PEABODY

WILPINJONG COAL
REHABILITATION STRATEGY

WI-ENV-MNP-0046

March 2022

Document Owner		Document Approver
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Version	Approval Date	Approver Name
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General Description of Changes from Previous Version

Document No.	Version	Date	Prepared/Reviewed By	Distribution	Description of Change
WI-ENV-MNP-0046	1	March 18	WCPL	DP&E	SSD-6764
WI-ENV-MNP-0046	2	August 20	WCPL	DP&E	Address DPIE Comments
WI-ENV-MNP-0046	3	March 22	WCPL	DPIE	Revised Final Landform

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1 Introduction

The Wilpinjong Coal Mine is owned and operated by Wilpinjong Coal Pty Limited (WCPL), a wholly owned subsidiary of Peabody Energy Australia Pty Ltd (Peabody).

The Wilpinjong Coal Mine is an existing open cut coal mining operation situated approximately 40 kilometres north-east of Mudgee, near the Village of Wollar, within the Mid-Western Regional Local Government Area, in central New South Wales (NSW) (**Figure 1**).

The Wilpinjong Coal Mine produces thermal coal products which are transported by rail to domestic customers for use in electricity generation and to port for export. Open cut mining operations are undertaken 24 hours per day, seven days per week.

The Wilpinjong Coal Mine originally operated under Project Approval (PA 05-0021) that was granted by the Minister for Planning under Part 3A of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) on 1 February 2006. Modification of the Project Approval subsequently occurred six times[1] with the most recent modification (Modification 7) approved in August 2016.

On 24 April 2017, WCPL was granted Development Consent (SSD-6764) for the Wilpinjong Extension Project that provides for the continued operation of the Wilpinjong Coal Mine at rates of up to 16 million tonnes per annum of run-of-mine coal, until 2033, and access to approximately 800 hectares of open cut extensions. The Development Consent (SSD-6764) has superseded the Project Approval (05-0021). This Rehabilitation Strategy has been prepared to satisfy the relevant conditions in Development Consent (SSD-6764).

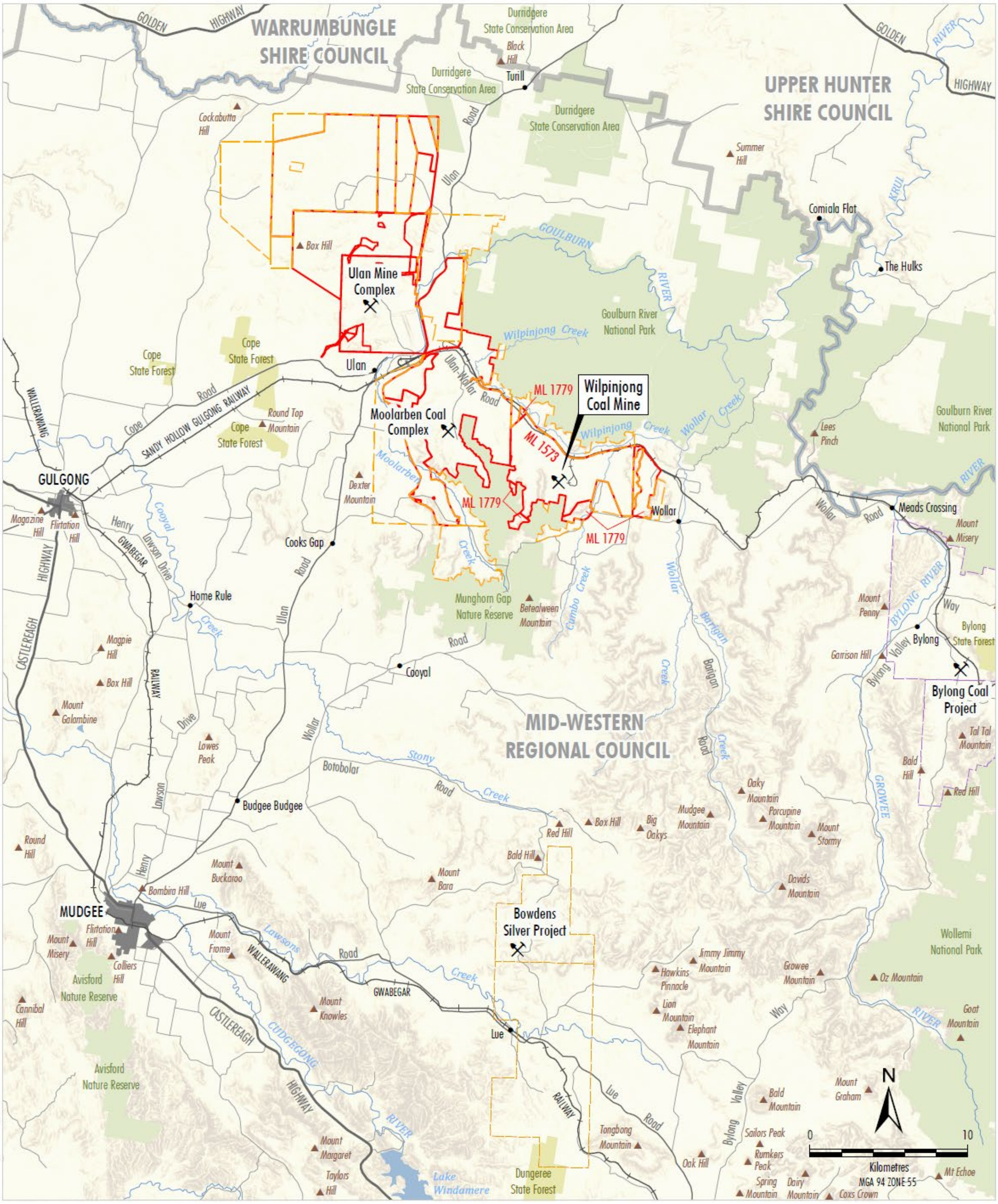
The approved Conceptual Rehabilitation Strategy (Appendix 8 of the Development Consent) is shown on **Figure 2**.

1.1 Purpose

This Rehabilitation Strategy has been prepared to address Condition 61, Schedule 3 of Development Consent (SSD-6764). Consistent with the requirements of Condition 61, this Rehabilitation Strategy presents a revised final landform that builds on the rehabilitation objectives in Table 11 of Development Consent (SSD-6764).

This Rehabilitation Strategy, once approved, will form the overarching guide for the development of the revised Rehabilitation Management Plan for the Wilpinjong Coal Mine. In accordance with Condition 66, Schedule 3 of Development Consent (SSD-6764), within three months of approval of this Rehabilitation Strategy, the Rehabilitation Management Plan must be revised accordingly. The Rehabilitation Management Plan details the rehabilitation objectives, performance standards and performance/completion criteria that are used to achieve these overarching objectives.

[1] Modification 2 was withdrawn.



LEGEND
Mining Lease Boundary
Exploration Licence Boundary
Authorisation Boundary
Local Government Boundary
NSW State Forest
National Park, Nature Reserve or State Conservation Area
Coal Mining Operation

Source: WCPL (2019); Office of Environment & Heritage NSW (2019); NSW Land & Property Information (2017); NSW Dept of Industry (2019); Geoscience Australia (2011)

Peabody
WILPINJONG COAL MINE
Regional Location

Figure 1

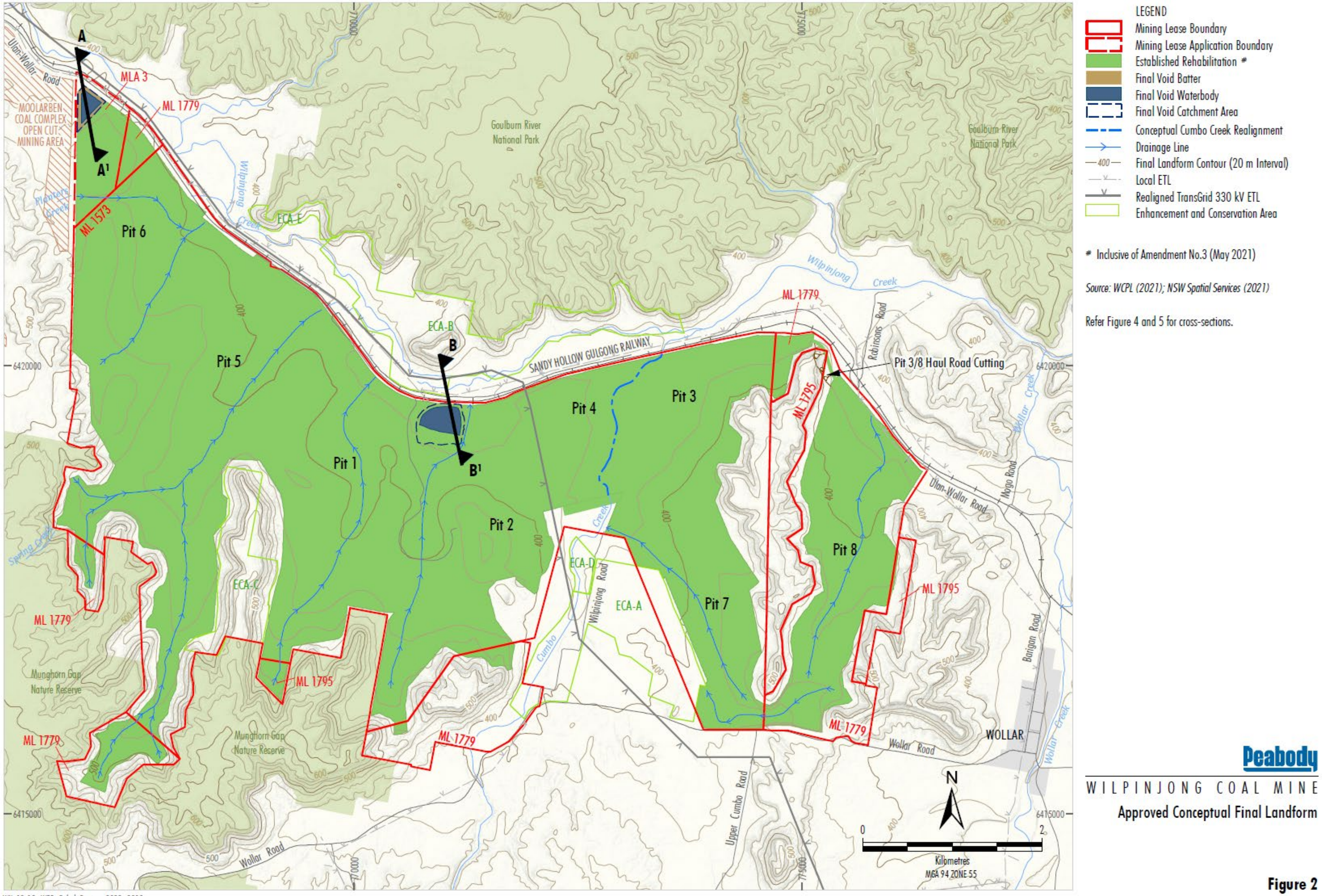


Figure 2

WIL-12-12_WEP_Rehab Strategy 2022_201C

1.2 Consultation

WCPL has an ongoing consultation programme with the Moolarben Coal Complex, and the two operations co-operate on environmental monitoring information sharing and various boundary interaction matters. In accordance with Condition 61(a), Schedule 3 of Development Consent (SSD-6764) WCPL has consulted with Moolarben Coal Operations Pty Ltd (MCO) to investigate potential options to integrate the Wilpinjong Coal Mine and Moolarben Coal Complex final landforms.

In particular, this consultation has focused on the potential to integrate the Wilpinjong Coal Mine Pit 6 final void with the Moolarben Coal Complex Open Cut 4 (OC4) final void. WCPL has held various meetings with MCO to discuss integration options at management/technical and environmental levels. While much of this consultation is necessarily commercial-in-confidence, the key outcomes of this process to date are outlined where relevant in Attachment 2.

WCPL also met with the NSW Department of Planning, Industry and Environment (DPIE) in January 2022 to discuss the revised conceptual final landform. DPIE requested the following was clarified in the revised Rehabilitation Strategy:

- details regarding how micro-relief is incorporated into the revised final landform (Section 3.1);
- confirmation that the updated final landform can continue to comply with the rehabilitation offset requirements under Condition 36, Schedule 3 of Development Consent (SSD-6764) (Section 3.5); and
- the proposed timing for resolving with MCO the potential for integration of the Pit 6 and OC4 final voids (Attachment 2).

The NSW Resources Regulator completed a Targeted Assessment Program (Landform Establishment) on the Wilpinjong Coal Mine on 29 July 2021 (TAP). The TAP focused on how the final approved landform is being established to achieve sustainable rehabilitation outcomes. The Resources Regulator summarised the outcomes of the TAP as follows (letter dated 1 October 2021):

> *Based on discussions held with the mine staff and documents presented as part of the assessment, the mine is identifying risks and defining controls associated with landform establishment.*

2 Statutory Requirements

This Rehabilitation Strategy has been prepared to fulfil the requirements of Development Consent (SSD-6764), recommendations documented in relevant studies, assessments and investigations, and relevant legislation, standards and guidelines.

Table 1 summarises WCPL's main statutory approval relevant to this Rehabilitation Strategy.

Table 1
WCPL's Statutory Approvals

Approval Licence No.	Description	Date of Approval	Agency
SSD-6764	Development Consent	24 April 2017	DPIE

2.1 Development Consent (SSD-6764) Requirements

This Rehabilitation Strategy has been prepared in accordance with Condition 61, Schedule 3 of Development Consent (SSD-6764). **Table 2** presents these requirements and indicates where they are addressed within this Rehabilitation Strategy.

Table 2
Development Consent (SSD-6764) Requirements

Development Consent (SSD-6764) Condition	Section
Rehabilitation Strategy	
61. Within 6 months of the commencement of development under this consent, unless the Secretary agrees otherwise, the Applicant must prepare a Rehabilitation Strategy to the satisfaction of the Secretary. This strategy must:	
(a) in consultation with the proponent of the Moolarben Coal Mine, investigate options to integrate the final landform with the Moolarben Coal Mine, including options to integrate final voids and minimise the sterilisation of land post-mining;	Attachment 2
(b) include an assessment of partially backfilling voids 2 and 6 above the groundwater equilibrium level having regard to the final void rehabilitation objectives in Table 11, including consideration of downstream water quality and the objectives in Table 6;	Attachment 3
(c) include a revised final landform plan which builds on the rehabilitation objectives in Table 11, including incorporation of micro-relief, landform stability, hydrological and ecological function; and	Section 3
(d) include detailed justification for proposed changes to the final landform, having regard to the approved post-mining land use.	Section 4

Table 6 and 11 from Schedule 3 of Development Consent (SSD-6764) are reproduced in Attachment 1.

