	**42**
Area 5 - R017	Day	**40**	< 30	**40**
	Evening	**39**	< 30	**40**
	Night	**41**	< 30	**41**
Area 5 - R028a	Day	**41**	< 30	**41**
	Evening	**41**	< 30	**41**
	Night	**43**	< 30	**43**
Area 5 - R028b	Day	**41**	< 30	**41**
	Evening	**41**	< 30	**41**
	Night	**43**	< 30	**43**
Area 5 - R039	Day	**44**	< 30	**44**
	Evening	**43**	< 30	**43**
	Night	**45**	< 30	**45**
Area 5 - R040	Day	**43**	< 30	**43**
	Evening	**43**	< 30	**43**
	Night	**44**	< 30	**44**
Area 5 - R043	Day	**39**	< 30	**40**
	Evening	**39**	< 30	**40**
	Night	**40**	< 30	**40**
Area 5 - R044	Day	**38**	< 30	**39**
	Evening	**38**	< 30	**39**

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level		Summation of the Maximum Predicted Intrusive 10th %ile Noise Levels
		SSD – United Wambo Project	Wambo CHPP / Train Loading Facility / MOD 12 Underground	
	Night	**39**	< 30	**40**
Area 5 - R050a	Day	**39**	< 30	**40**
	Evening	**39**	< 30	**40**
	Night	**40**	< 30	**40**
Area 5 - R050b	Day	**39**	< 30	**40**
	Evening	**39**	< 30	**40**
	Night	**40**	< 30	**40**
Area 5 - R050c	Day	**39**	< 30	**40**
	Evening	**39**	< 30	**40**
	Night	**40**	< 30	**40**
Area 5 - R056	Day	**36**	< 30	**37**
	Evening	**36**	< 30	**37**
	Night	**36**	< 30	**37**
Area 5 - R133	Day	**38**	< 30	**39**
	Evening	**38**	< 30	**39**
	Night	**39**	< 30	**40**

The rules for compliance assessment presented in **Table 1.7** for Area 4 are also applicable to the assessment of the measured noise levels in Area 5.

Area 6 Compliance Assessment

Area 6 is located to the west of the Project area and the Wambo mine. In Area 6, 13 properties are predicted to experience 10th %ile noise levels above 35 dB(A) from the project. The modelling results presented in **Table 1.9** indicates the contribution to the acoustic environment from the Wambo mine, at less than 30 dB(A) (assessed based on the maximum predicted 10th %ile noise level), is well below the contribution from the Project. The maximum predicted 10th %ile noise levels in Area 6 are presented in **Table 1.9**.

Table 1.9 Maximum Predicted 10th %ile Noise Level above 35 dB(A) in Area 6

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level		Summation of the Maximum Predicted Intrusive 10th %ile Noise Levels
		SSD – United Wambo Project	Wambo CHPP / Train Loading Facility / MOD 12 Underground	
Area 6 - R029	Day	**39**	< 30	**40**
	Evening	**41**	< 30	**41**
	Night	**38**	< 30	**39**
Area 6 - R030	Day	**39**	< 30	**40**
	Evening	**40**	< 30	**40**
	Night	**38**	< 30	**39**
Area 6 - R033	Day	**40**	< 30	**40**
	Evening	**40**	< 30	**40**
	Night	**39**	< 30	**40**
Area 6 - R041b	Day	35	< 30	**36**
	Evening	**36**	< 30	**37**
	Night	**36**	< 30	**37**
Area 6 - R042	Day	**39**	< 30	**40**
	Evening	**41**	< 30	**41**
	Night	**38**	< 30	**39**
Area 6 - R046	Day	**37**	< 30	**38**
	Evening	**37**	< 30	**38**
	Night	**37**	< 30	**38**
Area 6 - R048	Day	**39**	< 30	**40**
	Evening	**39**	< 30	**40**
	Night	**39**	< 30	**40**
Area 6 - R049	Day	**39**	< 30	**40**
	Evening	**40**	< 30	**40**

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level		Summation of the Maximum Predicted Intrusive 10th %ile Noise Levels
		SSD – United Wambo Project	Wambo CHPP / Train Loading Facility / MOD 12 Underground	
	Night	**38**	< 30	**39**
Area 6 - R075	Day	**38**	< 30	**39**
	Evening	**39**	< 30	**40**
	Night	**38**	< 30	**39**
Area 6 - R163	Day	**38**	< 30	**39**
	Evening	**39**	< 30	**40**
	Night	**38**	< 30	**39**
Area 6 - R320	Day	**40**	< 30	**40**
	Evening	**40**	< 30	**40**
	Night	**40**	< 30	**40**
Area 6 - R343	Day	**40**	< 30	**40**
	Evening	**40**	< 30	**40**
	Night	**40**	< 30	**40**
Area 6 - R344	Day	**38**	< 30	**39**
	Evening	**39**	< 30	**40**
	Night	**38**	< 30	**39**
Area 6 - R346	Day	**37**	< 30	**38**
	Evening	**39**	< 30	**40**
	Night	**37**	< 30	**38**
Area 6 - R348	Day	**37**	< 30	**38**
	Evening	**39**	< 30	**40**
	Night	**36**	< 30	**37**

The rules for compliance assessment presented in **Table 1.7** for Area 4 and 5 are also applicable to the assessment of the measured noise levels in Area 6.

Area 7 Compliance Assessment

Area 7 is located to the north west of the Project area and the Wambo mine. Based on the location of Area 7 in relation to the Project area and the Wambo mine, the measured intrusive $L_{Aeq,15minute}$ noise levels from the combined Project and Wambo mine would be attributed solely to the Project.

The compliance assessment methodology for Area 7 is outlined in **Table 1.10**.

Table 1.10 Compliance Assessment Methodology for Area 7

Rule	Estimated Attributable Intrusive $L_{Aeq.15minute}$ Noise Level	Compliance Assessment.
5	The estimated attributable intrusive $L_{Aeq.15minute}$ noise level from the combined Project and Wambo mine is above the noise limits for the Project.	The exceedance will be attributed to the Project unless another, non-related contributing noise source is clearly identifiable (e.g. another mine located in the region). The review of the results from the real-time directional noise monitoring units can assist in the identification of other non-related noise sources.

1.2 Noise Performance Monitoring

The noise performance management program for the Project and Wambo mine will be based on the use of real-time noise monitors at key locations in the region surrounding the operations. The proposed location of the real-time noise monitors are shown on **Figure 1**.

Real-time noise monitoring will be used for proactive and reactive noise management of day to day operations at the Project. The real-time monitors provide 24hour continuous information on the ambient noise levels and meteorological data local to the monitoring site and generate quantitative data and audio recordings that can be used to determine the likely source of the noise.

The continuous noise monitors record the following information:

- date and time
- L_{Aeq} for each 15 minute interval
- L_{Amin}, L_{A90}, L_{A10} and L_{Amax} for each 15 minute interval
- 15 minute one-third octave L_{Aeq} noise levels corresponding to the $L_{Aeq,15\ minute}$ interval
- between 10 second and one minute (depending on the settings) one-third octave noise levels over the entire monitoring period
- $L_{Aeq,period}$ (where period = day, evening and night) for each 24 hour interval
- maximum $L_{A1,1minute}$ noise level recorded over a predefined 15 minute night time measurement period
- continuous weather data monitoring for wind direction, speed, temperature and rainfall as 15 minute averages
- directional data for dominant noise sources.

The real-time monitors will be programmed to send alerts to operational personnel when a noise trigger level is reached. The alarms will be programmed to identify noise sources only from the United/Wambo JV Area-of-Influence (AOI). United/Wambo JV will utilise a two trigger levels system:

- Level 1 alert: when the measured noise levels from the AOI are within 2 dB of the relevant noise criteria at the nearest residence to the real-time noise monitoring unit for two consecutive 15-minute periods

- Level 2 alert: when noise levels from the AOI are at or above the relevant noise criteria at the nearest residence to the real-time noise monitoring unit for two consecutive 15-minute periods.

Following a Level 1 alert, a review of the audio and monitoring data will be undertaken to determine whether the noise source(s) are mining related (e.g. trucks, dozer, CHPP, trains) or non-mining related (traffic, birds, insects). This process will be undertaken in accordance with the United/Wambo JV Real-time Monitoring Procedure.

Proposed protocols in the United/Wambo JV Real-time Monitoring Procedure include:

1. If mining noise is identified at NM01 (South Wambo), Section 4 of the Compliance Assessment Protocol and Checklist will be used to identify if the Wambo mine is the dominant noise source.

2. In the event that mining noise is identified at NM02 (Maison Dieu), NM03 (Moses Crossing) or NM04 (Redmanvale Rd), or if the Project is deemed the dominant noise source at NM01, a review of operations and current meteorological conditions will be undertaken by site personnel in order to identify if the site operations are contributing to the recorded noise levels. The review will take into account current meteorological conditions. Where appropriate, management and mitigation measures, such as the modification and/or suspension of operations, will be undertaken in order to ensure compliance with the noise limits.

3. Following an alert from the real-time noise monitoring system, if the Project is deemed the dominant noise source equipment and/or operations determined to be contributing to the measured noise impacts will either cease or be modified to reduce the noise level to below criteria within 75 minutes.

4. In the event of consecutive, valid, Level 2 alerts from the same monitoring location over a three day period, attended monitoring will be conducted within the following 7 days by appropriately accredited and qualified acoustic consultants to determine compliance with the noise criteria.

1.3 Summary of Maximum Predicted 10th %ile Noise Level

Table 1.11 provides a summary of the maximum predicted 10th %ile noise level from the United Wambo Project and the Wambo mine incorporating the CHPP, Train Loading Facility, and underground operations (including MOD 12).