2.2 General Management Plan Requirements

Condition 3, Schedule 5 of Development Consent (SSD-6764) outlines general management plan requirements. These are not applicable to this Rehabilitation Strategy as it is a Strategy document rather than an environmental management plan. A separate management plan (Rehabilitation Management Plan) has been prepared by WCPL in accordance with Condition 64, Schedule 3 of Development Consent (SSD-6764) to address the management of rehabilitation.

Under Conditions 5 and 6 of Schedule 5 of Development Consent (SSD-6764), WCPL is required to periodically review and update relevant strategies, plans and programs such that the environmental management measures are regularly updated and address any material changes arising from annual reviews, incidents, audits, modifications or the direction of the Secretary. This will include, where relevant, this Rehabilitation Strategy. Further, in accordance with Condition 66, Schedule 3 of Development Consent (SSD-6764), within three months of approval of this Rehabilitation Strategy, the Rehabilitation Management Plan/Mining Operation Plan must be revised accordingly.

3 Revised Final Landform Plan

This Rehabilitation Strategy is required to include a revised final landform plan that builds on the rehabilitation objectives in Table 11 of the Development Consent, including:

- incorporation of micro-relief;
- landform stability; and
- hydrological and ecological function.

Table 11 of the Development Consent is reproduced in Attachment 1.

As a result of coal market conditions in 2018 – 2020, WCPL made mine sequence changes to maintain operations and employment through the coal price downturn. During this period commencement of the Pit 8 boxcut was delayed, and therefore mining advanced further in the existing open cut pits. The change in mine sequence, together with an identified material balance shortfall, requires a revision to the approved final landform. A revised Conceptual final landform, that accounts for the change in mine sequence and associated contemporary materials balance analysis, is shown on **Figure 3**. Cross-sections comparing the revised Pit 2 and Pit 6 void designs against the approved conceptual final landform are shown on **Figure 4** and **Figure 5**. Updated surface water and groundwater modelling has been completed by WRM Water and Environment (2022; Attachment 3) and SLR Consulting (2022; Attachment 4), respectively. The updated modelling confirms that environmental outcomes with the revised final landform would be consistent with the findings of previous assessments that supported the WEP approval (Section 3.4).

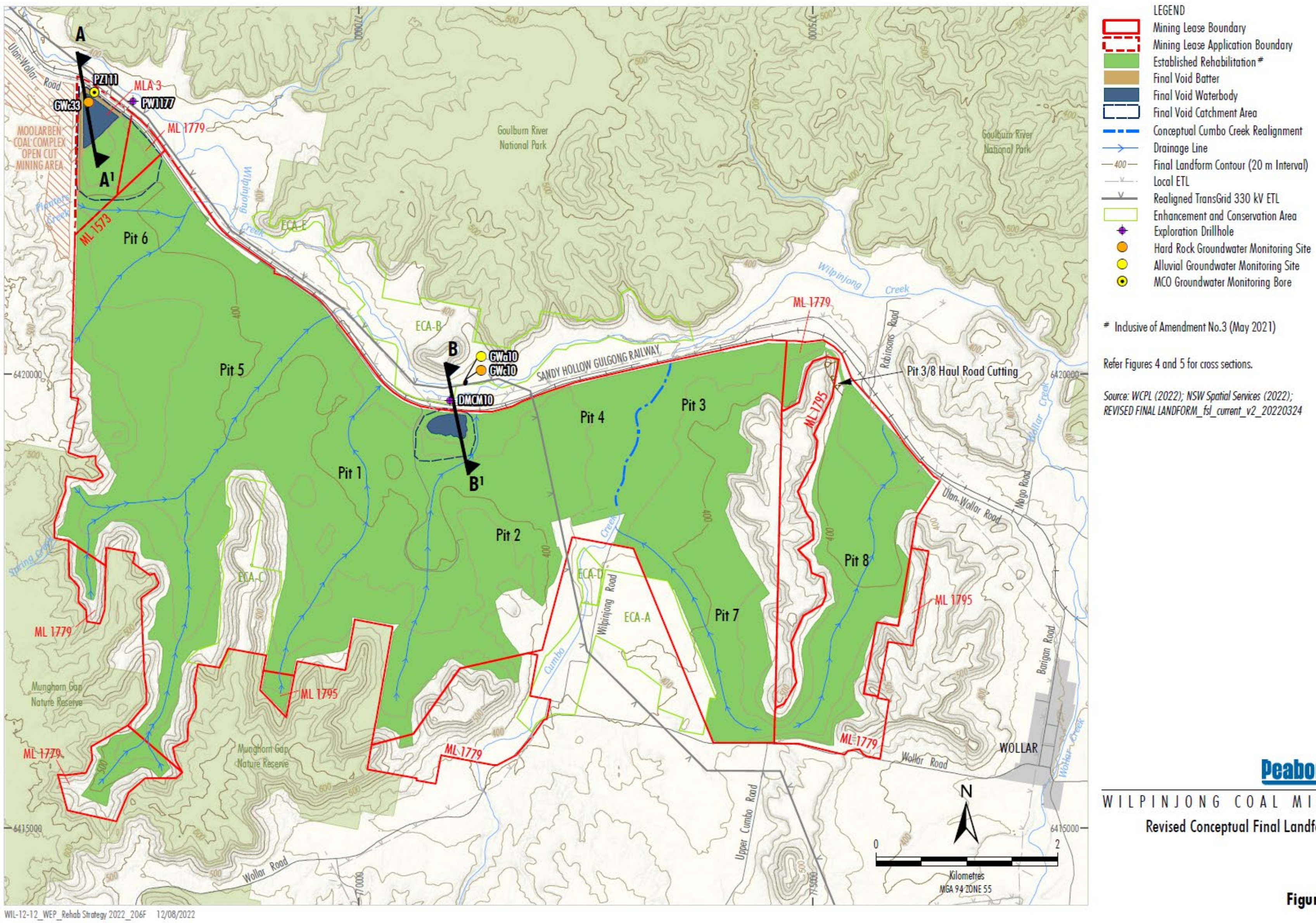
3.1 Micro Relief

One objective of the final landform is to develop drainage features in the post-mine landform that mitigate erosion potential and incorporate micro-relief (i.e. geomorphic landform design). The Resources Regulator defined geomorphic landform design in its *Rehabilitation Information Release – Geomorphic Landform Establishment at Mount Pleasant Operations Coal Mine* (August, 2021) as follows:

Geomorphic design is a method where a landscape is constructed based on a set of geomorphic rules such as Strahler stream order, hillslope length and curvature and stream length.

The application of micro-relief concepts to open cut mining activities is principally focussed on "complex landforms", such as the design of large elevated out of pit waste emplacement landforms. However, WCPL incorporates micro-relief within its in-pit waste rock emplacement landforms. The Wilpinjong Coal Mine final landform is much more topographically subdued than post-mining landforms that involve large out of pit waste emplacements or in-pit emplacements that are constructed significantly above pre-mining elevations. Notwithstanding, key principles that have been considered, and where relevant applied, include:

- Establishing valleys in rehabilitated landscapes consistent with the types of valleys observed in natural landscapes.
- Rehabilitated areas should blend into and complement the drainage pattern of the surrounding terrain.
- Designing channels of progressively higher orders and of greater capacity and cross-sectional area (Hannan, 1984).
- Establishing watercourses that become progressively steeper as one moves upstream (Environment Australia, 1998, p.20).



Peabody
WILPINJONG COAL MINE
Revised Conceptual Final Landform

Figure 3

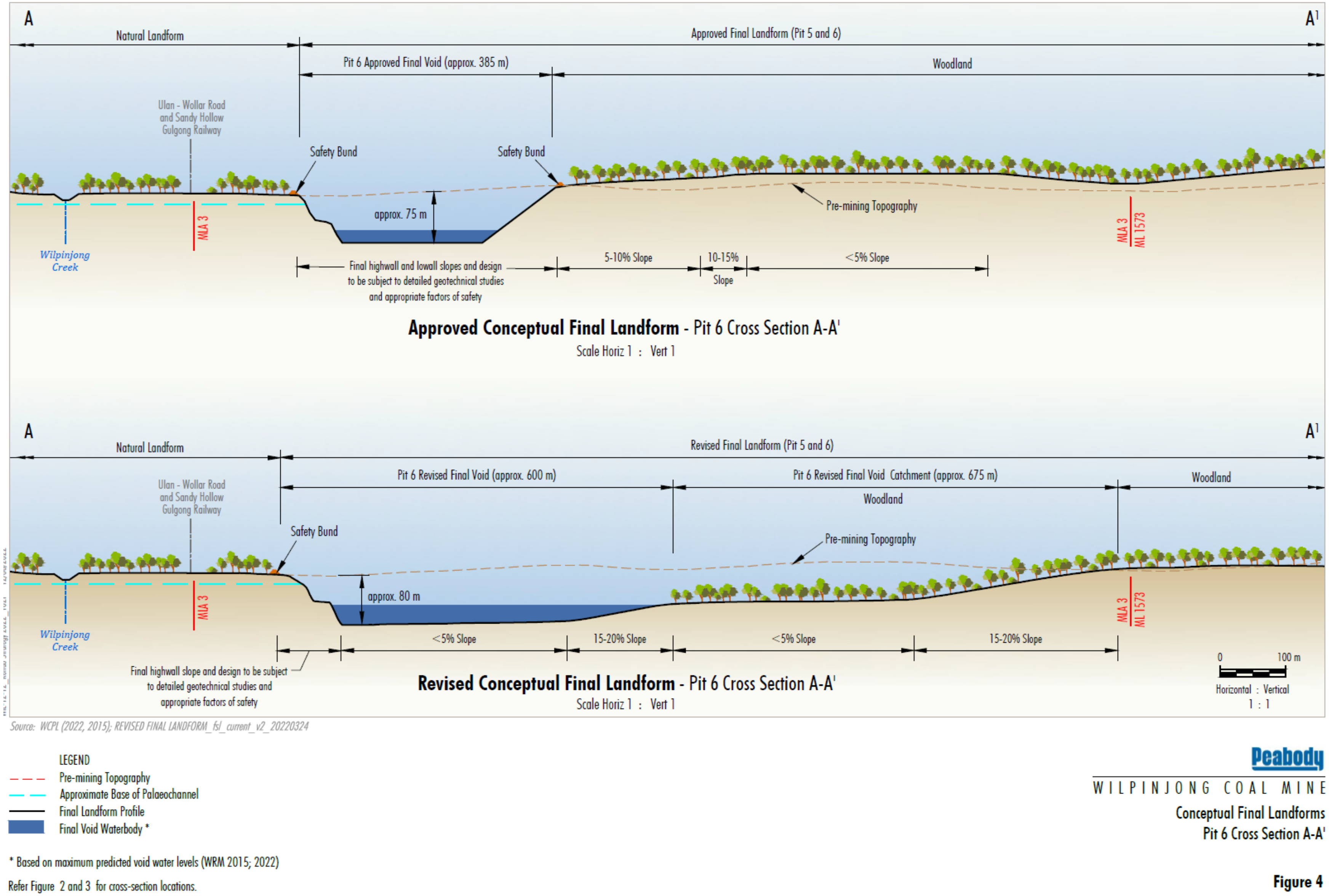
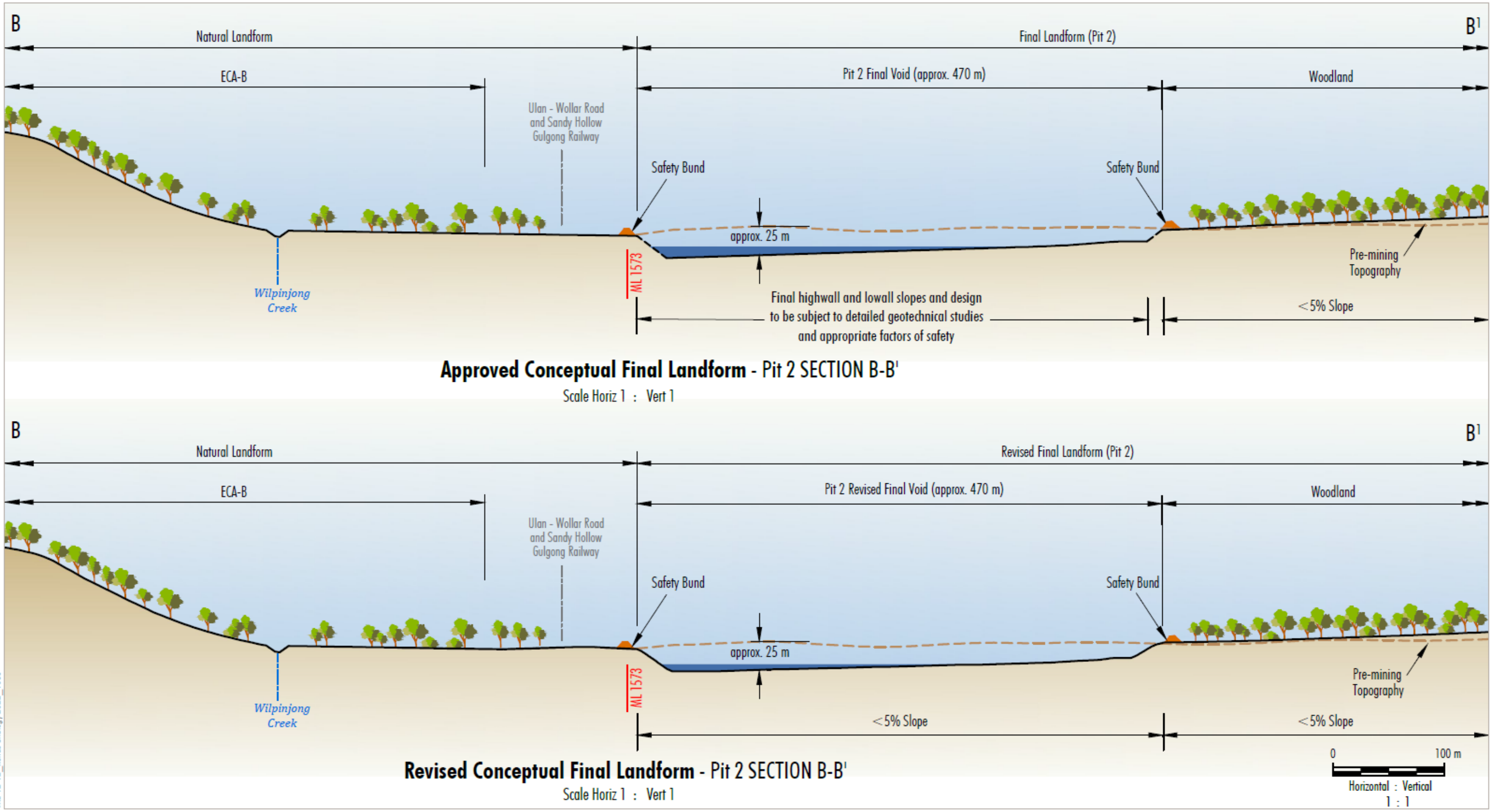

A
A1
Natural Landform
Approved Final Landform (Pit 5 and 6)
Pit 6 Approved Final Void (approx. 385 m)
Woodland
Ulan - Wollar Road
and Sandy Hollow
Gulgong Railway
Safety Bund
Safety Bund
approx. 75 m
Pre-mining Topography
MLA 3
MLA 3
ML 1573
Wilpinjong
Creek
Final highwall and lowall slopes and design
to be subject to detailed geotechnical studies
and appropriate factors of safety
5-10% Slope
10-15%
Slope
<5% Slope
Approved Conceptual Final Landform - Pit 6 Cross Section A-A'
Scale Horiz 1 : Vert 1
A
A1
Natural Landform
Revised Final Landform (Pit 5 and 6)
Pit 6 Revised Final Void (approx. 600 m)
Pit 6 Revised Final Void Catchment (approx. 675 m)
Woodland
Woodland
Ulan - Wollar Road
and Sandy Hollow
Gulgong Railway
Safety Bund
Pre-mining Topography
approx. 80 m
MLA 3
MLA 3
ML 1573
Wilpinjong
Creek
<5% Slope
15-20% Slope
<5% Slope
15-20% Slope
Final highwall slope and design to be subject
to detailed geotechnical studies and
appropriate factors of safety
Revised Conceptual Final Landform - Pit 6 Cross Section A-A'
Scale Horiz 1 : Vert 1
0
100 m
Horizontal : Vertical
1 : 1
Source: WCPL (2022, 2015); REVISED FINAL LANDFORM_fsl_current_v2_20220324
LEGEND
Pre-mining Topography
Approximate Base of Palaeochannel
Final Landform Profile
Final Void Waterbody *
* Based on maximum predicted void water levels (WRM 2015; 2022)
Refer Figure 2 and 3 for cross-section locations.
Peabody
WILPINJONG COAL MINE
Conceptual Final Landforms
Pit 6 Cross Section A-A'

Figure 4



Source: WCPL (2022, 2015); REVISED FINAL LANDFORM_fsl_current_v2_20220324

LEGEND
- Pre-mining Topography
- Final Landform Profile
- Final Void Waterbody *

* Based on maximum predicted void water levels (WRM 2015; 2022)

Refer Figure 2 and 3 for cross-section locations.

WILPINJONG COAL MINE
Conceptual Final Landforms
Pit 2 Cross Section B-B'

Figure 5

Pre-mining, the open cut areas are generally topographically simple, and valley floor slopes gently rise towards the more complex and steep landforms that form the valley sides and remain unmined. The pre-mining surface water drainage included large areas of ill-defined channels in the mid-slope where surface water overland flows were infrequent and only followed prolonged periods of heavy rainfall.

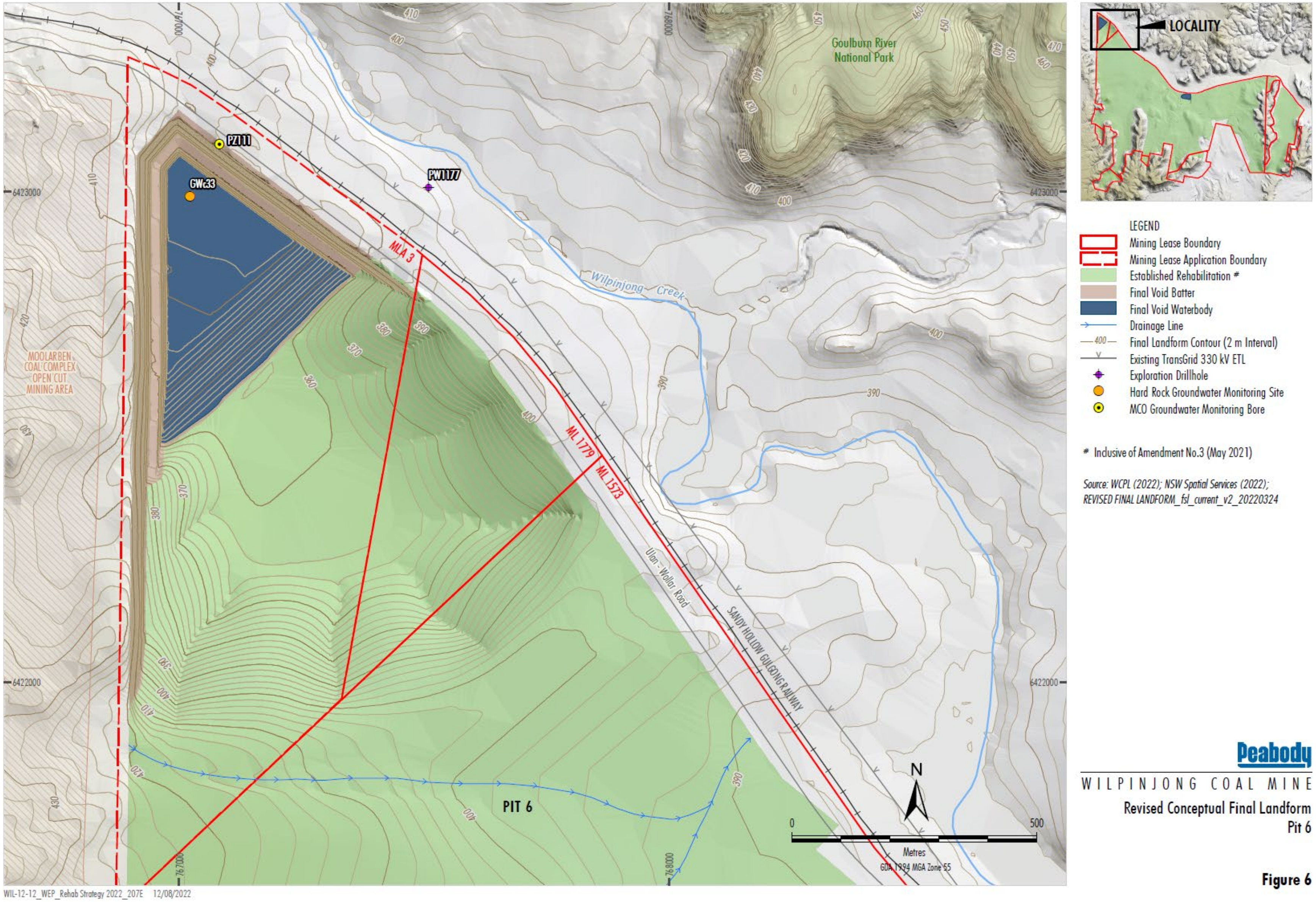
The backfilled areas of the open cut are similarly topographically simple with micro-relief comprising localised gentle slopes and modest undulations that direct drainage towards the broad and shallow valley bottoms that will similarly experience overland flow only infrequently. Backfilled areas also incorporate micro-relief structures such as discrete depressions and lined drainage features within the landform to attenuate water velocity and improve hydrological stability. WCPL is establishing varying topography within the backfilled open cut pits that generally reflects the topographic variations that were present in the pre-mining landform and are evident in adjacent unmined landforms.

Following NSW Government assessment of the Wilpinjong Extension Project, representatives of the DPIE – Division of Resources and Geosciences visited the Wilpinjong Coal Mine in March 2017 and advised general satisfaction with the level of micro-relief that is being incorporated into the progressive rehabilitation at Wilpinjong. In addition, the NSW Resources Regulator indicated that WCPL is appropriately identifying risks and defining controls associated with landform establishment at the Wilpinjong Coal Mine following the TAP on 29 July 2021 (Section 1.2).

Notwithstanding, WCPL has engaged Golder Associates to undertake a review of key areas of the revised final landform plan and implement geomorphic design refinement in future rehabilitation areas with potential erosion risk or to increase micro-relief variation in the final landform. GeoFluv™ design techniques have been applied in various areas as part of ongoing development of conceptual final landform designs.

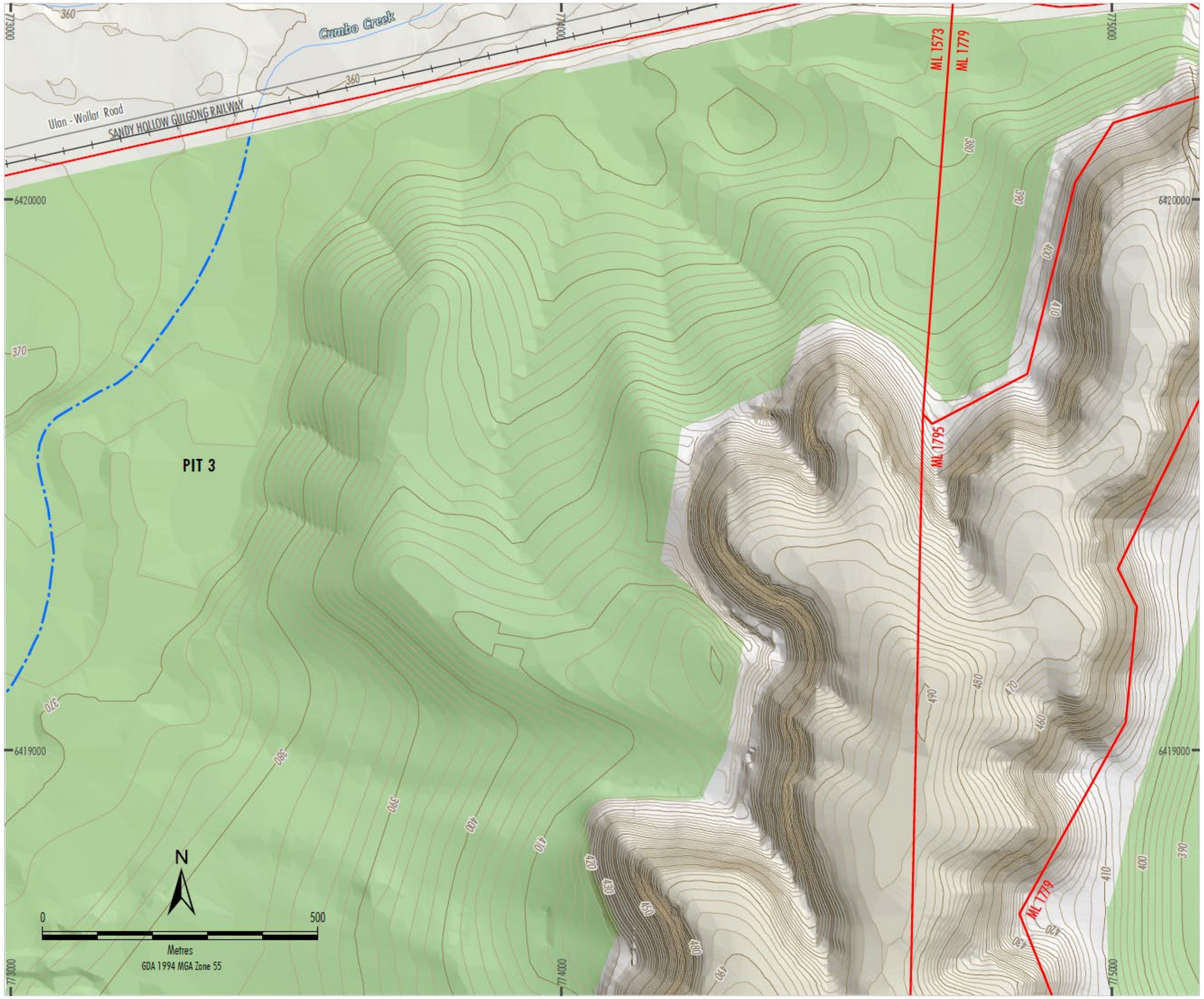
Examples of Preliminary GeoFluv design concepts for the Pit 6 void low wall and Pit 3 waste emplacement are shown on **Figure 6** and **Figure 7**. These preliminary designs will be reviewed and updated by WCPL throughout the life of the Wilpinjong Coal Mine, with the final design of such areas to be progressively incorporated into the relevant Rehabilitation Management Plan(s). The implementation of the GeoFluv design in Pit 6 requires the development of some temporary waste rock stockpiles within the mine footprint in the vicinity of the final void catchment.

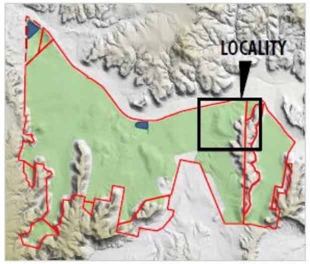
WCPL is also reviewing the final drainage system for the conceptual Wilpinjong Coal Mine landform, and with the assistance of GeoFluv landform design specialists has been incorporating natural drainage features (e.g. point bars, pinch points and boulders) to naturally attenuate flows and improve the long-term erosional stability of some key drainage lines within the backfilled open cuts. This work includes consideration of pre-mine drainage and the post-mining bed profiles, geomorphic parameters and hydraulic modelling of stream power and shear stress. This work will continue for relevant sections of the landform, with any material revisions to the final landform surface to be to be progressively incorporated into the relevant Rehabilitation Management Plan(s).



LOCALITY
LEGEND
Mining Lease Boundary
Mining Lease Application Boundary
Established Rehabilitation #
Final Void Batter
Final Void Waterbody
Drainage Line
Final Landform Contour (2 m Interval)
Existing TransGrid 330 kV ETL
Exploration Drillhole
Hard Rock Groundwater Monitoring Site
MCO Groundwater Monitoring Bore
Inclusive of Amendment No.3 (May 2021)
Source: WCPL (2022); NSW Spatial Services (2022); REVISED FINAL LANDFORM_fsl_current_v2_20220324
Goulburn River National Park
MOOLARBEN COAL COMPLEX OPEN CUT MINING AREA
PZ111
GWc33
PW1177
MLA 3
ML 1779
ML 1573
Wilpinjong Creek
Ulan - Wollar Road
SANDY HOLLOW GULGONG RAILWAY
PIT 6
N
0
500
Metres
GDA 1994 MGA Zone 55
Peabody
WILPINJONG COAL MINE
Revised Conceptual Final Landform
Pit 6
WIL-12-12_WEP_Rehab Strategy 2022_207E 12/08/2022

Figure 6





LEGEND
Mining Lease Boundary
Established Rehabilitation #
Conceptual Cumbo Creek Realignment
400 Final Landform Contour (2 m Interval)

Inclusive of Amendment No.3 (May 2021)

Source: WCPL (2022); NSW Spatial Services (2022); REVISED FINAL LANDFORM_fsl_current_v2_20220324

Peabody
WILPINJONG COAL MINE
Revised Conceptual Final Landform
Pit 3

Figure 7

WIL-12-12_WEP_Rehab Strategy 2022_208C

3.2 Landform Stability and Geotechnical Performance

A geotechnical assessment of the Wilpinjong Coal Mine was undertaken for the Wilpinjong Extension Project by Gavin Lowing, Principal Geotechnical Engineer, MAusIMM CP(Geotech), RPEQ 10512 (28 July 2015).