Table 1.11 Maximum Predicted 10th %ile Noise Levels

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
Area 1 - R_AGL	Day	32	31
	Evening	< 30	30
	Night	30	31
Area 1 - R003	Day	38	36
	Evening	33	36
	Night	36	38
Area 1 - R006	Day	37	34
	Evening	32	33
	Night	35	35
Area 1 - R007	Day	36	36
	Evening	30	35
	Night	35	37
Area 1 - R013	Day	34	30
	Evening	30	< 30
	Night	32	31
Area 1 - R379	Day	36	36
	Evening	30	35
	Night	34	37
Area 1 - R380	Day	35	32
	Evening	30	32
	Night	34	33
Area 1 - R381	Day	34	30
	Evening	31	30
	Night	33	31

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
Area 1 - R382	Day	< 30	32
	Evening	< 30	31
	Night	< 30	32
Area 1 - R383	Day	< 30	< 30
	Evening	< 30	< 30
	Night	< 30	< 30
Area 1 - R384	Day	< 30	31
	Evening	< 30	31
	Night	< 30	31
Area 1 - R386	Day	< 30	< 30
	Evening	< 30	< 30
	Night	< 30	< 30
Area 1 - R388	Day	< 30	31
	Evening	< 30	30
	Night	< 30	31
Area 1 - R389	Day	< 30	30
	Evening	< 30	30
	Night	< 30	31
Area 1 - R390	Day	< 30	31
	Evening	< 30	30
	Night	< 30	31
Area 1 - R395	Day	< 30	32
	Evening	< 30	31
	Night	< 30	32
Area 1 - R396	Day	30	31

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Evening	< 30	31
	Night	< 30	32
Area 1 - R397a	Day	31	< 30
	Evening	< 30	< 30
	Night	< 30	30
Area 1 - R397b	Day	32	< 30
	Evening	< 30	< 30
	Night	30	30
Area 1 - R400a	Day	34	< 30
	Evening	< 30	< 30
	Night	33	30
Area 1 - R400b	Day	34	< 30
	Evening	30	< 30
	Night	32	30
Area 1 - R401	Day	34	< 30
	Evening	30	< 30
	Night	32	30
Area 1 - R402	Day	34	30
	Evening	< 30	< 30
	Night	32	31
Area 1 - R404	Day	34	< 30
	Evening	< 30	< 30
	Night	32	30
Area 1 - R495	Day	31	30
	Evening	< 30	30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Night	30	31
Area 2 - R025	Day	39	39
	Evening	38	38
	Night	38	39
Area 2 - R035a	Day	37	37
	Evening	37	35
	Night	36	37
Area 2 - R035b	Day	34	35
	Evening	34	34
	Night	35	35
Area 3 - R_SSC	Day	55	57
	Evening	53	57
	Night	57	59
Area 3 - R019	Day	57	58
	Evening	54	57
	Night	57	59
Area 4 - R474a	Day	37	31
	Evening	35	30
	Night	37	32
Area 4 - R474b	Day	36	30
	Evening	35	30
	Night	37	31
Area 4 - R483	Day	33	< 30
	Evening	32	< 30
	Night	32	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
Area 4 - R485	Day	37	31
	Evening	36	31
	Night	38	32
Area 4 - R486a	Day	36	< 30
	Evening	34	< 30
	Night	37	30
Area 4 - R486b	Day	36	< 30
	Evening	34	< 30
	Night	37	30
Area 4 - R487a	Day	36	< 30
	Evening	35	< 30
	Night	37	31
Area 4 - R487b	Day	36	30
	Evening	35	30
	Night	37	31
Area 4 - R487c	Day	37	31
	Evening	36	31
	Night	38	32
Area 4 - R487d	Day	37	31
	Evening	36	31
	Night	37	32
Area 4 - R488	Day	37	30
	Evening	36	30
	Night	37	31
Area 4 - R489	Day	37	30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Evening	36	30
	Night	37	31
Area 4 - R490	Day	37	30
	Evening	36	30
	Night	37	31
Area 4 - R491	Day	37	30
	Evening	36	30
	Night	37	31
Area 4 - R492	Day	37	30
	Evening	36	30
	Night	37	31
Area 4 - R493a	Day	38	31
	Evening	36	31
	Night	38	32
Area 4 - R493b	Day	38	31
	Evening	36	31
	Night	39	32
Area 4 - R495	Day	37	32
	Evening	36	32
	Night	38	33
Area 4 - R496	Day	38	31
	Evening	37	31
	Night	39	32
Area 4 - R497	Day	36	32
	Evening	34	32

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Night	36	33
Area 5 - R016	Day	41	< 30
	Evening	40	< 30
	Night	42	< 30
Area 5 - R017	Day	40	< 30
	Evening	39	< 30
	Night	41	< 30
Area 5 - R028a	Day	41	< 30
	Evening	41	< 30
	Night	43	< 30
Area 5 - R028b	Day	41	< 30
	Evening	41	< 30
	Night	43	< 30
Area 5 - R039	Day	44	< 30
	Evening	43	< 30
	Night	45	< 30
Area 5 - R040	Day	43	< 30
	Evening	43	< 30
	Night	44	< 30
Area 5 - R043	Day	39	< 30
	Evening	39	< 30
	Night	40	< 30
Area 5 - R044	Day	38	< 30
	Evening	38	< 30
	Night	39	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
Area 5 - R050a	Day	39	< 30
	Evening	39	< 30
	Night	40	< 30
Area 5 - R050b	Day	39	< 30
	Evening	39	< 30
	Night	40	< 30
Area 5 - R050c	Day	39	< 30
	Evening	39	< 30
	Night	40	< 30
Area 5 - R056	Day	36	< 30
	Evening	36	< 30
	Night	36	< 30
Area 5 - R133	Day	38	< 30
	Evening	38	< 30
	Night	39	< 30
Area 6 - R029	Day	39	< 30
	Evening	41	< 30
	Night	38	< 30
Area 6 - R030	Day	39	< 30
	Evening	40	< 30
	Night	38	< 30
Area 6 - R033	Day	40	< 30
	Evening	40	< 30
	Night	39	< 30
Area 6 - R041a	Day	35	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Evening	35	< 30
	Night	35	< 30
Area 6 - R041b	Day	35	< 30
	Evening	36	< 30
	Night	36	< 30
Area 6 - R042	Day	39	< 30
	Evening	41	< 30
	Night	38	< 30
Area 6 - R046	Day	37	< 30
	Evening	37	< 30
	Night	37	< 30
Area 6 - R048	Day	39	< 30
	Evening	39	< 30
	Night	39	< 30
Area 6 - R049	Day	39	< 30
	Evening	40	< 30
	Night	38	< 30
Area 6 - R061	Day	34	< 30
	Evening	35	< 30
	Night	35	< 30
Area 6 - R075	Day	38	< 30
	Evening	39	< 30
	Night	38	< 30
Area 6 - R163	Day	38	< 30
	Evening	39	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Night	38	< 30
Area 6 - R170	Day	31	< 30
	Evening	32	< 30
	Night	30	< 30
Area 6 - R287	Day	32	< 30
	Evening	33	< 30
	Night	32	< 30
Area 6 - R320	Day	40	< 30
	Evening	40	< 30
	Night	40	< 30
Area 6 - R343	Day	40	< 30
	Evening	40	< 30
	Night	40	< 30
Area 6 - R344	Day	38	< 30
	Evening	39	< 30
	Night	38	< 30
Area 6 - R346	Day	37	< 30
	Evening	39	< 30
	Night	37	< 30
Area 6 - R348	Day	37	< 30
	Evening	39	< 30
	Night	36	< 30
Area 7 - R004	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
Area 7 - R047	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R052a	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R052b	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R054	Day	34	< 30
	Evening	35	< 30
	Night	35	< 30
Area 7 - R058a	Day	35	< 30
	Evening	35	< 30
	Night	35	< 30
Area 7 - R058b	Day	35	< 30
	Evening	35	< 30
	Night	35	< 30
Area 7 - R059	Day	34	< 30
	Evening	35	< 30
	Night	35	< 30
Area 7 - R060	Day	35	< 30
	Evening	35	< 30
	Night	35	< 30
Area 7 - R062	Day	32	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Evening	32	< 30
	Night	33	< 30
Area 7 - R068	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R098	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R105	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R106	Day	31	< 30
	Evening	31	< 30
	Night	32	< 30
Area 7 - R107	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R113a	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R113b	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R115	Day	33	< 30
	Evening	34	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Night	34	< 30
Area 7 - R116	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R135	Day	32	< 30
	Evening	32	< 30
	Night	32	< 30
Area 7 - R143	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R144	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R146	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R148a	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R148b	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R150	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
Area 7 - R151	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R156a	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R156b	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R168	Day	32	< 30
	Evening	32	< 30
	Night	32	< 30
Area 7 - R171	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R174a	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R174b	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R175	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R180	Day	32	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Evening	32	< 30
	Night	33	< 30
Area 7 - R186	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R187	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R198	Day	32	< 30
	Evening	32	< 30
	Night	32	< 30
Area 7 - R202	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R204	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R205	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R206	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R211a	Day	32	< 30
	Evening	32	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Night	33	< 30
Area 7 - R211b	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R240	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R256	Day	31	< 30
	Evening	32	< 30
	Night	32	< 30
Area 7 - R261	Day	32	< 30
	Evening	32	< 30
	Night	32	< 30
Area 7 - R276	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R277	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R280	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R281	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30