Key outcomes of the geotechnical assessment include:

- The final landform generally approximates the pre-mining topography with the exception of final voids.
- Current mining practices evaluate and mitigate potential geotechnical impacts on cliffs, rock formations and steep slopes.
- Backfilled rehabilitation landforms will be designed and constructed with final landform gradients of no more than 1:6 (with the exception of slopes associated with final voids and safety bunds) and will therefore be considered stable from a geotechnical perspective.
- Temporary open cut highwalls that are located proximal to public roads and railway infrastructure will be designed to factors of safety of 1.2 or more.
- While the open cut depths at Wilpinjong Coal Mine are relatively modest, final void highwalls will be subject to detailed geotechnical design and factors of safety would be adjusted to reflect that these voids will be a final landform feature.
- Final void design criteria will be detailed in the applicable Rehabilitation Management Plan and will be designed to ensure minimal highwall instability risk, based on site-specific geotechnical information.

The revised conceptual final landform shown on Figure 3 continues to conform with the outcomes of the EIS geotechnical assessment.

3.3 Hydrological and Ecological Function

Review of natural drainage systems in the vicinity of the Wilpinjong Coal Mine indicates:

- With the exception of Cumbo Creek, the creeks which flow through the Wilpinjong Coal Mine area show limited evidence of regular surface flow. Surface flow may occur following very heavy rainfall or in isolated locations where springs seep into the drainage line.
- Within all valleys (excluding Cumbo Creek) there is minimal evidence of alluvial deposits within the valley floor or aquatic vegetation which is typical of swampy, discontinuous Valley fill watercourses. Within Cumbo Creek the alluvial layer ranges from very shallow to non-existent.
- It is likely that geology of the region results in high rates of infiltration and sub-surface flow.
- With the existing (or pre-mine) vegetation characteristics the surface flow is unlikely to generate shear stress or stream power values which are able to scour a defined channel. This is reflected in the observed valley fill morphologies with no defined channels in the pre-mining landscape.

Consistent with the above, WCPL's approach is to create valley fill stream types along alignments similar to the historical alignments. Surface flow will typically occur in the valley bottom following large rainfall events where the infiltration rate is exceeded (as is currently the case in the pre-mine landforms). This approach is generally consistent with the nature of the existing drainage lines at the Wilpinjong Coal Mine and therefore integrates with the surrounding environment.

WCPL is progressively establishing varying topography within the backfilled open cut pits that generally reflects the topographic variations that were present in the pre-mining landforms. This includes designing flow paths of progressively higher orders of greater capacity and cross-sectional area as one moves downstream (Hannan, 1984), and conversely establishing drainage paths that become progressively steeper as one moves upstream (Environment Australia, 1998). WCPL is also investigating the incorporation of natural drainage features (e.g. point bars, pinch points and boulders) to naturally attenuate flows and improve the long-term erosional stability of drainage lines in the backfilled mine landform.

The Wilpinjong Coal Mine Rehabilitation Objectives require WCPL to restore and establish self-sustaining ecosystem function in areas of aquatic habitat, within diverted and/or re-established drainage lines. The development of self-sustaining woodland ecosystems adjacent to the valley fill streams in combination with the establishment of self-sustaining ecosystems in-stream, will represent a significant improvement relative to the poor pre-mining aquatic habitat in the existing drainage lines.

It is noted that the majority of drainage lines across the Wilpinjong Creek Mine pre-mine landform were poorly defined and highly ephemeral and therefore aquatic habitat was limited. This is also expected to be the case in the post-mining landform as no defined flow channel will occur in many contexts and this generally precludes chain-of-pond forms or incised channel features that are more common in other contexts. Notwithstanding, where valley bottoms in the post-mining landform have defined stream features, WCPL will employ applicable rehabilitation methods such as those described in *A Rehabilitation Manual for Australian Streams* (Rutherford, Jerie & Marsh, 2000).

WCPL also re-designed the Pit 8 landform during the Wilpinjong Extension Project assessment process to make the third void free-draining. This proposed amendment further improves the final landform by removing the free draining depression and reinstating the original pre-mining catchment boundary, aligning the post-mining surface water drainage with the pre-mining drainage direction.

WCPL's performance and completion criteria for the establishment of self-sustaining ecosystems that satisfy the requirements of Development Consent (SSD-6764) are specified in the Rehabilitation Management Plan and Biodiversity Management Plan.

3.4 Updated Final Void Modelling

The post-mining recovery of the groundwater system following cessation of mining at the Wilpinjong Coal Mine was modelled by HydroSimulations (2015). The outcomes of the groundwater modelling informed a water balance for each of the approved final voids prepared by WRM Water and Environment (2015).

Recovery of the groundwater water table and pressures within the porous rock groundwater system is predicted to occur over many decades following the cessation of mining. At equilibrium, natural groundwater flow direction is expected to be restored to a dominant northerly direction through the mine footprint toward Wilpinjong Creek, with the exception of around the Pit 2 and Pit 6 final voids (HydroSimulations, 2015).

The accumulation of surface runoff combined with groundwater inflows may result in the formation of a pond of water in the void which would rise until the average rate of inflow is balanced by evaporation from its surface (WRM Water and Environment, 2015).

The final void water levels in the approved Pit 2 and Pit 6 voids were expected to reach an equilibrium within approximately 100 years, with the maximum void water levels expected to be well below the crest of the void and hence would not spill to the environment (WRM Water and Environment, 2015).

Updated final void modelling of the revised final landform has been completed by SLR Consulting (Attachment 4) and WRM Water and Environment (Attachment 5). The key outcomes of this modelling are as follows:

- The revised Pit 6 final void would have a larger catchment area.
- The revised Pit 2 and Pit 6 final voids would continue to function as groundwater sinks.
- The maximum void water levels are expected to remain well below the crest of the void and hence would not spill to the environment.
- The total surface area of the final void waterbodies is similar to the approved concept, with some increase in the size of the ultimate Pit 6 void waterbody.

The reduced slope of the Pit 6 void low-wall provides improved accessibility to the final void waterbody (**Figure 4** and **Figure 6**). This is considered a beneficial change for post-mining access to the waterbody (subject to appropriate water quality considerations).

3.5 Rehabilitation Offset Requirements

Condition 36, Schedule 3 of Development Consent (SSD-6764) requires the establishment of specific vegetation communities and Regent Honeyeater habitat in the rehabilitated final landform. Revisions to the Pit 6 void design as described in this Strategy does reduce the area of land available at the end of mining to be rehabilitated to woodland communities by approximately 12 hectares.

However, the Wilpinjong Coal Mine currently has a surplus of rehabilitation area (approximately 40 hectares) available to satisfy this Condition (e.g. the mined area to be rehabilitated exceeds the required area of Regent Honeyeater habitat), so sufficient area within the revised conceptual final landform remains to establish the vegetation communities and habitat required under Condition 36, Schedule 3 of Development Consent (SSD-6764) (i.e. there is currently sufficient surplus area to account for a reduction of 12 hectares).

4 Final Landform Justification

A revised conceptual final landform plan is shown on **Figure 3** and discussed in Section 3.

As discussed in Attachment 3, WCPL is of the view that any further changes to the final landform in relation to partially backfilling the approved final voids in Pit 2 and Pit 6 do not represent a reasonable and feasible outcome. The revised final landform is strongly preferred given:

- The final voids would not spill to the environment.
- The approved final voids would act as groundwater sinks, limiting the flow of water from the waste rock emplacement areas to the Wilpinjong Creek and surrounding environment.
- The reduction in groundwater baseflow to nearby streams due to the approved final voids is predicted to be minor (less than the approved impact during mining) and will be suitably licensed (i.e. retirement of relevant licensed extraction entitlements).
- Groundwater modelling indicates there is no viable final void partial backfill options that would avoid development of a pit lake.
- The cost of backfilling the two final voids is considered unreasonable, particularly given that the Wilpinjong Extension Project was proposed with three final voids, as the Project included a new pit in Slate Gully (Pit 8). WCPL re-designed the Pit 8 landform during the assessment process to make the third void free-draining following the strong recommendation of the Planning Assessment Commission.

The proposed changes to the final landform as a result of the conduct of further evaluation and investigation for development of this Rehabilitation Strategy address:

- necessary changes to the sequence of mining, and contemporary materials balance analysis;
- the stability of the final landform by reducing the potential for in-stream erosion;
- integration of the final landform with the surrounding environment and continued employment of localized micro-relief that resembles the pre-mining landscape; and
- improves the potential hydrological and ecological function of the landform.

It is noted that the detailed hydrological design of individual drainage lines for the final landform surface would be progressively prepared and where relevant hydrological design improvements would be incorporated in the relevant Rehabilitation Management Plan. If this detailed design work identifies that material changes to the conceptual final landform presented in **Figure 3** are required, revision of this Rehabilitation Strategy would then be undertaken as appropriate.

5 References

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Hannan, J.C. (1984) *Mine Rehabilitation. A Handbook for the Coal Mining Industry*. New South Wales Coal Association, Sydney.

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SLR Consulting (2022) Wilpinjong Coal Mine – *Revised Final Landform Groundwater Assessment*.

WRM Water & Environment (2015) *Wilpinjong Extension Project Surface Water Assessment*.

WRM Water & Environment (2022) *Wilpinjong Coal Mine – Revised Final Landform Analysis*.

ATTACHMENT 1

DEVELOPMENT CONSENT TABLES

Table A1-1
Water Management Performance Measures – Table 6 of Development Consent (SSD-6764)

Feature	Objective
General	Maintain separation between clean, dirty and mine water management systems Minimise the use of clean water on site Design, install, operate and maintain water management systems in a proper and efficient manner
Clean water diversion & storage infrastructure	Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site
Sediment dams	*Design, install and/or maintain sediment dams to ensure no discharges to surface waters, except in accordance with an EPL or in accordance with Section 120 of the POEO Act.*
Mine water storages	*Design, install and/or maintain mine water storage infrastructure to ensure no discharge of untreated mine water off-site.* *Discharge treated mine water in accordance with an EPL or in accordance with Section 120 of the POEO Act.*
Wilpinjong, Cumbo and Wollar Creeks	*No greater impact than predicted for the development for water flow and quality*
Aquatic, riparian and groundwater dependent ecosystems	*Negligible environmental consequences beyond those predicted for the development*
Flood mitigation measures	*Ensure all open cut pits, CHPP, coal stockpiles and main mine facilities areas exclude flows for all flood events up to and including the 1 in 100 year ARI.* *All final voids designed to exclude all flood events up to including the PMF event.*
Overburden, CHPP Reject and Tailings	*Design, install and maintain emplacements to prevent or minimise the migration of pollutants due to seepage*
Chemical and hydrocarbon storage	*Chemical and hydrocarbon products to be stored in bunded areas or structures in accordance with relevant Australian Standards*

Table A1-2
Rehabilitation Objectives – Table 11 of Development Consent (SSD-6764)

Feature	Objective
Mine site (as a whole)	• *Safe, stable and non-polluting* • *Final landforms designed to incorporate micro-relief and integrate with surrounding natural landforms and adjacent mine rehabilitation* • *Final landforms maximise geotechnical performance, stability and hydrological function* • *Constructed landforms maximise surface water drainage to the natural environment (excluding final void catchments)* • *Minimise long term groundwater seepage from the site to ensure negligible environmental consequences beyond those predicted for the development* • *Minimise visual impact of final landforms as far as is reasonable and feasible*

Final Voids	• *Minimise to the greatest extent practicable:*
	  ○ *the size and depth of final voids*
	  ○ *the drainage catchment of final voids*
	  ○ *any high wall and low wall instability risk*
	  ○ *risk of flood interaction for all flood events up to and including the PMF*

Surface infrastructure	• *To be decommissioned and removed, unless the Secretary agrees otherwise*

Rehabilitation	• *Rehabilitate at least 2,906 hectares of self-sustaining woodland ecosystem to the BVTs specified in Tables 8 and 9;*
	• *Establish self-sustaining ecosystem function in areas of:*
	  ○ *aquatic habitat, within diverted and/or re-established drainage lines and retained water features, with consideration of hydro-geomorphological constraints;*
	  ○ *habitat for threatened flora and fauna species; and*
	  ○ *habitat for flora and fauna species known to occur in the region.*

Cumbo Creek relocation	• *Restored in accordance with conditions 26 to 28 of this Schedule.*
Other reinstated drainage lines	• *Drainage lines are restored in accordance with the principles, concepts and techniques described in "A rehabilitation manual for Australian streams (Rutherford,I; Jerie, K; Marsh, N 2000)*
Community	• *Ensure public safety* • *Minimise the adverse socio-economic effects associated with mine closure*

ATTACHMENT 2

POTENTIAL INTEGRATION OF FINAL LANDFORM WITH MOOLARBEN

Integration of Final Landform with Moolarben Coal Complex

The approved Pit 6 final void is located at the western boundary of the mine and proximal to the OC4 final void that was approved as part of the Moolarben Stage 2 project by the NSW Planning Assessment Commission in 2015.

The Pit 6 final void represents the last area of the planned sequence of mining for the Wilpinjong Coal Mine and therefore represents a logical position for a final void. A final void at this location also provides the potential opportunity to rationalise the Wilpinjong Coal Mine Pit 6 and Moolarben OC4 final voids and recover the associated barrier coal between the two mining operations, should this be economical at the relevant time.

Consideration of final landform integration between the two mining operations is presented below.

Consultation Undertaken with MCO

WCPL first wrote to MCO regarding opportunities to integrate the Wilpinjong Coal Mine and the Moolarben Coal Complex final landforms in the vicinity of the Pit 6 and OC4 final voids in May 2017.

WCPL and MCO have subsequently continued to consult regarding the potential integration of the Pit 6 and OC4 final voids.

The key outcomes of consultation undertaken to date are:

- There is a material commercial incentive to integrate the voids given approximately 5 million tonnes of 'barrier' coal could be extracted if the two mines agree to extract the coal.
- Mining in Pit 6 and OC4 are advancing at different rates, which complicates the planning for integration of the two open cut pits.
- It is difficult to establish a preferred option with confidence at present, given changes to mine planning and sequencing are common over the life of large coal mining operations.
- MCO and WCPL are both committed to investigate the potential integration of the landforms.

Options for Integration

Initial options for the integration of the Wilpinjong Coal Mine and Moolarben Coal Complex final landforms that have been considered by WCPL include:

- partial or complete backfilling of one void using waste rock material from the other site;
- open cut mining of the barrier coal to leave a single residual void and integrated waste emplacements;
- extending open cut mining from Pit 6 into the approved OC4 extent, resulting in a consolidated final void in an alternative location within the approved OC4 extent; or
- utilizing an alternative mining methodology (e.g. underground mining) in the vicinity of the barrier that would facilitate the recovery of the barrier coal.

The potential for integration of the landform between the two mining operations will be dependent on a number of considerations, including:

- timing of Pit 6 progression at the Wilpinjong Coal Mine relative to the progression of OC4 mining at the Moolarben Coal Complex;
- maintaining suitably safe, stable and non-polluting landforms;
- the practicality and economic feasibility of alternative mining methodologies;
- minimising sterilisation of coal; and
- obtaining any necessary environmental approvals to facilitate access to barrier coal and integrate final landforms.

Ongoing Consultation Programme and Review

WCPL is targeting resolution of an agreed final landform by the end of 2022. Subject to the outcome of the final landform design, relevant commercial agreements and necessary regulatory approvals will then be progressed.

ATTACHMENT 3

ALTERNATIVE BACKFILLING CONSIDERATIONS

Alternative Backfilling Considerations

A final void is a depression below the natural ground level at the completion of open cut mining and closure. The size of final voids are dictated by the depth of the open cut, the extent of backfilling (if any) that is undertaken and the mining sequence.

The approved Wilpinjong Extension Project final landform includes two final voids in Pits 2 and 6 (**Figure 2**). The revised final landform (**Figure 3**) is consistent with the approved final landform concept (i.e. two residual final voids that function as groundwater sinks).

As described in the Response to Submissions (WCPL, 2016), the low strip ratio (the ratio of waste rock [bulk cubic metres {bcm}] removed per tonne of coal) at the Project relative to most other open cut mining operations in NSW allows for the majority of waste rock to be placed in the mine voids behind the advancing open cut operations.

This low strip ratio results in a final landform that is generally similar to the pre-mining landform (i.e. elevations and slopes) with an undulating landform and gentle slopes. Further, there are no large out-of-pit waste rock emplacements associated with the approved Project final landform.

Because of the lack of out-of-pit emplacements and the backfilling of waste rock and the shallow nature of the coal seams, the result is a smaller working footprint for the mining operation, enabling the rehabilitated final surface to be kept close behind the active pit, with the final voids being modest in size and depth.

Potential Backfill Options

The final landform presented in the Wilpinjong Extension Project Environmental Impact Statement originally included a final void in the south of Pit 8. In light of the Wilpinjong Extension Project Planning Assessment Commission's strong recommendation, WCPL committed to revise the final Pit 8 landform such that the southern end is wholly free draining (either north into Wilpinjong Creek, or west into the Cumbo Valley) and no longer includes a final void.

Condition 61(b), Schedule 3 of Development Consent (SSD-6764) requires an assessment of partially backfilling the Pits 2 and 6 final voids above the groundwater equilibrium level, having regard to the final void rehabilitation objectives in Table 11.

The final void rehabilitation objectives require WCPL to minimise, to the greatest extent practicable:

- the size and depth of final voids;
- the drainage catchment of final voids;
- any high wall and low wall instability risk; and
- risk of flood interaction for all flood events up to and including the probable maximum flood.

The Rehabilitation Objectives also require WCPL to minimise long term groundwater seepage from the site to ensure negligible environmental consequences beyond those predicted for the development. It is noted that meeting this objective is facilitated by the final voids acting as groundwater sinks, consistent with groundwater assessment findings.

Groundwater Modelling

HydroSimulations (2018) undertook groundwater modelling to determine the final groundwater equilibrium level for the Pit 2 and Pit 6 voids if they were backfilled (i.e. there is no longer a groundwater sink associated with the evaporation of water from the voids).

The Pit 6 equilibrium level was modelled with and without the Moolarben Coal Complex OC4 final void present in the approved location. The presence of the OC4 final void had a negligible effect on the modelled equilibrium groundwater level at the Pit 6 void (HydroSimulations, 2018). This is a function of the un-mined intervening rock, plus the OC4 void is located to the south of the Pit 6 void (i.e. the two voids are offset north-south as well as having a material residual rock barrier between, and post-mining slopes generally directed northwards towards Wilpinjong Creek, either side of this barrier).

The results of HydroSimulations' (2018) modelling are summarised in **Table A3**. The equilibrium groundwater level and rehabilitated ground surface level are presented for the north and south of each void, as the groundwater table and ground both slope north towards Wilpinjong Creek.

Table A3
Final Void Equilibrium Analysis

Void	Equilibrium Groundwater Level (m AHD)		Rehabilitated Ground Surface Level (m AHD)	
	North	South	North	South
Pit 6	399	402	400	415
Pit 2	373	380	370	375

Source: HydroSimulations (2018)

The groundwater modelling indicates that if the pits were backfilled the groundwater equilibrium level would:

- approximate the surrounding ground level at the Pit 6 Void; and
- potentially exceed the surrounding ground level at the Pit 2 Void, resulting in potential development of a groundwater soak.

Therefore, to backfill the Pits 2 and 6 final voids above the groundwater equilibrium level effectively requires the complete backfilling of these voids (i.e. any partial backfill option would still involve the creation of a pit lake).

Groundwater Implications

Recovery of the groundwater water table and pressures within the porous rock groundwater system is predicted to occur over many decades following the cessation of mining. At equilibrium, natural groundwater flow direction is expected to be restored to a dominant northerly direction through the mine footprint toward Wilpinjong Creek, with the exception of around the Pit 2 and Pit 6 final voids (HydroSimulations, 2015).

The Pit 2 and Pit 6 final void lakes would remain as permanent and localised groundwater sinks (HydroSimulations, 2015). It is noted that the NSW Independent Planning Commission (formerly the NSW Planning Assessment Commission or Independent Hearing and Assessment Panel) has on previous occasions recognised final void sinks can have hydrological benefits over backfilling of mine voids. For example, the original Independent Hearing and Assessment Panel for the Wilpinjong Coal Project (Kearns, Middlemis and Hardie, 2005) concluded:

> *The available information and modelling tools were also used to predict the impacts of the final or residual mine voids. The approach and predictions have been assessed as acceptable in a hydrological sense, in that pit void lakes should develop as stable and long term hydrological sinks, and the water quality status should not change from its current beneficial use status (stock water) within a 200-year timeframe.*

Consideration of the option of backfilling the final voids to the groundwater equilibrium level was targeted at preventing the formation of a final void water body. However, in this case the voids would cease to operate as permanent and localised groundwater sinks. At equilibrium, groundwater would flow through the site in a northerly direction, raising local groundwater table levels on the southern side of Wilpinjong Creek (HydroSimulations, 2018).

This would be inconsistent with the rehabilitation objective in Table 11 of the Development Consent to *minimise long term groundwater seepage* from the site (Attachment 1).

Surface Water Implications

The accumulation of surface runoff combined with groundwater inflows may result in the formation of a pond of water in the void which would rise until the average rate of inflow is balanced by evaporation from its surface (WRM Water and Environment, 2015).

WRM Water and Environment (2015) simulated the long-term behaviour of the approved final voids. Updated modelling of the revised final landform was undertaken by WRM Water and Environment in 2022 and is summarised in Attachment 5.

Final void water levels in Pit 2 and Pit 6 are expected to reach an equilibrium within approximately 100 years. The maximum void water levels are also expected to be well below the crest of the void and hence would not spill to the environment (WRM Water and Environment, 2022).

The expected reduction in groundwater baseflow to nearby streams due to the approved final voids was modelled by HydroSimulations (2015) and is summarised as follows:

- Wilpinjong Creek: 0.37 megalitres per day (ML/day);
- Wollar Creek: 0.40 ML/day; and
- Goulburn River: 0.41 ML/day.

A review completed by SLR Consulting (2022) of the revised final landform (Attachment 4) indicated there would be negligible change to the baseflow reduction described above.

Should the Pit 2 and Pit 6 final voids be backfilled to the rehabilitated ground surface, they would become free draining towards Wilpinjong Creek. This would result in reinstatement of the small area of surface water catchment excised from Wilpinjong Creek under the approved mine. In addition, the higher elevation of the groundwater equilibrium level in the vicinity of the two final voids may provide for increased migration of water from the rehabilitated waste rock material and naturally saline hard rock groundwater to Wilpinjong Creek. This is arguably inconsistent with the Development Consent Rehabilitation Objective to *minimise long term groundwater seepage from the site*... (Attachment 1).

It is also noted that if any partial void backfill option was to be adopted, there would also be a corresponding decrease in the capacity of the voids to contain all incidental rainfall and runoff under very wet rainfall sequences (i.e. assuming the total catchment area remains the same, the void's capacity to contain rainfall and runoff without spilling would be reduced by the volume of additional rock emplaced).

With the voids as approved, slow evapo-concentration of salts would occur in the void lakes over an extended period. However, this would not preclude the use of the water by fauna following rehabilitation of the site and until such time that the waterbody salinity has risen to the point it is no longer a useful local water resource.

Cost Implications

WCPL undertook a review of the estimated cost to backfill the approved conceptual Pit 2 and Pit 6 final voids to the groundwater equilibrium level (noting that this requires complete backfilling of the voids) in 2018.

The estimated cost (2018) was:

- $6.6 Million to backfill the Pit 2 Final Void.
- $10.3 to $17.5 Million to backfill the Pit 6 Final Void (dependent on available potential sources of backfill waste rock material).

These costs are considered unreasonable by WCPL.

Other Environmental Implications

Backfilling of the Pit 2 and Pit 6 final voids would also have the following potential environmental implications:

- an extension to the operational life of the Wilpinjong Coal Mine after open cut coal mining is complete to allow for void backfill activities;
- delay to the establishment of rehabilitation (including Regent Honeyeater habitat) in areas required for temporary stockpiling of planned backfill waste material and/or disturbance of previously completed rehabilitation;
- increased risk of spontaneous combustion due to temporary stockpiling, rehandling and re-exposure of waste rock materials; and
- additional surface water discharge to Wilpinjong Creek associated with emptying the Pit 2 void (i.e. site water storage) prior to backfilling commencing.

Conclusion

WCPL is of the view that the revised final landform described in Section 3 is strongly preferable to the option of any additional backfilling of the Pit 2 and/or Pit 6 final voids given:

- The final voids would not spill to the environment.
- The approved final voids would act as groundwater sinks, limiting the flow of water from the waste rock emplacement areas to the Wilpinjong Creek and surrounding environment.
- The reduction in groundwater baseflow to nearby streams due to the revised final voids is predicted to be minor and will be suitably licensed (i.e. retirement of relevant licenced extraction entitlements).
- The predicted groundwater equilibrium levels would require the complete backfilling of the voids (i.e. groundwater modelling indicates there is no viable partial backfill option that would avoid development of a pit lake).
- The cost of backfilling the two final voids is considered unreasonable and would be associated with other additional environmental impacts after the cessation of coal extraction.

It is also noted that the original Wilpinjong Coal Project was also approved with two final voids, and this was recognised through the Wilpinjong Extension Project approval process.

ATTACHMENT 4

REVISED FINAL VOID GROUNDWATER MODELLING
(SLR CONSULTING, 2022)

WILPINJONG COAL MINE

Final Landform Groundwater Review

Prepared for:

Wilpinjong Coal Pty Ltd
1434 Ulan-Wollar Road,
Wilpinjong NSW 2850

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BASIS OF REPORT

DOCUMENT CONTROL

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665.10014.00505-R01-v3.0	18 March 2022	Adam Skorulis	Brian Rask	Brian Rask
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665.10014.00505-R01-v1.0	21 September 2021	Adam Skorulis	Brian Rask	Brian Rask

CONTENTS

TABLES

FIGURES

1 Introduction

The Wilpinjong Coal Mine is owned and operated by Wilpinjong Coal Pty Limited (WCPL), a wholly owned subsidiary of Peabody Energy Australia Pty Ltd.

HydroSimulations (2015)[1] prepared a Groundwater Assessment for the Wilpinjong Extension Project (WEP), which included an assessment of the post-mining impacts of the final voids. The Groundwater Assessment assessed the final landform that was presented in the Wilpinjong Extension Project Environmental Impact Statement (WEP EIS).

The final landform presented in the EIS originally included a final void in the south of Pit 8. In light of the WEP Planning Assessment Commission's strong recommendation, WCPL committed to revise the final Pit 8 landform such that the southern end is wholly free draining (either north into Wilpinjong Creek, or west into the Cumbo Valley) and no longer includes a final void.

The WEP was approved on 24 April 2017 (Development Consent SSD-6764). The approved Conceptual Rehabilitation Strategy is shown on Appendix 8 of the Development Consent and includes two final voids (Pit 2 and Pit 6). The Pit 2 and Pit 6 final voids are consistent with the voids assessed in the WEP EIS Groundwater Assessment.

WCPL has developed a revised conceptual final landform to account for changes in mine sequencing and revised material balance at the Wilpinjong Coal Mine. The revised conceptual final landform is shown on **Figure 1**.

WCPL has engaged SLR to undertake a groundwater review to identify and assess the nature and magnitude of any incremental groundwater impacts associated with the revised final landform relative to the final landform assessed as part of the WEP EIS (HydroSimulations, 2015).

1.1 Description of Final Landform Change

Figure 1 provides a comparison between the final void configurations of the final landform assessed as part of the Groundwater Assessment for the WEP EIS (HydroSimulations, 2015), and the revised final landform. A summary of key changes to the final void geometries is provided below:

- <u>Pit 6:</u> Increased final void catchment area to the east and south.
- <u>Pit 2:</u> Slight increase in the final void catchment area to north and east.
- <u>Pit 8:</u> Revised final landform does not contain a final void at Pit 8 (as described above, WCPL committed to revising the Pit 8 final void to be free draining following submission of the EIS).

[1] HydroSimulations has subsequently been acquired by SLR Consulting.

2 Groundwater Modelling

For the WEP EIS, the transient prediction groundwater model from HydroSimulations (2015) was used in conjunction with the WRM Water and Environment (WRM) (2015) final void water balance model to estimate the final void water levels, and long-term fluxes to and from the final voids. To enable the appropriate evaluation of incremental impacts between the approved and revised final landforms, the existing groundwater model was adopted and updated with the final void water levels as modelled by WRM (2022).