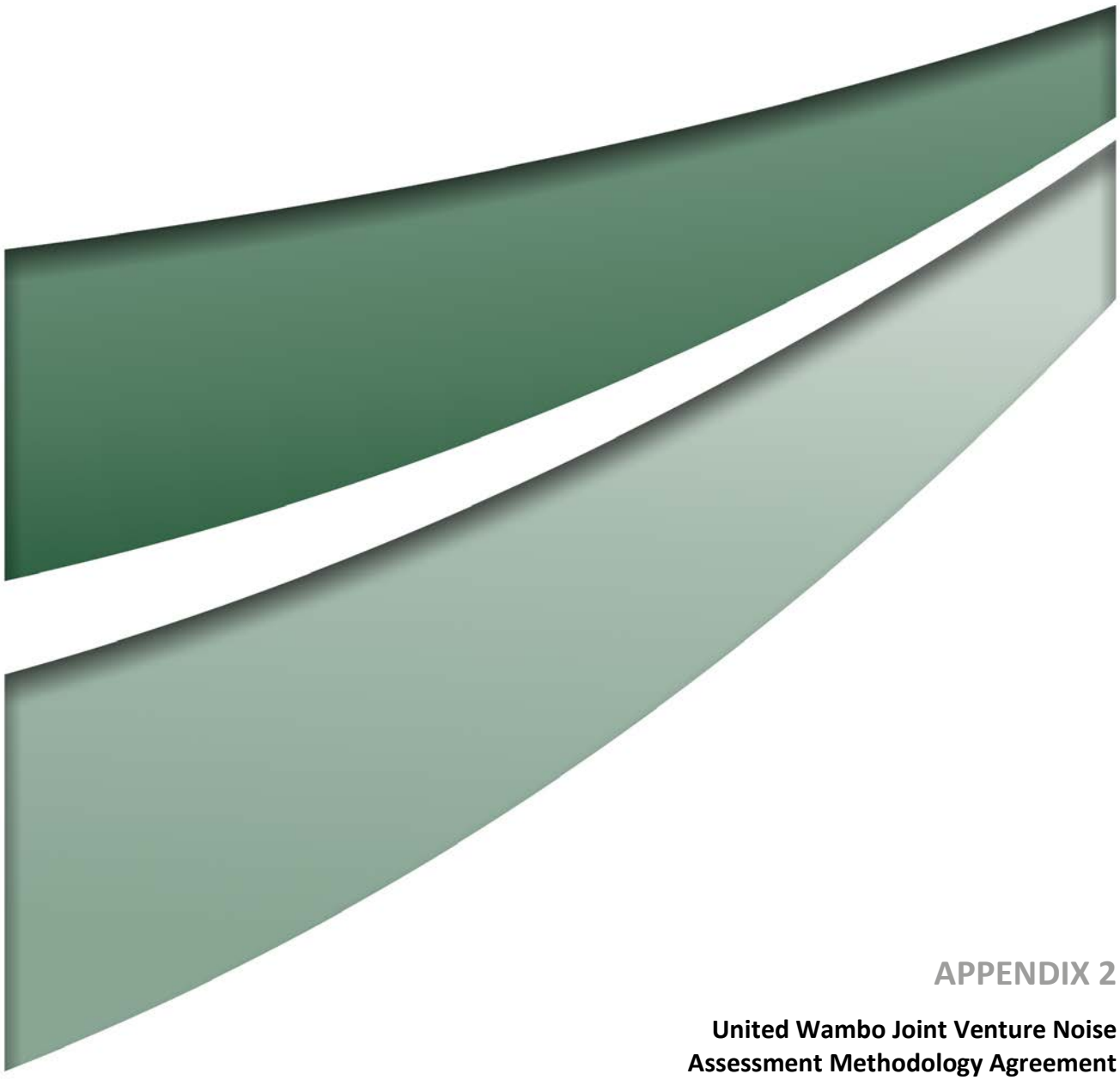
Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
Area 7 - R282a	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R282b	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R283	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R286	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R291	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R325	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R326a	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R326b	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R326c	Day	33	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Evening	33	< 30
	Night	34	< 30
Area 7 - R327	Day	32	< 30
	Evening	32	< 30
	Night	32	< 30
Area 7 - R328	Day	32	< 30
	Evening	32	< 30
	Night	32	< 30
Area 7 - R329	Day	32	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R330	Day	32	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R332	Day	32	< 30
	Evening	32	< 30
	Night	33	< 30
Area 7 - R333	Day	32	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R334	Day	32	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R335	Day	33	< 30
	Evening	33	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Night	33	< 30
Area 7 - R336	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R337	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R338	Day	33	< 30
	Evening	33	< 30
	Night	33	< 30
Area 7 - R352	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R353	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R355	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R356	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R357	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
Area 7 - R358	Day	34	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R362	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R363	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R364	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R365	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R366a	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R366b	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30
Area 7 - R367a	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R367b	Day	33	< 30

Receiver ID	Period	Maximum Predicted 10th %ile Noise Level	
		SSD - United Wambo Project	Wambo CHPP / Train Loading Facility / Underground Mine
	Evening	33	< 30
	Night	34	< 30
Area 7 - R368	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R370	Day	33	< 30
	Evening	33	< 30
	Night	34	< 30
Area 7 - R504	Day	33	< 30
	Evening	34	< 30
	Night	34	< 30



APPENDIX 2

United Wambo Joint Venture Noise Assessment Methodology Agreement

UNITED WAMBO
JOINT VENTURE

GLENCORE

20 September 2017

Howard Reed
Director – Resource Assessments
Resource Assessments & Compliance Division
Department of Planning & Environment
Sydney NSW 2000

Dear Howard,

Noise Compliance Assessment

The United Wambo Open Cut Coal Mine Project (SSD-7142) is a Joint Venture between United Collieries and Wambo Coal. Under the Joint Venture arrangements United Collieries will manage the Joint Venture Project and Wambo Coal will continue to manage and operate the Wambo Coal Mine (DA 305-7-2003 & DA 177-8-2004) including the underground mining operations, Coal Handling and Preparation Plant and train-loading facilities. United Collieries and Wambo Coal each confirm that the Noise Compliance Assessment Methodology as described in Appendix 1 of the response to the Department of Planning & Environment Request for Additional Information (RFAI) is suitable to each company for the purposes of the operational requirements of each business.

The assessment methodology provides the department with a simplistic approach to noise assessment and compliance that provides accuracy, certainty and timeliness of accountability that can be independently interrogated by the government agencies responsible for compliance of noise limits.

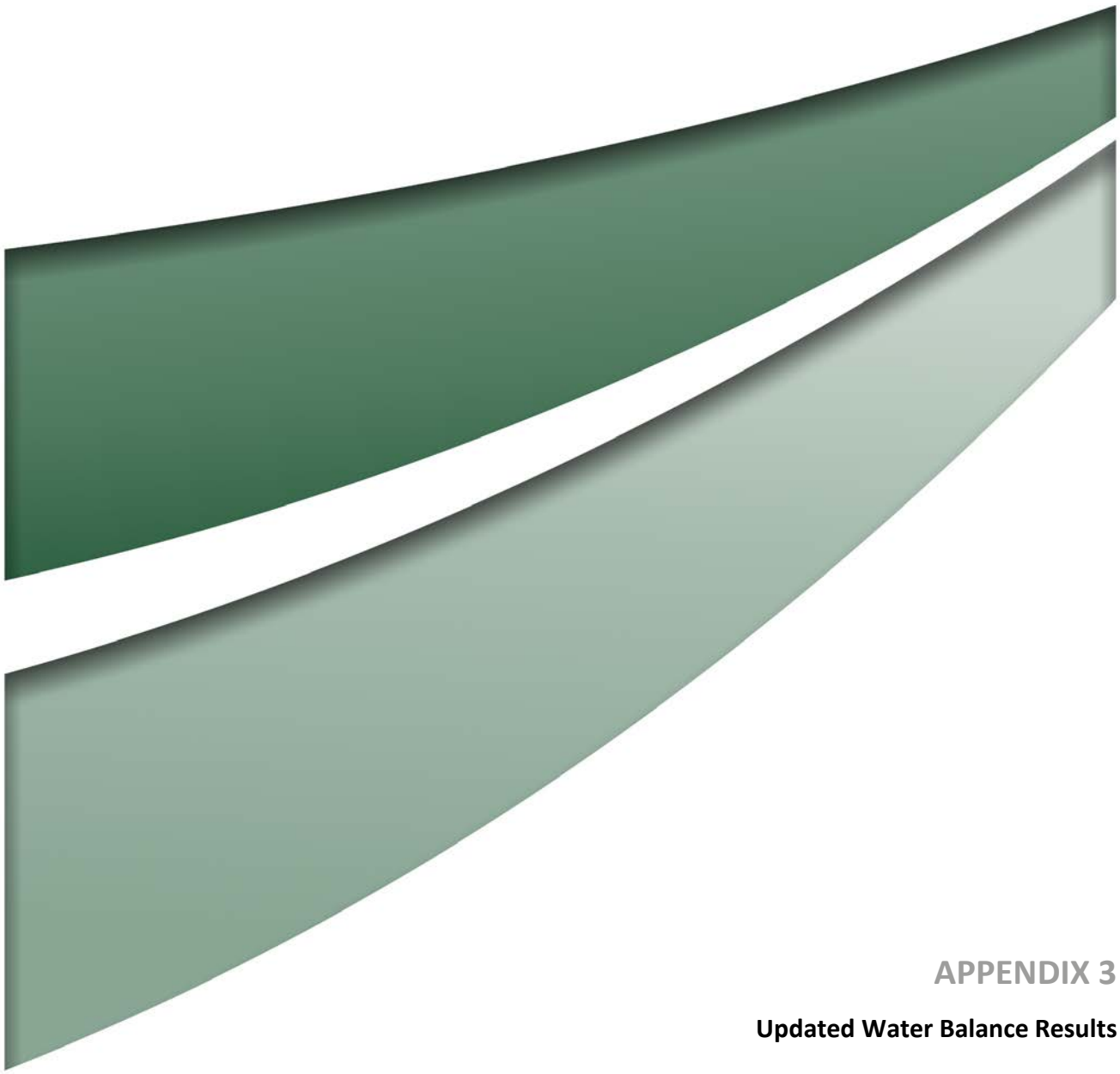
Regards,

Gary Wills
United Collieries (Glencore)

Micheal Alexander
Wambo Coal (Peabody)

Private Mail Bag 13, Singleton, NSW 2330
134 Jerrys Plains Road, Warkworth, NSW 2330
T + 61 2 6578 9500 F + 61 2 6574 4606 www.unitedcollieries.com.au

United Wambo Joint Venture ABN 67 001 990 209



APPENDIX 3

Updated Water Balance Results

HYDRO ENGINEERING & CONSULTING PTY LTD

20 September 2017

Group Manager, Environment & Community NSW
Umwelt (Australia) Pty Limited
75 York Street
Teralba, NSW 2284
Attention: John Merrell

Dear John,

Re: United Wambo Open Cut Coal Mine Project:
Updated Final Void Water Balance Results

Further to your request, this letter report outlines a summary of the final void water and salt balance modelling undertaken for the United Wambo Open Cut Coal Mine Project (the Project). Based on these refinements, the original EIS model is considered conservative and not reflective of our most recent updated predictions.

1. EIS Modelling

Results for the final void water and salt balance for both the proposed United final void and Wambo final void were first documented in the Project Surface Water Assessment (SWA) Water Balance (WB) report (HEC 2016). The predicted water level in the United final void was approximately 19 mRL with an upward trending salinity profile which was approximately 35,000 mg/L at the end of the 500 year simulation period. The predicted water level in the Wambo final void was approximately 52 mRL with an upward trending salinity profile which was approximately 300,000 mg/L at the end of the 500 year simulation. Results for the EIS modelling are shown in Figure 1 and Figure 2 for the United and Wambo voids respectively.

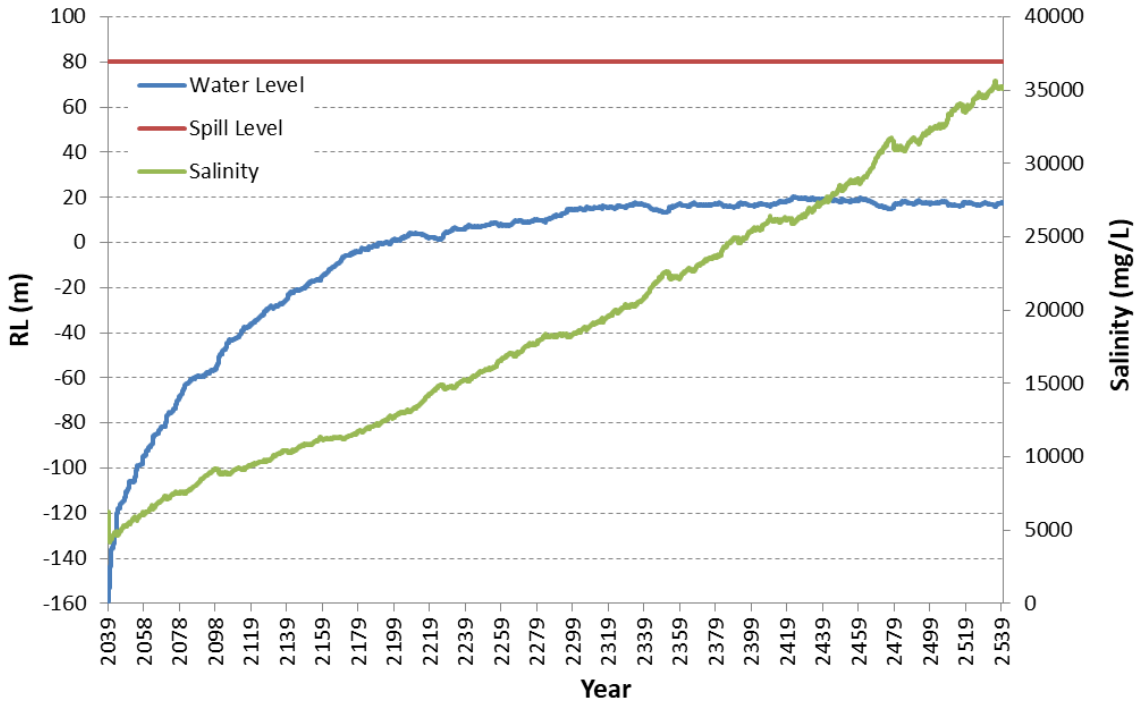


Figure 1 EIS Final Void Results: United

38a Nash Street
Rosalie QLD 4064
p (07) 3367 2388

PO Box 1575
Carindale QLD 4152
www.hecons.com
ABN 11 247 282 058

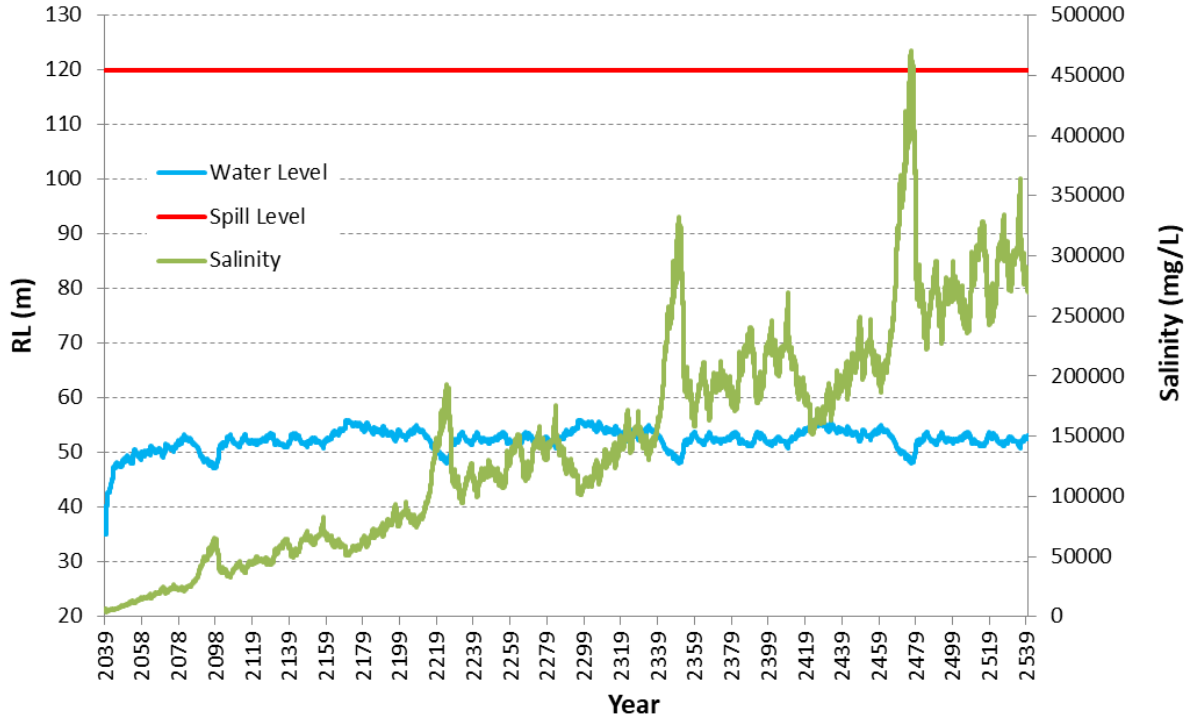


Figure 2 EIS Final Void Results: Wambo

Key underpinning assumptions for the above model results were as follows:

- Final void catchment areas estimated from supplied final landform plans: 261 ha and 198 ha for the United Open Cut and Wambo Open Cut voids respectively).
- Rainfall runoff for the final void catchments estimated using a rainfall runoff model applied to the final void sub-catchments.
- Groundwater inflow rates, provided by AGE (2016), varying (with water level) up to 0.63 ML/d for the United final void and zero for the Wambo final void.
- Final void level-volume-area relationships derived from supplied contour plans.
- Evaporation loss calculated from pan evaporation multiplied by void water surface area. A constant pan factor of 0.8 was assumed for calculation of evaporation loss (as a multiplier on pan evaporation).
- Rainfall runoff was assigned a uniform salinity of 4,000 mg/L, while groundwater inflow was assigned a salinity of 6,000 mg/L. These values were based on monitored salinity values at the existing Wambo Coal Mine. The 4,000 mg/L number was intended to be a conservative estimate in the prediction of the trend of salinity in the final voids. Ultimately, given that these are to be contained voids (i.e. no spill), salinity will tend towards hyper-salinity and any assumption around inflow salinity only affects how quickly this occurs.

2. Model Refinements Subsequent to the EIS

Given the high salinity values simulated for the Project EIS final voids and as a result of submissions received regarding the EIS, an effort was made to improve the accuracy of predicted salinity via a refinement to separate incident rainfall salinity from catchment runoff salinity. The Project EIS model assumed direct rainfall to the water surface *and* catchment runoff reporting to both final voids was assigned a salinity of 4,000 mg/L. This was

considered overly conservative and refined in order to simulate direct rainfall to the water surface with a salinity value of 0 mg/L and catchment runoff with a salinity of 4,000 mg/L. Catchment runoff salinity was further refined to a value of 423 mg/L based on a median overburden leachate electrical conductivity of 661 µS/cm reported by GeoTerra (2017) – i.e. testwork undertaken after the EIS. This change improves the model accuracy. Two sensitivity runs with a catchment runoff salinity of 210 mg/L and 750 mg/L respectively were also included. The lower of the two values is based on the median monitored value reported in the Wambo EIS (WCPL 2003) while the higher of the two values is based on the median TDS recorded for United Dam 3 between January 2013 and July 2017. A summary of the assumed salinity for each simulated inflow type is provided in Table 1 for each of the model results presented herein.