The following sections provide an overview of the groundwater model setup used to simulate the final voids for the approved final landform, and how the groundwater model setup was updated to incorporate the revised final landform.

2.1 WEP EIS Groundwater Model Setup

After completion of the simulated open cut mining in each pit at the Wilpinjong Coal Mine, all MODFLOW Drain cells (DRN) representing open cut pits were deactivated and replaced with spoil, except for the residual final voids (i.e. Pit 6 and Pit 2 for the Wilpinjong Coal Mine and the approved final void at the Moolarben Coal Complex) using the Time-Variant Materials (TVM) MODFLOW-USG package. Hydraulic properties of the cells representing the final voids were modified to the properties shown in **Table 1**, which effectively simulated open air and allowed the development of an open body of water (final void lake). Hydraulic properties representing spoil/backfill material are also included in **Table 1**.

Table 1 Hydraulic Properties used to Simulate Final Voids in the Groundwater Model

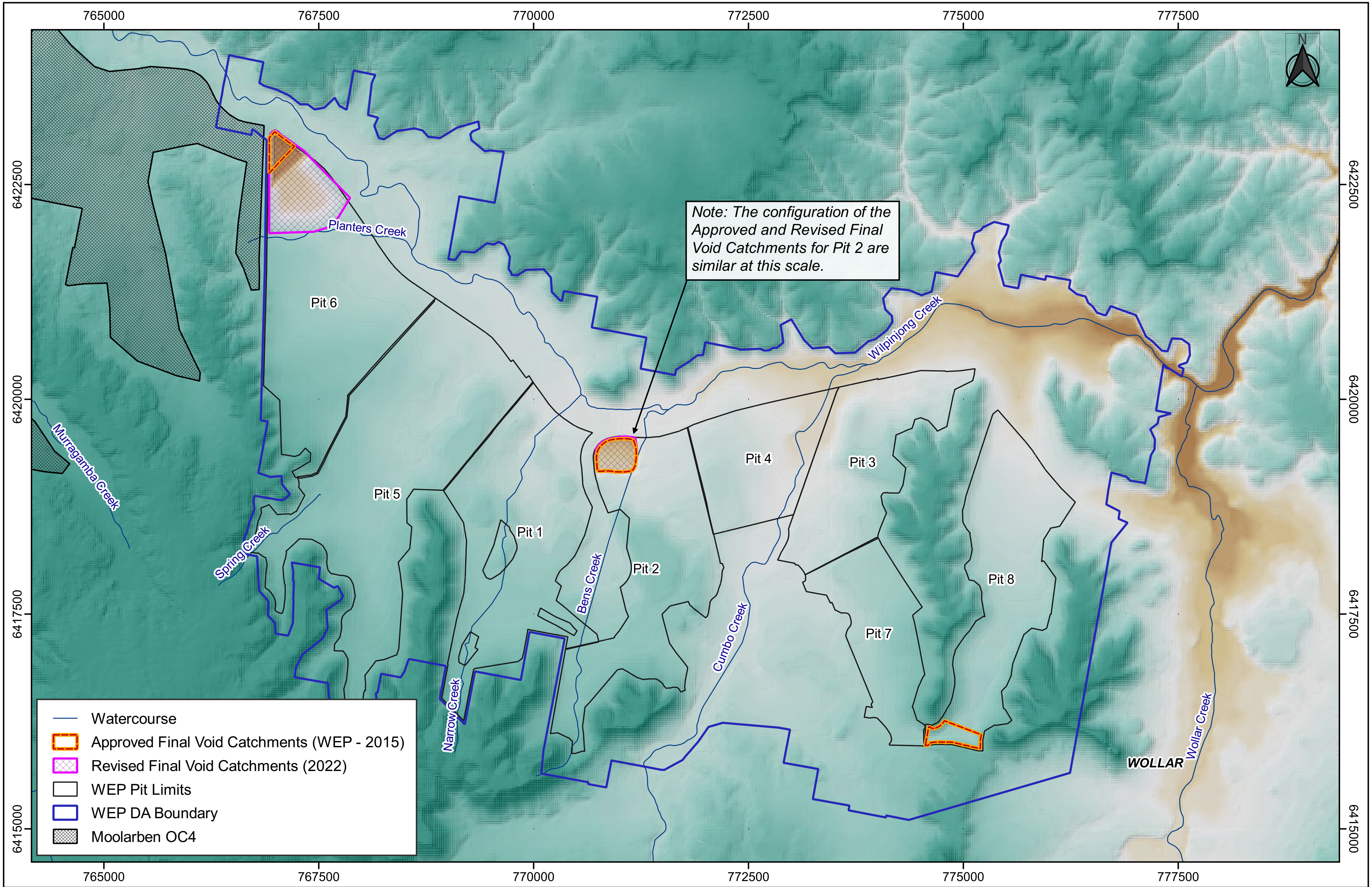
Type	Kh [m/d]	Kv [m/d]	Sy	Ss [m^{-1}]	Recharge
Final Void	1000	1000	1	as host	0% rainfall[1]
Spoil/ Backfill	1	1	0.2	$5e^{-4}$	5% rainfall

Kh = horizontal conductivity; Kv = vertical conductivity; Sy = specific yield; Ss = specific storage

Kh, Kv and Sy values for spoil/ backfill are based on Hawkins (1998) and Mackie (2009)

[1]Open water evaporation, direct rainfall, and runoff are accounted for in the surface water modelling and therefore not simulated in the groundwater model.

The representation is relatively simplistic, but is considered appropriate for the purpose of estimating groundwater level recovery and the development of final void water bodies (HydroSimulations, 2015). Simulation of the final void water bodies was completed using both this groundwater model and the final void water balance model (WRM, 2015), which incorporates open water evaporation and direct rainfall (relying on the final void water level-volume-surface area relationships) and runoff. The process was therefore iterative, involving final void stage - flux model results being compared and exchanged between HydroSimulations (2015) and WRM (2015). The final void water levels presented in WRM (2015) were adopted for the purposes of the environmental assessment due to the greater resolution of the final void water balance model.



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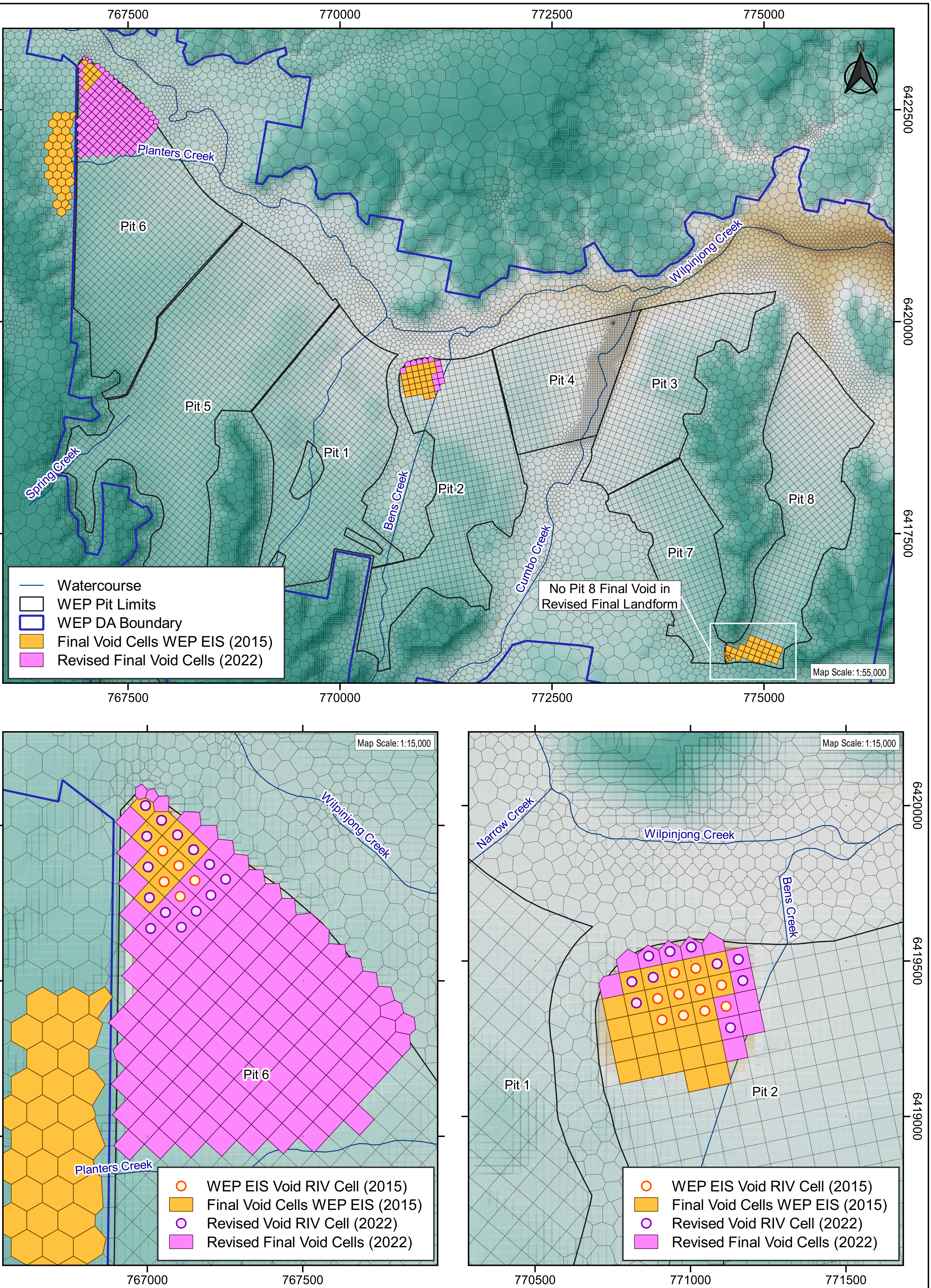
Wilpinjong Coal Mine
Revised Final Landform Groundwater Assessment
Final Void Configuration for Approved and Revised Landform - Figure 1



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Wilpinjong Coal Mine

Revised Final Landform Groundwater Assessment

Final Void Model Updates - Figure 2

The MODFLOW River (RIV) package was used to simulate the final iteration of the final void water levels on an average level per stress period basis. Volumetric fluxes to the RIV package provide the final magnitude and polarity (source or sink) of groundwater flow to the final voids, and long-term take for groundwater licencing.

2.2 Model Revision for Revised Final Landform

The following steps were taken to update the HydroSimulations (2015) transient prediction model to incorporate the revised final landform and allow for the appropriate determination of incremental impacts:

- Change extent and number of final void and spoil/ backfill cells simulated using the TVM package, accounting for the change in final landform. The revised void extent also involved changes to zones within the recharge (RCH) package.
- Provide WRM with an updated stage-inflow relationship based on a simulation incorporating the revised final voids.
- Simulate an updated final void lake recovery curve using the RIV package to predict the final magnitude and polarity of groundwater fluxes to the final void lakes.

Figure 2 shows a comparison of the groundwater model set up for the simulation of the approved and revised final void configuration . Key details on the model setup are included in the points below:

- Void properties within the TVM package were applied in the location of simulated RIV cells from Layers 1 to 6, consistent with the HydroSimulations (2015) approach.
- The RCH package was updated for the entire extent of the revised final void catchment. The same extent was used for zone budget calculations to determine incremental flux changes to the final voids.

The RIV package was constructed to increase/decrease the footprint of RIV cells within the final void, consistent with the water level in the final voids. **Figure 3** and **Figure 4** show the simulated final void water levels as provided by WRM, with average values per stress period extracted from the time-series data provided by WRM.

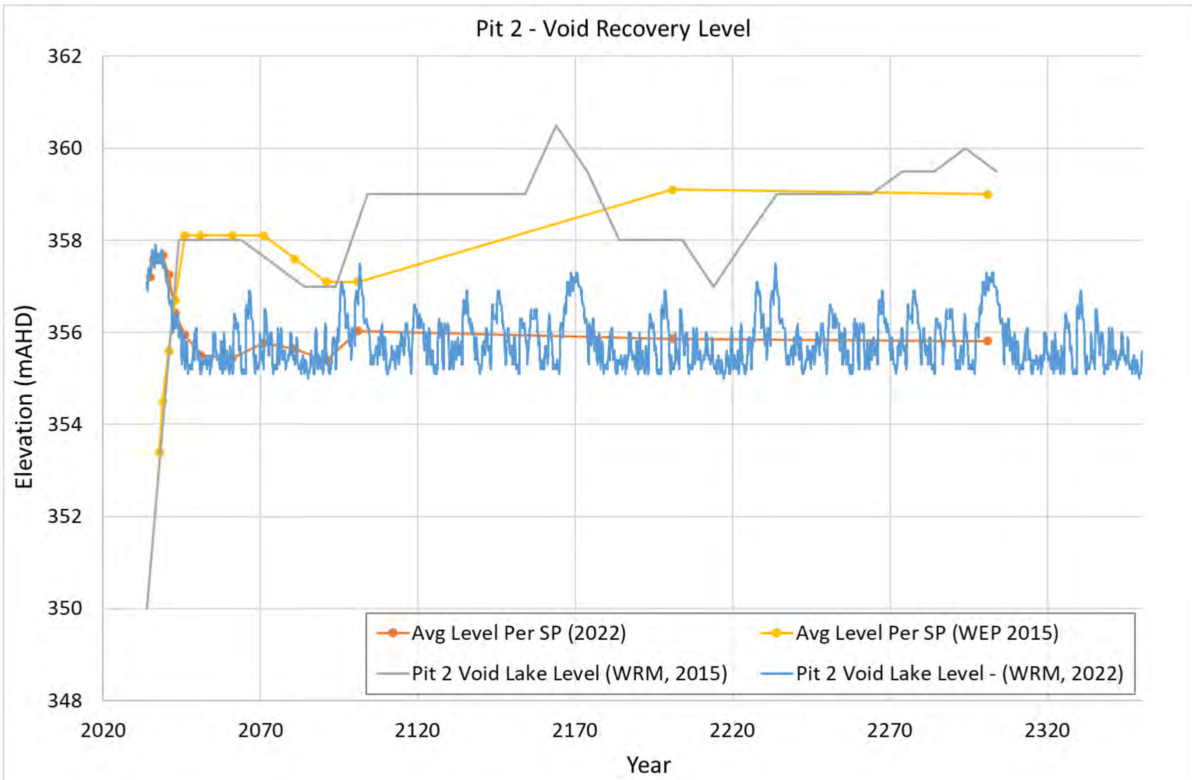

Figure 3 Predicted Pit 2 Final Void Water Levels

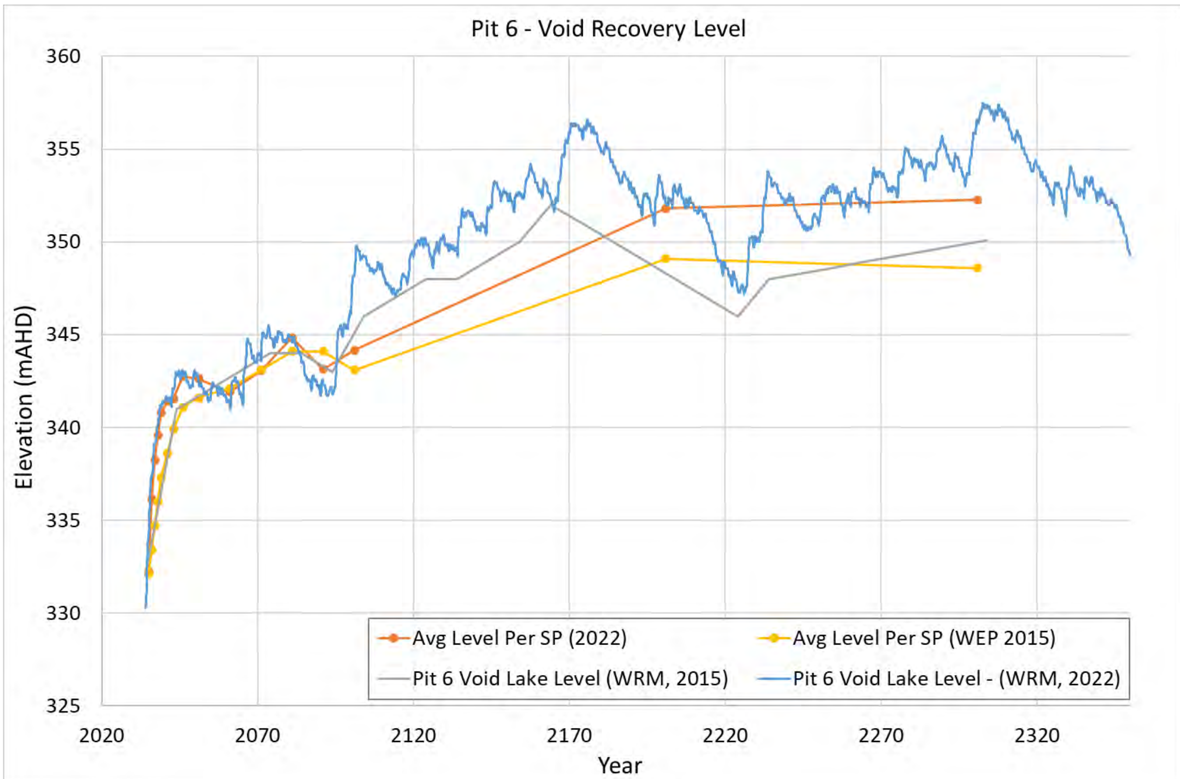

Figure 4 Predicted Pit 6 Final Void Water Levels

3 Results

This section presents incremental groundwater impacts between the approved final landform and the revised final landform, with a focus on the long-term interaction between the final void water bodies and the surrounding groundwater system. The groundwater model outputs processed and reviewed are generally consistent with those reported on in the Groundwater Assessment for the WEP EIS (HydroSimulations, 2015).

As described in **Section 2.2**, the final void water levels modelled by WRM (2022) have been adopted and used in the groundwater model to assess the likely interaction between the final voids and the surrounding groundwater system.

3.1 Pit 6 Final Void

Consistent with the groundwater modelling predictions in HydroSimulations (2015), the revised Pit 6 final void is predicted to be a net inflow system and long-term hydraulic sink. The surrounding groundwater system is predicted to recover at a faster rate than water levels in the Pit 6 final void, and therefore the void is predicted to be a groundwater sink following the cessation of mining.

Long-term groundwater flux to the revised Pit 6 final void is predicted to be very similar to Pit 6 final void configuration of the approved final landform. The similarities in long-term flux likely relate to balancing between a larger final void size (leading to more aquifer/ spoil intersected and more inflow) and a slightly higher predicted final void water level (reducing the gradient to the final void).

3.2 Pit 2 Final Void

Consistent with the groundwater modelling predictions in HydroSimulations (2015), the Pit 2 final void is predicted to be a net inflow system and long-term hydraulic sink. The surrounding groundwater system is predicted to recover at a faster rate than water levels in the Pit 2 final void, and therefore the void is predicted to be a groundwater sink following the cessation of mining.

Long-term groundwater flux to the revised Pit 2 final void is predicted to increase by 15% compared with the final void configuration simulated for the approved final landform. A similar but slightly larger void geometry and a lower predicted recovery level would create a larger hydraulic gradient to the pit and increase the long-term groundwater flux to the Pit 2 final void.

4 Conclusions

The groundwater modelling undertaken to assess the impacts of the revised final landform for Wilpinjong Coal Mine focused on incorporating changes to the final landform using a methodology consistent with HydroSimulations (2015).

The modelling results predict a lower void water level in Pit 2 and a 15% increase in groundwater flux to the void compared with the approved final landform (HydroSimulations, 2015). While a higher final void water level, but very similar long-term flux is predicted for Pit 6.

The predicted post-mining groundwater take would be lower than the groundwater take during-mining. Accordingly, sufficient water licence entitlement will be available to retire at the completion of mining to account for groundwater inflows to the voids post-mining.

When considering the balance between final void size and groundwater inflow and final void water levels and hydraulic gradients to the final voids, the incremental differences in model results for each of the final voids are consistent with the conceptualisation of the system and appropriately reflect the model revisions.

5 Recommendations

The original groundwater model developed for the WEP EIS has been used for this groundwater review in order to provide a like-for-like comparison between the approved and revised final landforms. The site groundwater model continues to be updated to progressively incorporate additional groundwater monitoring data, consistent with requirements from Section 6.4 of the Groundwater Management Plan (Peabody, 2017). There are also alternate groundwater modelling methodologies that can be utilised to predict equilibrium water levels and fluxes to final voids. Additional groundwater data will continue to be collected, and groundwater modelling methodologies will continue to be refined over the life of the Wilpinjong Coal Mine. In advance of mine closure, it is therefore recommended that final void modelling is revisited utilising the contemporary groundwater model for the Wilpinjong Coal Mine and consideration is given to using the most suitable final void modelling techniques that are available at that time.

The groundwater and final void water balance models have adopted a full range of climatic conditions represented in the historical rainfall record. However, changes to the climate, such as increased or decreased rainfall and evaporation have not been considered in this assessment. Future final void modelling could incorporate estimates toward the upper and lower limits of future climate predictions to test model sensitivity.

Site specific hydraulic testing (pump, slug, or packer testing) of spoil material would help validate the parameters selected to represent spoil in the groundwater model and could be incorporated into future assessments.

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ATTACHMENT 5

REVISED FINAL VOID SURFACE WATER MODELLING
(WRM WATER AND ENVIRONMENT, 2022)

water + environment

Memorandum

Date	18 February 2022	Pages	10
Attention	Ian Flood		
Company	Wilpinjong Coal Pty Ltd		
Job No.	1052-12-B2		
Subject	Wilpinjong Coal Mine – Revised Final Landform Analysis		

Dear Ian,

Introduction

The Wilpinjong Coal Mine (WCM) is owned and operated by Wilpinjong Coal Pty Limited (WCPL), a wholly owned subsidiary of Peabody Energy Australia Pty Ltd.

WRM previously prepared the Wilpinjong Extension Project Surface Water Assessment (WEP SWA), which included assessment of the final landform presented in the 2015 WEP Environmental Impact Statement (EIS) (WRM, 2015). The WEP SWA included a final landform analysis and final void water balance.

The final landform presented in the EIS originally included a final void in the south of Pit 8. In light of the WEP Planning Assessment Commission's strong recommendation, WCPL committed to revise the final Pit 8 landform such that the southern end is wholly free draining (either north into Wilpinjong Creek, or west into the Cumbo Valley) and no longer includes a final void.

The WEP was approved on 24 April 2017 (Development Consent SSD-6764). The approved Conceptual Rehabilitation Strategy is shown on Appendix 8 of the Development Consent and includes two final voids (Pit 2 and Pit 6). The Pit 2 and Pit 6 final voids are consistent with the voids assessed in the WEP SWA.

WCPL has developed a revised conceptual final landform to account for changes in mine sequencing and material balance at the WCM. The revised conceptual final landform is shown on Figure 1.

WCPL has requested that WRM assess the potential implications on final void behaviour and catchment excision for the revised final landform surface, in particular the revised final void in Pit 6. This memo presents the outcomes of a final void analysis of the modified final landform design, including updated:

- model assumptions;
- water balance results; and
- final landform impact assessment.

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Memorandum

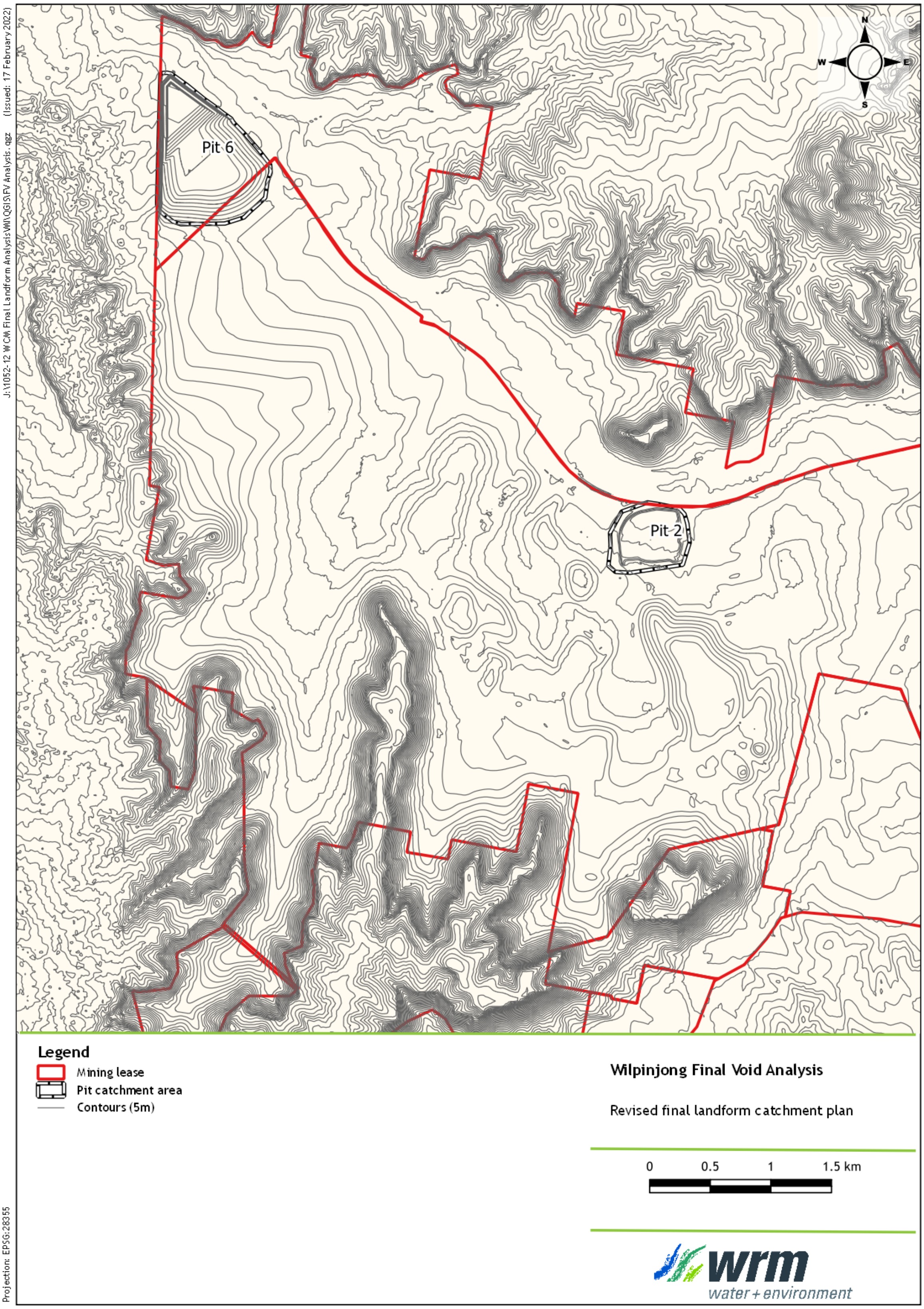

Figure 1 – Revised final landform catchment plan

Memorandum

Model assumptions

A GOLDSIM model of the final voids was developed based on the original OPSIM model used for the WEP SWA (WRM, 2015). The model was updated for the Pit 2 and Pit 6 final voids based on the revised final landform.

The following section documents the main model assumptions, including:

- Void configuration.
- Catchment parameters.
- Groundwater inflows.
- Salinity.

Void configuration

The final landform assessed in the WEP EIS included the retention of three final voids – Pit 6, Pit 2 and Pit 8 (WRM, 2015). Pit 8 is no longer proposed to be a final void, and will be a free-draining landform.

The revised final landform for the WCM, as well as the revised catchments reporting to the Pit 6 and Pit 2 is shown in Figure 1.

The up-stream catchment areas reporting to the final voids will be diverted based on proposed works by WCPL, including:

- WCPL will consult with Moolarben Coal Operations Pty Ltd (MCPL) regarding the diversion of natural catchment draining to Pit 6 from the west. It is understood this natural catchment is yet to be mined by MCPL and will form part of the Moolarben Coal Complex final landform.
- WCPL will implement a bund along the pit crest contour around the Pit 2 void to minimise the up-stream catchment to the southwest reporting to the void.

The catchment areas reporting to the voids shown in Figure 1 and summarised in Table 1 have been delineated based upon the above works.

If there is a change to the catchment areas reporting to the final voids, the final void investigations presented in this memo will require revision.

Table 1 – Adopted catchment areas

Final void	Catchment area (ha)
Pit 6	81.8
Pit 2	31.6

The stage-storage curves for the two voids have been applied in the GOLDSIM model based on the modified final landform. The key void parameters are shown in Table 2.

Table 2 - Void parameters

Final void	Pit floor level (mAHD)	Pit crest level (mAHD)	Capacity (ML)
Pit 6	325	395	20,180
Pit 2	355	370	2,130

AWBM parameters

The GOLDSIM model uses the Australian Water Balance Model (AWBM) (Boughton, 1993) to estimate runoff from rainfall. The AWBM is a saturated overland flow model which allows for variable source areas of surface runoff.