Table 1 Summary of Assumed Salinity for Each Inflow Type

Description	Assumed Salinity (mg/L)	
	EIS	Refinement
Groundwater	6,000	6,000
Direct rainfall	4,000	0
Catchment Runoff	4,000	423 (sensitivity 210 or 750)

The second model refinement undertaken was to allow for a change in evaporation pan factor as salinity increased. A 'salinity pan factor' was included (as a multiplier on pan evaporation) in the model based on Morton (1985) as noted in Grayson et al. (1996).

These refinements contribute toward a more accurate model.

A third model refinement was included as a result of a change to the final landform plan. The change to the final landform resulted in subsequent changes to void storage characteristics (i.e. level-volume-area relationships) and catchment areas. Changes to storage characteristics are summarised in Figure 3 and Figure 4 for the United and Wambo voids respectively.

Changes to catchment areas as a result of the final landform refinement are summarised in Table 2. Different rainfall-runoff model parameters apply to each catchment type.

Table 2 Changes due to Final Landform Refinement: Catchment Area

Catchment Type	United Catchment Area (ha)		Wambo Catchment Area (ha)	
	EIS	Refinement	EIS	Refinement
Natural	121.6	140.9	0.0	0.0
Rehabilitation	8.2	143.3	26.9	276.6
Open Cut Pit & Spoil	131.4	76.1	170.6	0.0
Total	261.2	360.3	197.5	276.6

Simulated water level and salinity for both the United and Wambo final voids with these refinements included are shown in Figure 5 and Figure 6. Note this has that resulted in a lowering of the predicted salinity at the end of the 500 year modelling period to 13,000 mg/L and 17,000 mg/L for the United and Wambo final voids respectively. However these voids

will still ultimately tend towards hyper-salinity (well beyond the modelled 500 year simulation).

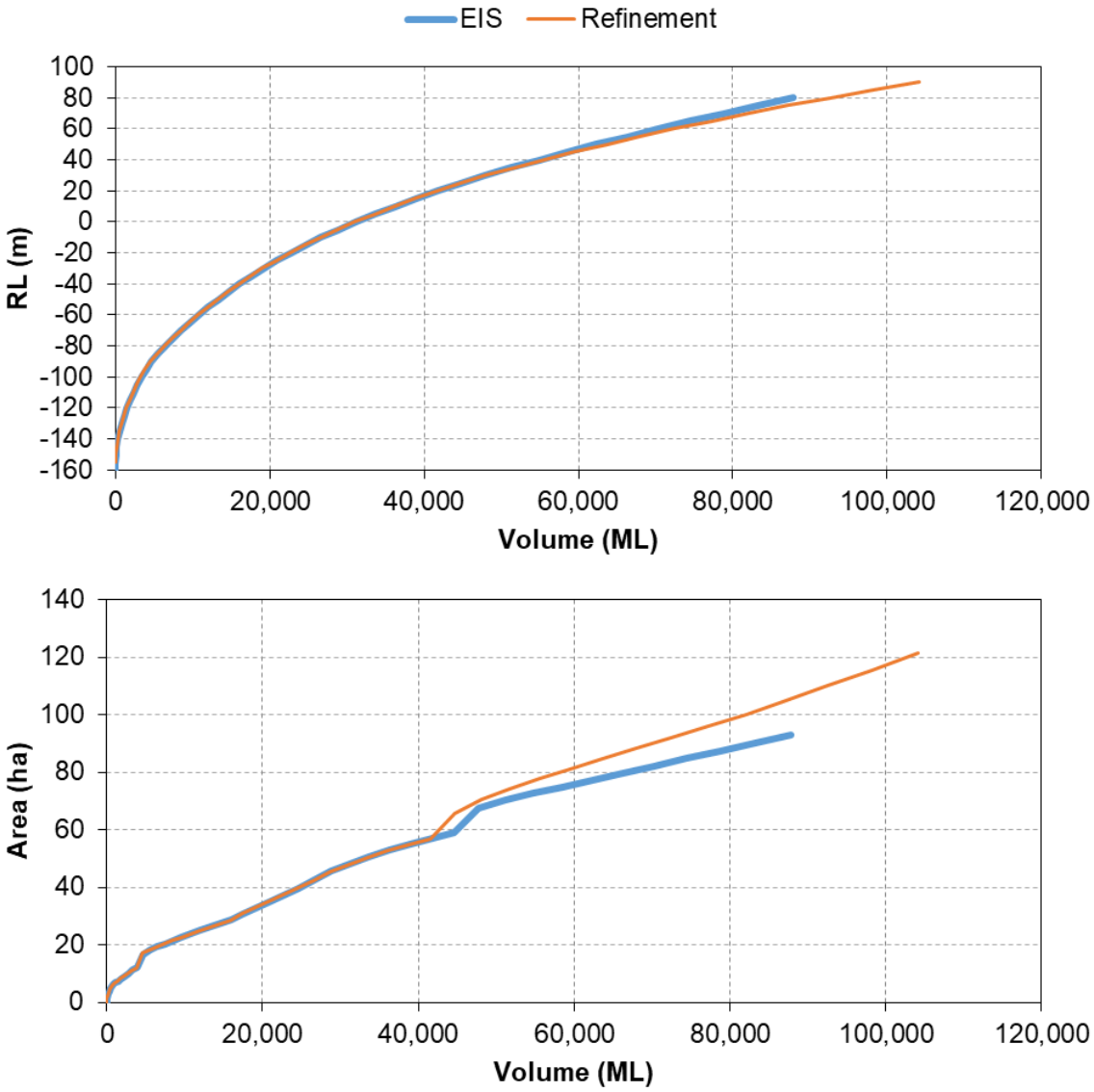


Figure 3 Changes due to Final Landform Refinement: Level-Volume-Area United

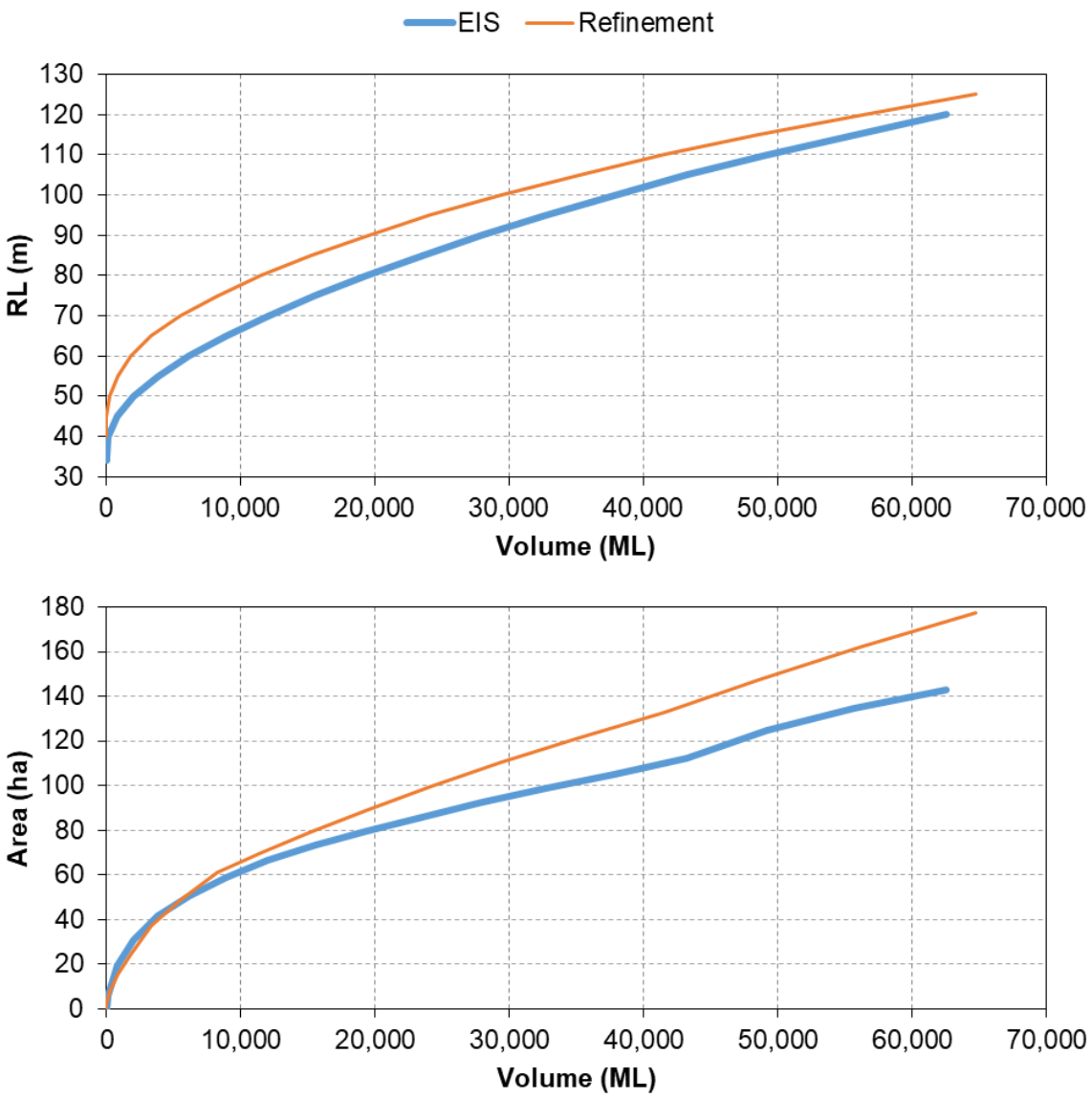


Figure 4 Changes due to Final Landform Refinement: Level-Volume-Area Wambo

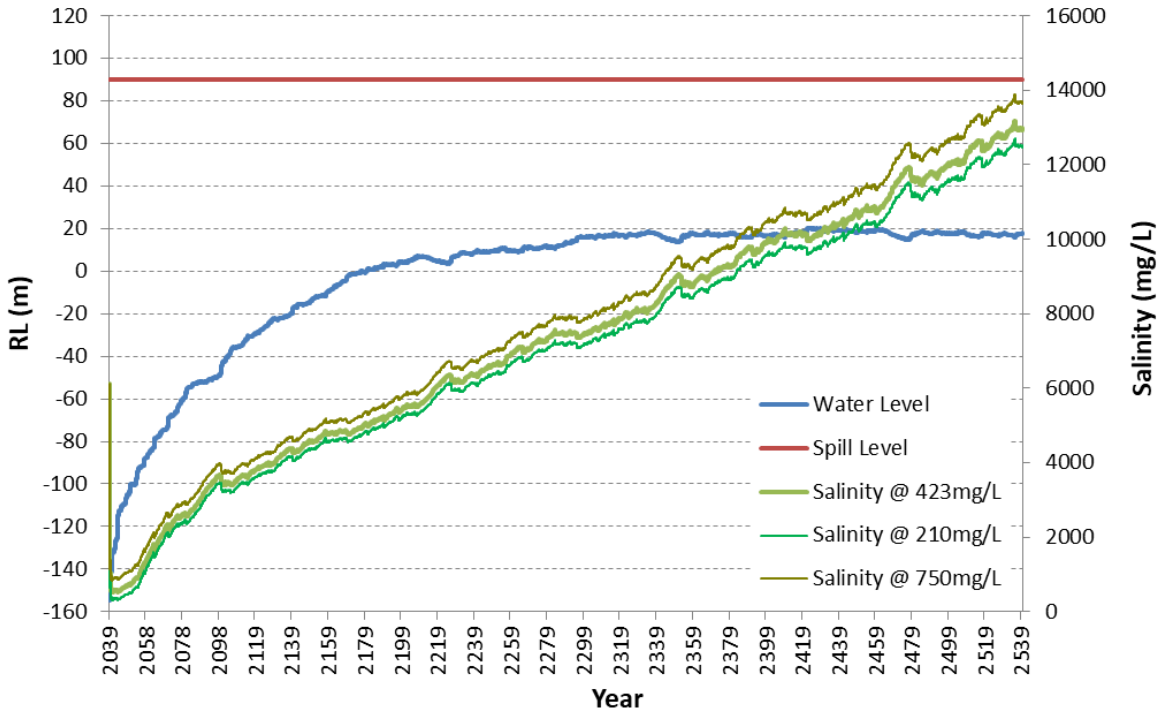


Figure 5 EIS Refinements Final Void Results: United

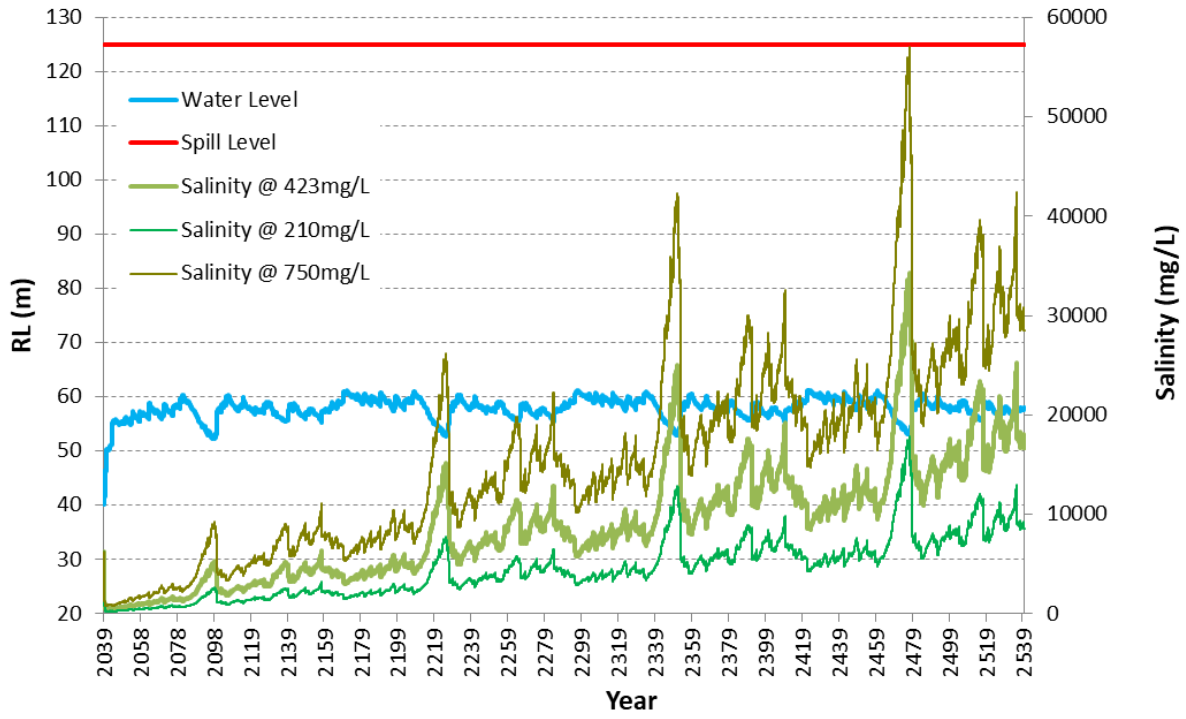


Figure 6 EIS Refinements Final Void Results: Wambo

3. Summary of Model Refinements and Results

A summary of model refinements along with key model results are summarised in Table 3.

Table 3 Timeline of Model Refinements and Key Model Results

Date	Description of Refinements	United Final Void		Wambo Final Void	
		Equilibrium Water RL (m)	Salinity after 500 years (mg/L)	Equilibrium Water RL (m)	Salinity after 500 years (mg/L)
15/07/2016	n/a	19	35,000	52	300,000
18/09/2017	• Rainfall salinity separated from catchment runoff salinity • Salinity pan factor included • Catchment runoff salinity reductions • Final landform revision (storage relationships and catchments)	19	13,000	58	17,000 (423 mg/L); 9,000 (210 mg/L) 30,000 (750 mg/L)

In conclusion, we consider that the model refinements undertaken since the EIS modelling, which include data that was not available during the EIS, significantly improve the accuracy of model forecasts.

Please contact the undersigned if there are any queries.

Yours faithfully,

Dayjil Fincham
Senior Water Resources Engineer

Tony Marszalek
Director

References:

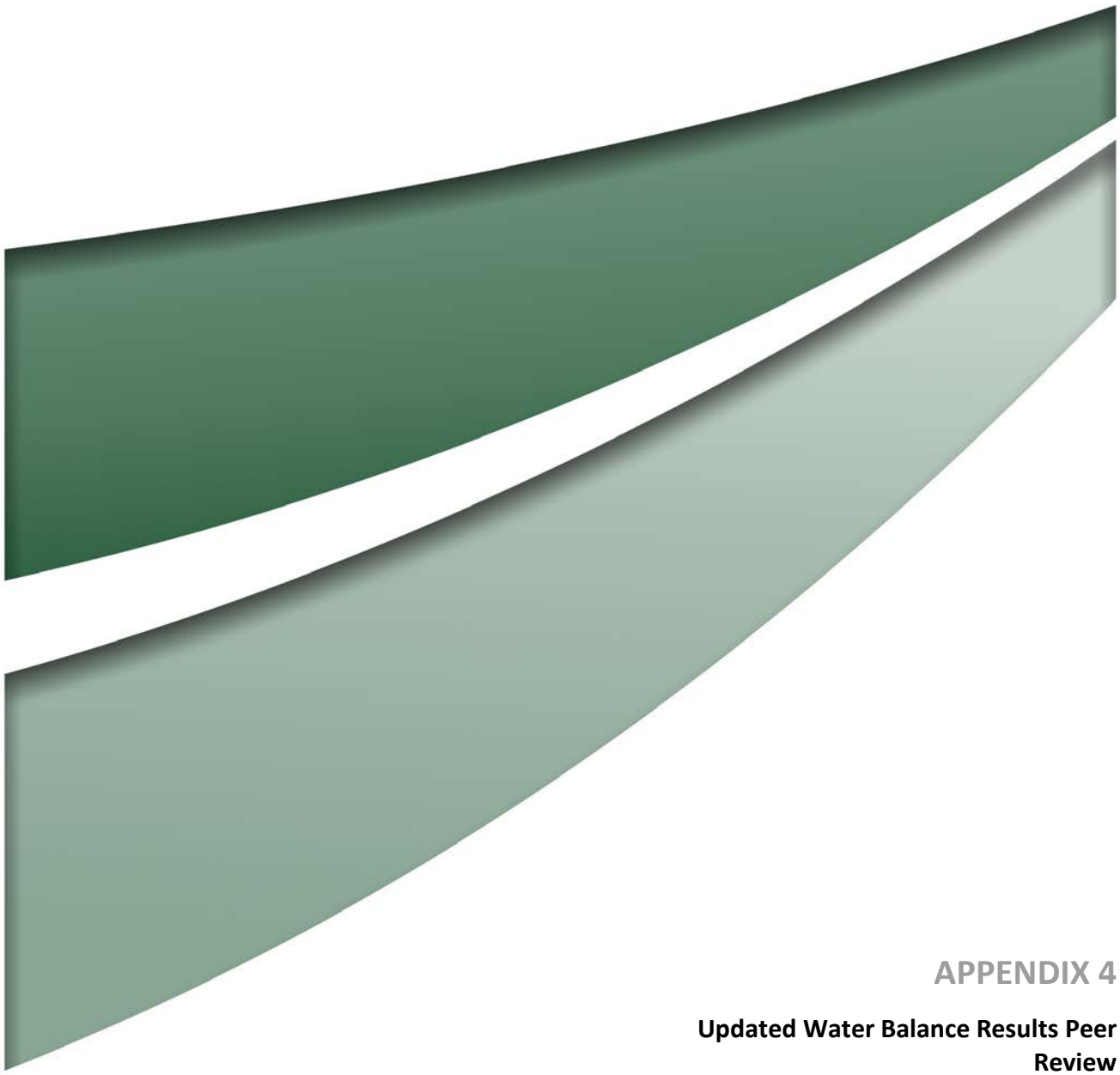
AGE 2016, *United Wambo Open-Cut Coal Mine Project: Groundwater Impact Assessment*, prepared by Australasian Groundwater and Environmental Consultants Pty Ltd for Umwelt Australia Pty Ltd, May, G1733.

GeoTerra 2017, *United Wambo open Cut Coal Mine Project Waste Rock/Tailings Geochemical Characterisation and Acid & Metalliferous Drainage Assessment*, Report UNi2-R1B, prepared by GeoTerra Pty Ltd for United Collieries Pty Ltd, March.

Grayson, R.B., Argent, R.M., Nathan, R.J., McMahon, T.A. and Mein, R. (1996) *Hydrological Recipes: Estimation Techniques in Australian Hydrology,* Cooperative Research Centre for Catchment Hydrology, Australia.

HEC 2016, *United Wambo Open Cut Coal Mine Project Surface Water Assessment Water Balance,* prepared by Hydro Engineering & Consulting Pty Ltd for Umwelt (Australia) Pty Limited, Rev 5, July.

Wambo Coal Pty Limited 2003, *Wambo Development Project: Environmental Impact Statement*, prepared by Resource Strategies, July.



APPENDIX 4

Updated Water Balance Results Peer Review

ENGENY
WATER MANAGEMENT
Level 7, 500 Queen Street Brisbane QLD 4000
PO Box 10183 Brisbane QLD 4000
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P: 07 3221 7174
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20 September 2017

Umwelt (Australia) Pty Ltd
75 York Street
Teralba NSW 2284

Attention: John Merrell (Group Manager, Environment & Community NSW)

Dear John

RE: Technical Review of Final Void Modelling – United Wambo Open Cut Coal Mine Project

Introduction

This letter summarises the findings of a technical review of the final void modelling for the United Wambo Open Cut Coal Mine Project undertaken by Hydro Engineering & Consulting Pty Ltd (HEC). Final void modelling was undertaken for the United and Wambo final voids (two voids).

The technical review was performed by Dr Andrew Vitale from Engeny Water Management who is a Principal Water Resources Engineer with 24 years of experience and a Registered Professional Engineer of Queensland.

Scope of Technical Review

Final void modelling for the United Wambo Open Cut Coal Mine Project was described in the Water Balance Report (HEC, Revision 5, 15 July 2016) that was prepared for the Environmental Impact Statement (EIS) for the Project. The final void modelling was revised in September 2017 to include changes to the final landform designs and additional information on spoil leaching characteristics that were available since the completion of the EIS. The revision of the final void modelling also included some refinements to the modelling of salt inflows to the final voids from catchment runoff that was resulting in unrealistically high long term salt concentrations in the final voids.

The technical review described in this letter was focussed on the revised final void modelling. The original final void modelling undertaken for the EIS has not been specifically reviewed.

The following information was reviewed and considered for the technical review of the final void modelling:

- Report on United Wambo Open Cut Coal Mine Project Surface Water Assessment: Water Balance (HEC, Revision 5, 15 July 2016).
- Letter Report on United Wambo Open Cut Coal Mine Project: Updated Final Void Water Balance Results (HEC, 19 September 2017).

- Report on United Wambo Open Cut Project Waste Rock / Tailings Geochemical Characterisation and Acid & Metalliferous Drainage Assessment (GeoTerra Pty Ltd, 20 March 2017).
- GoldSim Player version of revised final void model for United Wambo Open Cut Coal Mine Project (HEC, September 2017, Filename: United_FV_v1.1 update6.gsp).

Modelling Approach

The final void modelling was undertaken using the GoldSim general purpose simulation software. The model runs on a daily time step for a period of 500 years and utilises repeated sequences of historical (1889 to 2014) climate data (Silo Data Drill) for the 500 year simulation.

The water balance model accounts for the volume of water and mass of salt in the final voids. A mass balance check for the salt balance is included in the model and confirms that all salt flows have been correctly accounted for.

The following water and salt inflows and outflows are included in the model for the final voids:

- Direct rainfall on the void lake.
- Catchment runoff from the balance of the void catchment area above the void lake level.
- Groundwater inflow.
- Evaporation losses from the void lake.
- Overflows from the void lake (included in the model but do not occur in the simulation).

The overall modelling approach is considered fit for purpose and consistent with current industry standards for final void modelling.

Key Assumptions

Key assumptions and data utilised for the development of the water balance model are adequately documented in the original EIS Water Balance Report (HEC, 2016) and the letter report on the revised final void modelling (HEC, 2017).

Comments on the assumptions and data are provided below:

- The model uses daily rainfall and pan evaporation data for the mine location and the period 1889 to 2014 obtained from the Silo Data Drill facility. The average annual rainfall for the climate data sequence used in the model is 617 mm/yr which is slightly lower than the long-term average rainfall totals recorded at nearby Bureau of Meteorology (BoM) rainfall stations as follows:
    - 683 mm/yr at Warkworth Homestead (Station No. 61200).

- 632 mm/yr at Jerrys Plains (Carrington) (Station No. 61171).
- 667 mm/yr at Bulga South Wambo (Station No. 61191).
- 645 mm/yr at Jerrys Plains Post Office (Station No. 61086).

The reason for the differences between the average annual rainfall totals from the Data Drill and the BoM rainfall stations is not known. These differences are not considered significant in terms of the final void model outcomes.

- The average annual pan evaporation for the climate data sequence used in the model is 1,462 mm/yr which is slightly lower than the long-term average pan evaporation total of approximately 1,640 mm/year recorded at the nearby Jerrys Plains Post Office weather station (Station No. 61086). This difference is not considered significant in terms of the final void model outcomes.

- Pan factors of 0.8 and 0.85 were used to convert the daily pan evaporation totals to lake evaporation and evapotranspiration totals. These pan factors are considered to be reasonable.

- Revised storage characteristics for the final voids have been adopted for the revised final void modelling. The storage characteristics for the two final voids are very different, with the United void a much deeper void than the Wambo void.

- The total catchment areas reporting to the final voids were 360.3 ha for the United void and 276.6 ha for the Wambo void.

- Catchment runoff inflows to the final voids were calculated in the water balance model using the AWBM runoff model. Different AWBM parameters were used for the natural, open cut pit and rehabilitated spoil areas reporting to the final voids. The AWBM parameters adopted for the natural, open cut pit and rehabilitation land uses are considered reasonable with equivalent average annual runoff coefficients of 7% for natural areas, 27% for open cut pit areas and 9% for rehabilitated spoil areas. In the water balance model, the baseflow component to runoff (22% of total runoff) for the rehabilitated spoil land use was subtracted from the calculated runoff volumes since the infiltration (groundwater recharge) through the spoil was considered to be included in the groundwater inflow estimates to the voids that were determined through groundwater modelling. There is some uncertainty in this assumption, however it is not considered to have a material impact on the final void model outcomes.

- Groundwater inflows to the United final void were input as varying rates that vary with the recovery (filling) of the void lake. The groundwater inflow rates were supplied to HEC by AGE Consultants and were based on outputs from groundwater modelling. The modelled groundwater inflows to the United void include the loss of groundwater from the void into the adjacent spoil (i.e. the groundwater inflow rate is a net inflow rate) and accordingly the groundwater inflow rate is initially a low value at low void lake levels and increases to a maximum inflow rate of 0.63 ML/d when the void lake has filled to RL -12 m. The groundwater inflow rate then reduces as the pit lake continues to fill above RL -12 m. Since the Wambo final void is significantly higher than the United final void, the groundwater flow direction is generally towards the United final void and accordingly no groundwater inflows to

the Wambo final void were included in the final void water balance model. While there is some uncertainty in the groundwater inflows, it is considered that the best available information on groundwater inflows has been used in the final void model.

- For the final void modelling, it was assumed that there would be no transfers of water between the Wambo and United final voids as a result of seepage through spoil. The predicted equilibrium lake level in the Wambo final void is approximately 40 m higher than the predicted equilibrium lake level in the United void and it is possible that seepage from the Wambo void into the United void could occur. This would result in a smaller final void lake in the Wambo void and a larger final void lake in the United void, but is unlikely to result in any significant change to the water quality outcome for the United void. Modelling the two final voids as separate systems (no seepage flows between the voids) is considered reasonable for the purpose of identifying the maximum final void lake scenario for the Wambo void.

- A constant salt concentration (total dissolved solids, TDS) of 6,000 mg/L was assumed for groundwater inflows and was based on groundwater monitoring data.

- A constant salt concentration of 423 mg/L TDS for catchment runoff inflows to the voids was assumed based on median values from spoil leaching testing (GeoTerra, 2017). It is considered likely that the long term runoff salinity from rehabilitated areas will be less than the values determined from spoil leaching testing and accordingly the final void model predictions for the final void lake salinities are considered to be conservatively high. A sensitivity analysis was included in the revised final void modelling to simulate a lower runoff TDS value of 210 mg/L which is typical of surface water quality monitoring of waterways in the vicinity of the mine and a higher runoff TDS value of 750 mg/L which is the median TDS recorded in United Dam 3 which includes rehabilitated spoil in its' catchment.

- No salt inflows to the final voids were assumed to occur as a result of direct rainfall on the void lake areas. The salinity of rainfall is relatively low (approximately 10 mg/L but depends on the distance from the coast) and is not considered to have a material impact on the salinity of the final void lakes.

- Evaporation reduction factors for saline water were included in the final void model but have negligible impact on the final void modelling results (maximum evaporation reductions of approximately 2% after 500 years) as a result of the relatively low salinities predicted in the final void lakes.

- The water balance modelling has assumed fully mixed conditions in the final voids. It is likely that some stratification will develop, particularly in the deeper United void. More detailed modelling of stratification effects in the final voids will ultimately be required closer to mine closure.

The assumptions and data used for the development of the final void model are considered reasonable and fit for the purpose of the final void study.

Final Void Model Results

The revised final void model results were summarised in the letter report on the revised final void modelling (HEC, 2017) and are reproduced in Figure 1 and Figure 2. A summary of the predicted final void outcomes for the two voids is provided in Table 1.

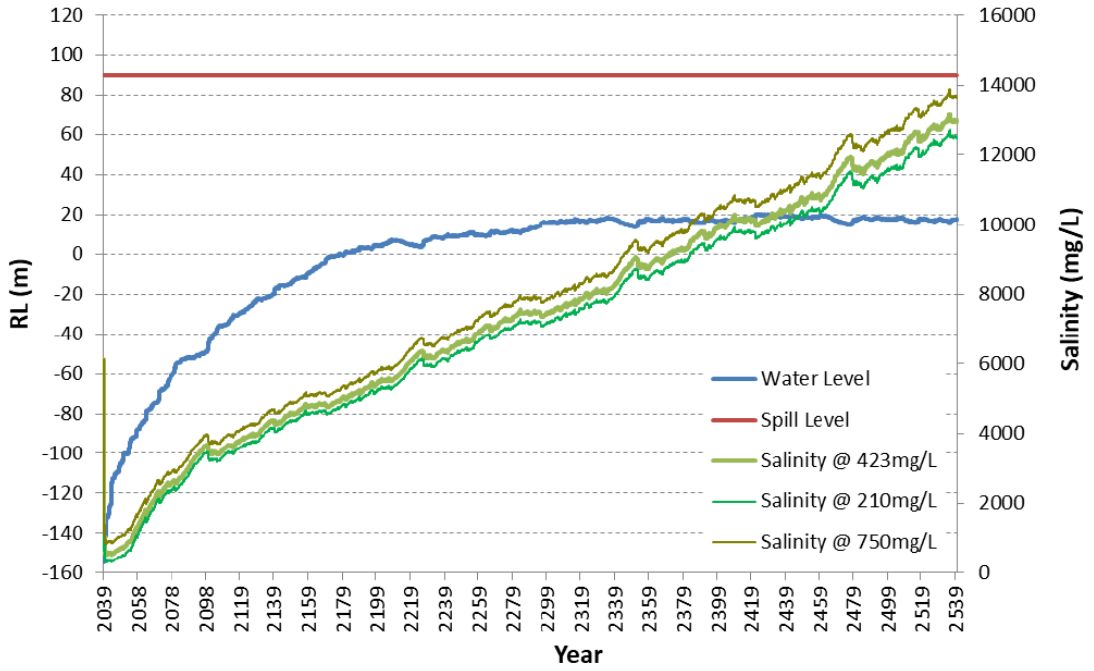

Figure 1 Final void modelling results for United Void (HEC, 2017)

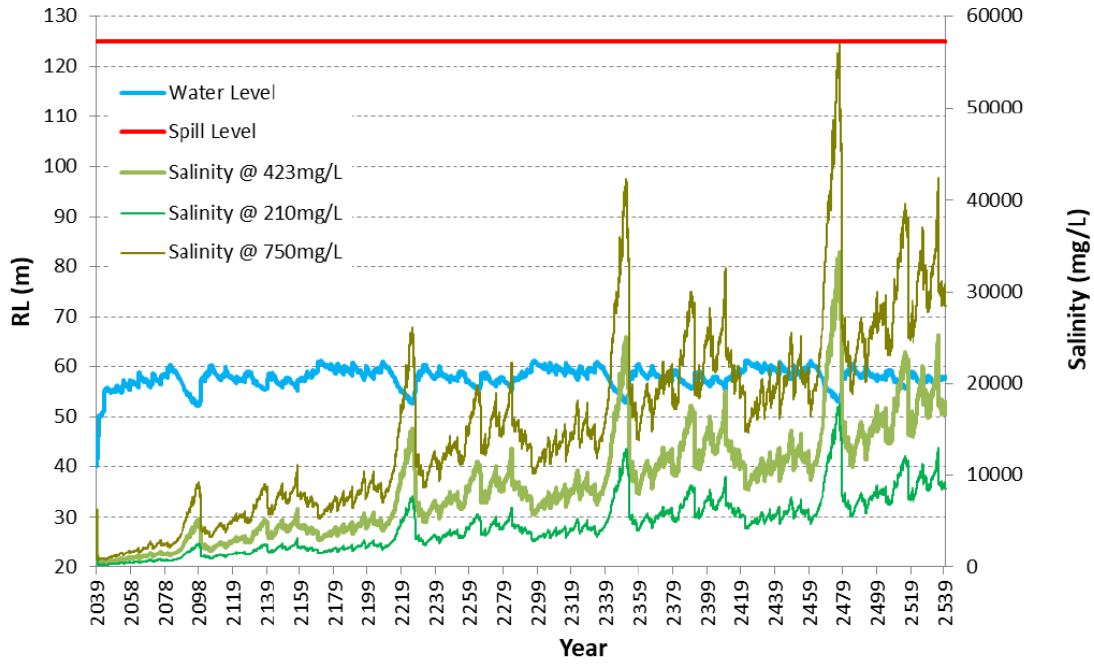

Figure 2 Final void modelling results for Wambo Void (HEC, 2017)

Table 1 Summary of revised final void water balance modelling outcomes (runoff TDS = 423 mg/L)

Final Void Outcome	United Void	Wambo Void
Equilibrium void lake volume	41,000 ML	1,500 ML
Equilibrium void lake level	RL 18 m	RL 58 m
Equilibrium void lake area	56 ha	21 ha
Time to fill to equilibrium lake level	380 years	40 years
Void lake salinity after 500 years	13,000 mg/L TDS	17,000 mg/L TDS
Void lake salinity increase after equilibrium reached	23 mg/L TDS increase per year	33 mg/L TDS increase per year

Key outcomes from the final void modelling are as follows:

- The Wambo void lake will take a significantly shorter time to reach equilibrium conditions than the United void lake. This is a result of the different storage characteristics of the two voids (Wambo void is significantly shallower).
- The United final void lake will contain approximately 27 times more water than the Wambo final void lake.
- The final voids will remain as groundwater sinks and will not overflow.
- The United final void lake is predicted to increase in salinity at a slightly slower rate than the Wambo final void lake after equilibrium is reached.
- The climate induced salinity fluctuations in the Wambo void after equilibrium is reached will be significantly greater than the United void because of the smaller volume of water in the Wambo final void lake.
- The long-term salinity of the United final void lake is driven more by the salinity of the groundwater inflows to the void than the salinity of the catchment runoff into the void (sensitivity analysis of catchment runoff TDS has only a small impact on the final void salinity).
- The long-term salinity of the Wambo final void lake is driven by the salinity of the catchment runoff into the void (sensitivity analysis of catchment runoff TDS has a significant impact on the final void salinity).

Independent Verification of Final Void Modelling

Independent calculations (hand calculations) of the behaviour of the final void lakes after equilibrium conditions are reached was undertaken to verify the final void water balance modelling results. The independent water balance calculations were based on

average climate conditions and assuming the equilibrium void lake characteristics shown in Table 1. The independent average water balance calculations are summarised in Table 2 and Table 3.

Table 2 Independent water balance calculations (average conditions) of final void lake behaviour (volume) after equilibrium conditions reached (runoff TDS = 423 mg/L)

Water Balance Parameter	United Void	Wambo Void
Direct rainfall inflow	346 ML/year	128 ML/year
Open cut pit runoff inflow (27% runoff coefficient)	33 ML/year	Nil
Natural & rehab spoil runoff inflow (7% runoff coefficient)	123 ML/year	110 ML/year
Groundwater inflow	140 ML/year	Nil
Total inflow	642 ML/year	238 ML/year
Evaporation loss	648 ML/year	241 ML/year
Net balance	-6 ML/year (i.e. approximately balanced)	-3 ML/year (i.e. approximately balanced)

Table 3 Independent water balance calculations (average conditions) of final void lake behaviour (salinity) after equilibrium conditions reached (runoff TDS = 423 mg/L)

Salt Balance Parameter	United Void	Wambo Void
Direct rainfall inflow	Nil	Nil
Open cut pit runoff inflow (27% runoff coefficient)	14 tonnes salt per year	Nil
Natural & rehab spoil runoff inflow (7% runoff coefficient)	52 tonnes salt per year	47 tonnes salt per year
Groundwater inflow	842 tonnes salt per year	Nil
Total inflow	908 tonnes salt per year	47 tonnes salt per year
Evaporation loss	Nil	Nil
Net balance	908 tonnes salt per year	47 tonnes salt per year
Rate of salinity increase	22 mg/L TDS per year	32 mg/L TDS per year

The independent average water balance calculations indicate that:

- The equilibrium void lake conditions predicted from the final void modelling are correct (i.e. the equilibrium final void lakes will have a net neutral water balance under average climate conditions).
- The long-term salinity increases in the final void lakes predicted from the final void modelling are consistent with those calculated independently based on average climate conditions.

Conclusions

The technical review of the final void modelling (revised after EIS) undertaken for the United Wambo Open Cut Coal Mine Project has concluded that:

- The final void modelling has been performed using current industry practice methods for final void modelling.
- Input data and assumptions used for the development of the final void model are reasonable, fit for purpose and based on the best information available at the current time.
- The final void modelling results and trends are reasonable and make physical sense based on the assumptions and data used for the modelling.
- An independent verification of the final void modelling results has been performed and indicates that the water and salt balance calculations have been correctly implemented within the final void model.

Yours faithfully

Andrew Vitale
Principal Water Resources Engineer
Registered Professional Engineer of Queensland (RPEQ No. 9341)

GLENCORE

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