The AWBM parameters have been adopted from WRM (2015) and are shown in Table 3. These parameters were based on those adopted for previous water balance invetsigations (undertaken by others), and have been previously calibrated against site measurements (WRM, 2015).

Table 3 – AWBM parameters

Parameters	Natural	Hardstand	Spoil	Pit	Rehabilitated spoil	Tailings
A1	0.01	1.0	0.05	0.1	0.012	1.0
A2	0.65	-	0.95	0.9	0.63	-
A3	0.34	-	-	-	0.358	-
C1	6	3	5	5	6	2
C2	120	-	65	15	120	-
C3	160	-	-	-	160	-
BFI	0.3	-	0.7	0.2	0.3	-
k_b	0.975	-	0.99	0.95	0.97	-
k_s	0.5	-	0.15	0.1	0.5	-
Long term C_v*	2.2%	51.7%	8.6%	30.6%	2.2%	54.9%

* Average volumetric runoff - this is an output of the AWBM model and is effectively a measure of the total runoff divided by the total rainfall.

Groundwater inflows

Groundwater inflow estimates were provided by SLR Consulting for the two voids based upon a groundwater model updated with the modified final landform. These groundwater inflows were applied to the voids within the GOLDISM model.

The updated groundwater inflows for Pit 6 are shown in Table 4 and for Pit 2 in Table 5.

Table 4 - Pit 6 groundwater inflows

Water level (mAHD)	Net inflow (m^3/day)
326	600
340	60
350	55
360	55
370	50
380	45

Table 5 - Pit 2 groundwater inflows

Water level (mAHD)	Net inflow (m^3/day)
360	10
365	21.5
370	21
375	5

Salinity

The GOLDSIM model was configured to use salinity as an indicator of water quality. Representative electrical conductivity (EC) values were assigned to runoff from catchments and other inflow sources of water to track salinity. A conversion factor of 0.65 was adopted between EC and total dissolved solids (TDS).

The representative salinity for runoff from the various catchment types were adopted from WRM (2015) and are shown in Table 6.

Table 6 - Adopted salinity

Water source	EC (µS/cm)	TDS (mg/L)
Natural	1,600	1,040
Pit/Hardstand/Tailings	3,000	1,950
Rehabilitated spoil	2,000	1,300
Spoil	2,500	1,625
Groundwater	3,000	1,950

Memorandum

Water balance results

The GOLDSIM model was run for a period of 400 years (from mine closure) using climate data for the WCM site from the SILO climate database (Jeffrey et al., 2001). The accumulation of surface runoff combined with groundwater inflows usually results in the formation of a pond of water in the void which rises until the average rate of inflow is balanced by evaporation from its surface.

The following section outlines the predicted long-term final void behaviour following mine closure for the two voids.

Pit 6 long-term void behaviour

The long-term Pit 6 void water level and salinity is shown in Figure 2.

The void is predicted to initially collect water until reaching equilibrium after approximately 150 years. After reaching equilibrium, the void forms a permanent pit lake, oscillating between a minimum water level of approximately 347 mAHD and a maximum of 357 mAHD. The long-term pit lake is therefore predicted to maintain a depth of at least 22 m and is never predicted to approach the pit crest of 395 mAHD. The salinity of the void builds over time, reaching a maximum of approximately 62,000 µS/cm after 400 years.

Key statistics regarding the final void after reaching equilibrium are shown in Table 7.

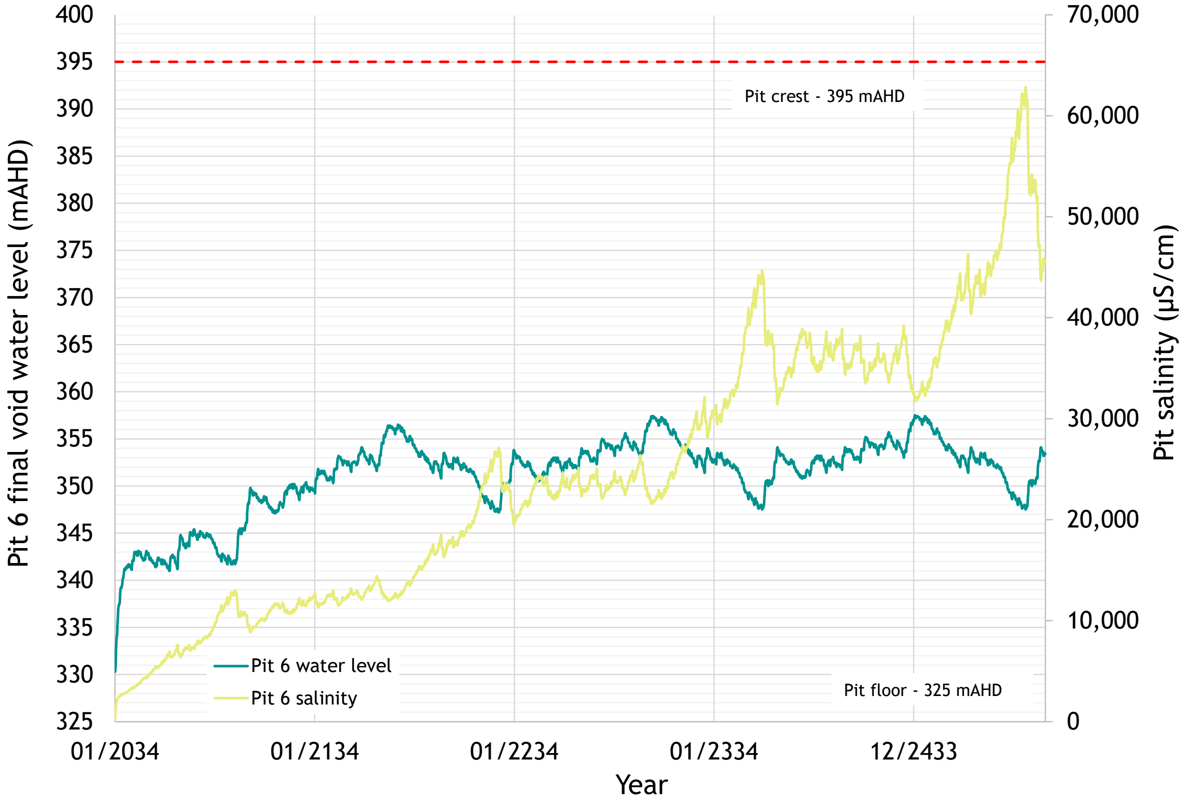

Figure 2 - Pit 6 modelled water level and salinity

Table 7 – Pit 6 void lake statistics

Max. water level (mAHD)	90%ile water level (mAHD)	Maximum surface area (ha)	90%ile surface area (ha)
357.5	355.5	13.8	11.9

Pit 2 long-term void behaviour

The long-term Pit 2 void water level and salinity is shown in Figure 3.

The void is predicted to initially lose water until reaching equilibrium after approximately 50 years. After reaching equilibrium, the void oscillates between nearly dry (depth less than 10 cm) and a maximum of 3 m (357.5 mAHD). The salinity of the void oscillates as the void undergoes wetting and drying cycles and is highly concentrated compared to Pit 6 due to the very small volume of lake water during drying cycles. An upper salinity evaporation level of 357,000 mg/L (approximately 549,780 µS/cm) has been applied to represent the maximum saturation level of salt in water.

Key statistics regarding the final void after reaching equilibrium are shown in Table 8.

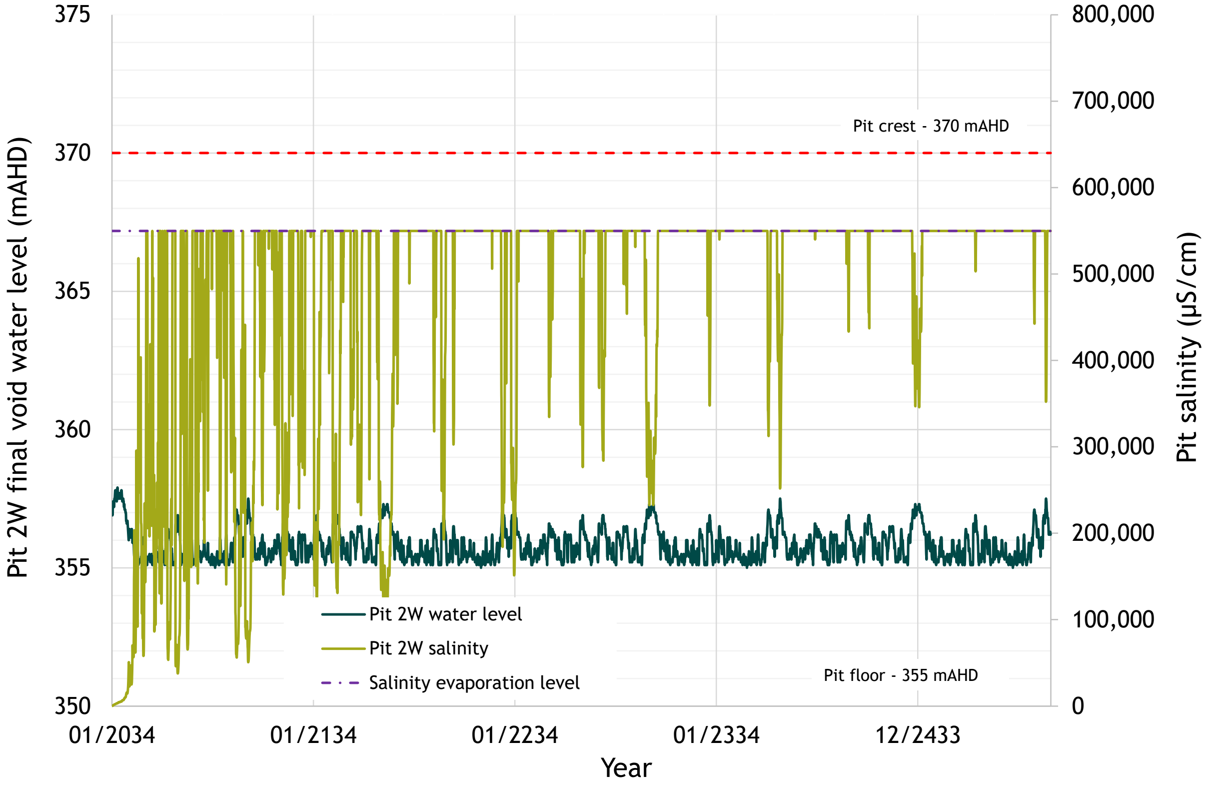

Figure 3 - Pit 2 modelled water level and salinity

Table 8 - Pit 2 void statistics

Max. water level (mAHD)	90%ile water level (mAHD)	Maximum surface area (ha)	90%ile surface area (ha)
357.5	356.6	8.2	6.8

Impact assessment

After completion of mining operations, the Pit 2 and Pit 6 voids will continue to intercept the catchments outlined in Table 1, which will not report to the natural environment.

Table 9 shows the residual catchment area captured at the completion of active mining operations (i.e. reporting to the modified final voids).

Memorandum

Table 9 - Catchment area captured at end of mine life

Catchment	Total Catchment Area (km²)	WCM final void catchment area (km²)	Percentage of total catchment excised by WCM final voids
Wilpinjong Creek to Wollar Creek confluence	213.8	1.13	0.53 %
Wollar Creek to Goulburn River confluence	530.6	1.13	0.21 %
Goulburn River to Hunter River confluence	7,965	1.13	0.01 %

The total catchment areas of the natural catchments surrounding the WCM are outlined in Table 9. The final landform will intercept a total catchment area of 1.13 km^2 post-mining. This represents only 0.53% of the Wilpinjong Creek catchment to the Wollar Creek confluence. The potential impact on water quantity in Wilpinjong Creek due to catchment excision associated with the final landform is expected to be undetectable.

The final void water balance assessment outlined above shows that the final void equilibrium water level for both retained final voids lies well below the pit crest (i.e. 10m+). The final voids are therefore not at risk of spilling. As such, the Project will have no impact on receiving water quality resulting from overtopping of the final voids.

For and on behalf of WRM Water & Environment Pty Ltd
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MBriody

Matthew Briody
Associate/Principal Engineer

Memorandum

References:

Jeffrey et al. 2001	Jeffrey, SJ, Carter, JO, Moodie, KB & Beswick, AR 2001, '*Using spatial interpolation to construct a comprehensive archive of Australian climate data, Environmental Modelling and Software*', Vol 16/4, pp 309-330.
WRM, 2015	*'Wilpinjong Extension Project Surface Water Assessment'* Prepared for Wilpinjong Coal Pty Ltd, WRM Water & Environment, 1052-01-B9, November 2015.

ATTACHMENT 6

GOVERNMENT CONSULTATION

Department of Planning and Environment

Our ref: SSD-6764-PA-57

Mr Ian Flood
Manager Project Development and Approvals
Wilpinjong Coal Pty Ltd

By email: iflood@peabodyenergy.com

06/12/2022

Subject: Wilpinjong Coal Rehabilitation Strategy (SSD-6764)

Dear Mr Flood

I refer to the revised Rehabilitation Strategy submitted in accordance with condition 61 of Schedule 3 of the above development consent.

I understand that the strategy includes a revised conceptual final landform having regard to the rehabilitation objectives of the development consent. The revised landform incorporates pricinples of micro-relief and retains two amended final voids (ie Pit 2 and Pit 6) following an assessment that concluded that backfilling these voids above groundwater equilibrium levels is not a reasonable or feasibile solution.

I also understand that Wilpinjong Coal Pty Ltd continues to consult with Moolarben Coal Operations Pty Ltd regarding opportunities to integrate the Pit 6 final void with the OC4 final void at the Moolarben Coal Complex. It is noted that decisions regarding this potential integration are not required until approximately 2028, pursuant to mine progression.

As the Rehabilitation Strategy included a groundwater review of the revised final landform, the Department sought advice from its Water Group (DPE Water) on the outputs of this assessment. DPE Water raised concern regarding risks of saline discharge into Wilpinjong Creek due to its proximity to Pit 6, and recommened an independent review of the groundwater model to advise if the model is sufficiently robust and commensurate with the risk.

The Department acknowledges advice from Wilpingjong Coal that the groundwater review was based on the 2015 groundwater model with adopted amendments following model updates undertaken in 2020.
The Department also notes that Wilpingjong Coal is required to update the groundwater model every three years, and a new model is proposed for development during 2023.

Whilst the Department considers that the Rehabilitation Strategy has generally been prepared in accordance with the relevant conditions of consent, it is also considered that groundwater equilibrium levels and and potential downstream risks should continue to be modelled and evaluated over the project life. On this basis, the Secretary has conditionally approved the Rehabilitation Strategy subject to: