# *RUSSELL VALE COLLIERY*

# *REVISED UNDERGROUND EXPANSION PROJECT*

# *EXTRACTION PLAN*

# *STAGES ONE and TWO - PC07, PC08 & PC21 to PC25 and PC27 to PC34*

# RVE EC PLN 010

# Contents

1 INTRODUCTION ....9
1.1 Background ....9
1.2 Document Structure ....11
1.3 Extraction Plan Team ....12
1.4 Regulatory Requirements and Performance Measures ....15
1.4.1 Approval Conditions ....15
1.4.2 Performance Measures ....24
1.4.3 EPBC Approval Conditions ....26
1.4.4 Mining Lease Conditions ....31
2 PROJECT DESCRIPTION ....33
2.1 Surface Infrastructure - Project Overview ....33
2.2 Surface Infrastructure - Project Staging ....34
2.2.1 Coal Handling and Processing ....35
2.2.2 Reject Material Handling ....35
2.2.3 Coal Stockpiling ....35
2.3 Bellambi Gully Creek ....35
2.4 Rehabilitation ....36
2.5 Environmental Duty of Care ....36
2.6 Extraction Plan – Project Overview ....40
2.7 Extraction Plan – Project Staging ....44
2.8 Mine Planning and Design ....45
2.8.1 Geology and Stratigraphy ....46
2.8.2 Mine Roof and Floor Conditions ....47
2.8.3 Status of Overlying Workings ....47
2.8.4 Selection of Mine Design ....49
3. SUBSIDENCE PREDICTIONS ....52
4. DEVELOPMENT OF THE EXTRACTION PLAN ....58
4.1 Risk Assessment ....58
4.2 Stakeholder Consultation ....58
4.2.1 Consultation During the Environmental Assessment Process ....58
4.2.2 Consultation During the Preparation of the Management Plan ....59
4.2.3 Landowner Consultation ....60
4.3 Baseline Data ....60

4.3.1 Baseline Data Relevant to Stage 1 and Stage 2 ....60
4.3.2 Reference Data Relevant to Stage 1 and Stage 2 ....61
4.3.3 Monitoring to Establish Baseline Data for Future Extraction Plans ....61
5. MANAGEMENT FRAMEWORK ....62
5.1 RVC Environmental Management System ....62
5.2 Incidents, Exceedances and Non-Compliances ....64
5.3 Trigger Action Response Plans ....65
5.3.1 TARP Levels ....66
5.4 Adaptive Management ....69
5.5 Potential Incident Notifications ....71
5.6 Contingency Plans ....71
6. SUBSIDENCE MANAGEMENT AND MONITORING ....73
6.1 Subsidence Monitoring Program ....73
6.1.1 Overview ....73
6.1.2 Performance Measures and Triggers ....73
6.1.3 Management and Monitoring Measures ....73
6.2 Water Management Plan ....76
6.2.1 Water Management Plan ....76
6.2.2 Groundwater Management Plan ....80
6.3 Biodiversity Management Plan ....84
6.3.1 Overview ....84
6.3.2 Potential Impacts ....88
6.3.3 Performance Measures and Triggers ....89
6.3.4 Management and Monitoring Measures ....90
6.4 Upland Swamp Monitoring Plan ....93
6.4.1 Overview ....93
6.4.2 Potential Impacts ....93
6.4.3 Performance Measures and Triggers ....94
6.4.4 Management and Monitoring Measures ....95
6.5 Land Management Plan .... 114
6.5.1 Overview .... 114
6.5.2 Potential Impacts .... 117
6.5.3 Performance Measures and Triggers .... 117
6.5.4 Management and Monitoring Measures .... 117
6.6 Heritage Management Plan .... 118

6.6.1 Overview ..... 118
6.6.2 Potential Impacts ..... 121
6.6.3 Performance Measures and Triggers ..... 122
6.6.4 Management and Monitoring Measures ..... 123
6.7 Built Features Management Plan ..... 123
6.7.1 Overview ..... 123
6.7.2 Potential Impacts ..... 126
6.7.3 Performance Measures and Triggers ..... 126
6.7.4 Management and Monitoring Measures ..... 128
6.8 Public Safety Management Plan ..... 129
6.8.1 Overview ..... 129
6.8.2 Potential Impacts ..... 131
6.8.3 Performance Measures and Triggers ..... 131
6.8.4 Management and Monitoring Measures ..... 131
7. Implementation ..... 132
7.1 Compliance Register ..... 132
7.2 Reporting Framework ..... 132
7.2.1 Incident Reporting ..... 132
7.2.2 Six Monthly Reporting ..... 133
7.2.3 Impact Reporting ..... 133
7.2.4 Annual Review ..... 134
7.2.5 Annual Compliance Reporting ..... 134
7.3 Auditing ..... 135
7.4 Review of Extraction Plan and Key Component Management Plans ..... 136
7.5 Rehabilitation Management Plan ..... 136
7.6 Key Responsibilities ..... 136
7.7 Record Keeping and Control ..... 137
7.8 Training ..... 138
7.9 Inductions ..... 138
7.10 Complaints Handling ..... 139
7.11 Dispute Resolution ..... 139
8. Graphical Plan ..... 140
9. Abbreviations and Definitions ..... 142
10. References ..... 145
Appendix A: Master Trigger Action Response Plans ..... 147

Appendix B: Consultation ..... 148
Appendix C: Risk Assessment ..... 150
Appendix D: Subsidence Assessment ..... 151
Appendix E: Built Features Management Plan ..... 152
Appendix F: Public Safety Management Plan ..... 153
Appendix G: Water Management Plan ..... 154
Appendix H: Groundwater Management Plan ..... 155
Appendix I: Biodiversity Management Plan ..... 156
Appendix J: Upland Swamp Monitoring Plan ..... 157
Appendix K: Land Management Plan ..... 158
Appendix L: Heritage Management Plan ..... 159
Appendix M: Subsidence Monitoring Program ..... 160

# Figures

Figure 1: Russell Vale Colliery Locality Plan ....10
Figure 2: Existing Russell Vale Colliery Pit Top ....37
Figure 3: Proposed Stage 1 Without Surface Infrastructure ....38
Figure 4: Proposed Stage 2A Surface Infrastructure Components without Coal Processing Plant.39
Figure 5: Extraction Plan Mining Area: Proposed Bord and Pillar Panels and Existing Bulli Goaf....42
Figure 6: Stage 1 and Stage 2 EP Areas and Historical Workings ....43
Figure 7: Subsidence Predictions PC07-08 ....55
Figure 8: Subsidence Predictions PC21-25 ....56
Figure 9: Subsidence Predictions PC27-34 ....57
Figure 10: WCL RVC Environmental Management Framework....63
Figure 11: TARP Process....68
Figure 12: Adaptive Management Process ....70
Figure 13: Subsidence Monitoring ....75
Figure 14: Surface Water Monitoring ....79
Figure 15: Groundwater Monitoring....83
Figure 16: Vegetation Communities ....86
Figure 17: Threatened Flora and Fauna ....87
Figure 18: Biodiversity Impact Monitoring Sites ....91
Figure 19: Biodiversity Control Monitoring Sites....92
Figure 20: Upland Swamp Monitoring Program (Including Groundwater and Subsidence Monitoring) ....97
Figure 21: Land Features.... 116
Figure 22: Heritage Features .... 120
Figure 23: Built Features .... 125
Figure 24: Public Safety Features.... 130
Figure 25: Graphical Plan relevant for Stage 1 and Stage 2 EP Areas .... 141

# Tables

Table 1 Summary of Appendices ..... 11
Table 2 Extraction Plan Team ..... 13
Table 3 Extraction Plan Requirements ..... 15
Table 4 Natural and Heritage Features Performance Measures ..... 24
Table 5 Built Features Performance Measures ..... 25
Table 6 EPBC 2020/8702 Approval Conditions ..... 26
Table 7 Mining Lease Conditions ..... 32
Table 8 Extraction Plan Staging and Relevance to this Plan ..... 44
Table 9 Mining Parameters in the EP Area ..... 45
Table 10 Subsidence Predictions ..... 52
Table 11 Consultation to Date for the EP ..... 59
Table 12 Extraction Plan Trigger Levels ..... 66
Table 13 Water Performance Measures ..... 77
Table 14 Biodiversity Performance Measures ..... 89
Table 15 Coastal Upland Swamp Performance Measures ..... 95
Table 16 Vegetation Monitoring Techniques ..... 96
Table 17 Swamp Groundwater Monitoring ..... 98
Table 18 UEP upland swamp ecological monitoring requirements ..... 100
Table 19 Giant Burrowing Frog monitoring and methodology ..... 109
Table 20 Water monitoring requirements and locations ..... 109
Table 21 Natural Features Description and EP Area Location ..... 115
Table 22 Land Features Performance Measures ..... 117
Table 23 Summary of Land Features Subsidence Monitoring ..... 117
Table 24 Scientific and cultural significance of cultural heritage sites ..... 119
Table 25 Risk to Heritage Sites from Stage 1 and Stage 2 Second Workings Subsidence ..... 121
Table 26 Heritage Features Performance Measures ..... 122
Table 27 Built Features Performance Measures ..... 126
Table 28 Public Safety Performance Measures ..... 131
Table 29 Roles and Responsibilities ..... 137
Table 30 Abbreviations ..... 142
Table 31 Definitions ..... 143

| PROPERTY | VALUE |
|---|---|
| Approved by | Warwick Lidbury |
| Document Owner | Warwick Lidbury |
| Effective Date | |

**Revisions**

| VERSION | DATE REVIEWED | REVIEW TEAM (CONSULTATION) | NATURE OF THE AMENDMENT |
|---|---|---|---|
| D1 (V1) | 08/10/2021 | WCL | Final draft |
| 0 | 19/11/2021 | WCL | Finalised post submission and response to regulatory comments |
| D1 (V2) | 08/04/2022 | WCL | Updated to incorporate Stage 2 extraction area (PC27 to PC34) |
| D1 (V3) | 10/06/2022 | WCL | Updated to incorporate changes following submission to stakeholders and receipt of comments. |
| F1 | 10/06/2022 | WCL | Finalisation for submission to DPE |
| F1.1 | 7/10/2022 | WCL | Amendments to address DPE RFI |

# 1 INTRODUCTION

## 1.1 Background

Wollongong Coal Limited (WCL) operates the Russell Vale Colliery (RVC) (formerly known as NRE No 1 Colliery) located approximately 8 km north of Wollongong and 70 km south of Sydney. The RVC is located on the eastern slopes of the Illawarra Escarpment. Mining has been undertaken at RVC since the 1880s, including mining within the Bulli Seam, Balgownie Seam and the Wongawilli Seam. All three seams outcrop along the Illawarra Escarpment and the seams are accessed by adits (underground mine entrances) directly into the seams. There are two main mining areas within the RVC lease area, which are referred to as Wonga East and Wonga West.

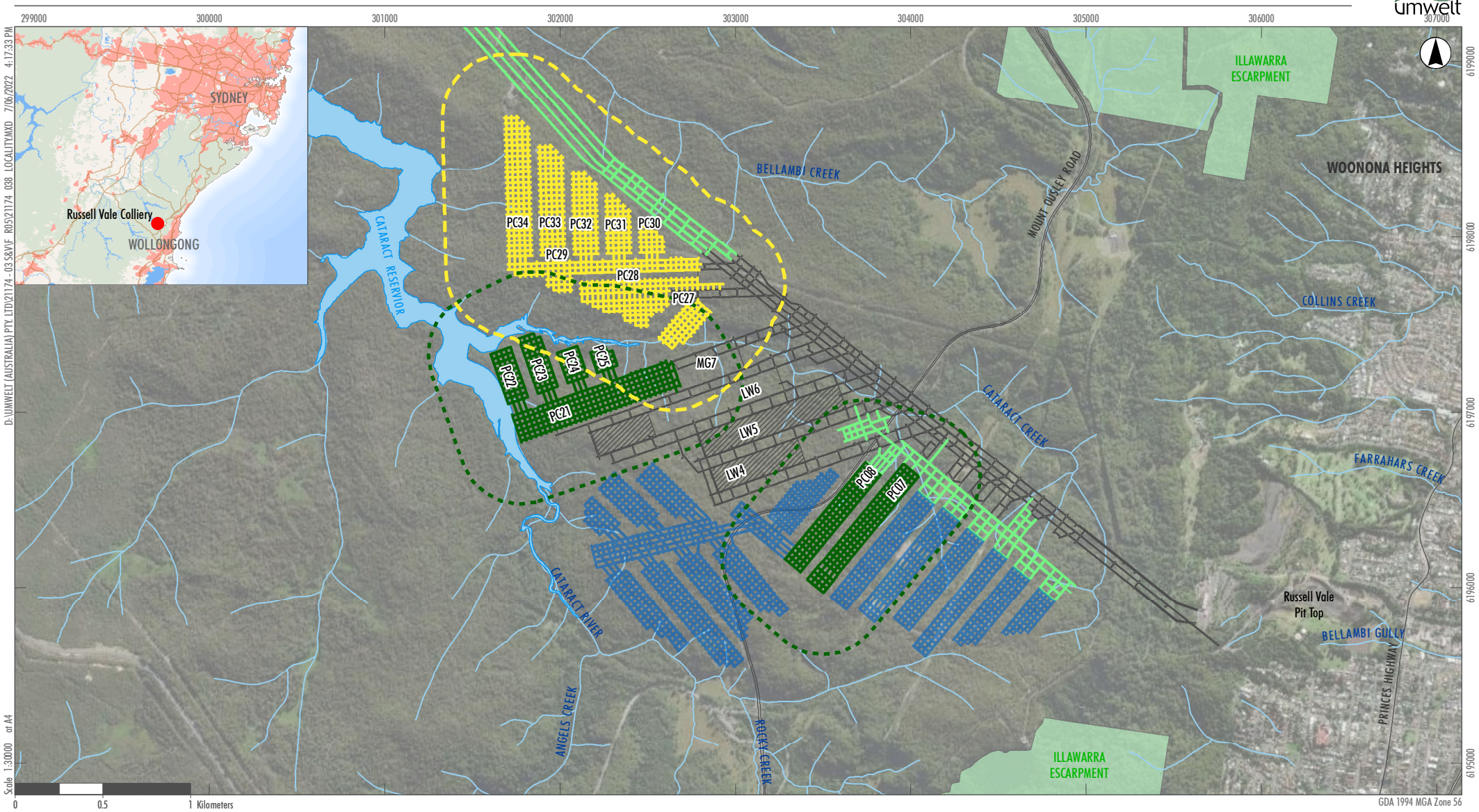
The RVC Pit Top consists of the main surface infrastructure and facilities for the colliery, including coal stockpiles, drift portals, conveyors, truck loading facilities, administration buildings and water management infrastructure. The location of the RVC and mining areas relating to this extraction plan (EP) are shown in **Figure 1**.

The RVC has been in 'care and maintenance' since 2015 until September 2021, when coal production from first workings commenced. Previous mine owners Gujarat NRE Coking Coal Ltd sought approval to expand the longwall mining operations at RVC in 2009, with subsequent amendments to submissions by new owners WCL in 2013 and 2019 in response to reviews undertaken by the NSW Department of Planning, Industry and Environment (DPIE). The July 2019 submission provided major changes to the project to significantly reduce impacts from subsidence, including an amended mine plan which no longer involves longwall mining.

Development Consent MP 09_0013 (the Development Consent) for the revised Russell Vale East (RVE) Underground Expansion Project (UEP) was approved by the Independent Planning Commission (IPC) of New South Wales (NSW) on 8 December 2020. The approved development involves mining of panels within the Wonga East area by means of non-caving bord and pillar mining technique only, with workings designed to be long term stable with negligible subsidence impacts.

Mining within the UEP will be completed in a staged approach, with this EP covering mining of the panels within the "Stage 1" (PC07, PC08 and PC21 to PC25) and "Stage 2" (PC27 to PC34) EP areas. These areas are defined in **Figure 1** and further discussed in **Section 2.7**.

The RVC UEP is also subject to the requirements of the Environment Protection and Biodiversity Conservation (EPBC) Act 1999, with EPBC approval 2020-8702 being granted by the Department of Agriculture, Water and the Environment (DAWE) on 31 August 2021. The EPBC Act Approval conditions are included in **Section 1.4.3**.




Legend

- Stage 2 Area PC27-34
- Stage 1 Areas PC07-08 and PC21-25
- EP2 Layout PC27-34
- EP1 Layout PC07-08 and PC21-25
- Future Wongawilli Seam Workings (not subject to this EP)
- Existing Wongawilli Seam Workings
- Wongawilli Seam First Workings (Approved under MP09_0013)
- State Conservation Area
- Road

FIGURE 1

Russell Vale Colliery
Locality Plan

Image Source: ESRI (2021) Data source: DFSI (2020)

## 1.2 Document Structure

This EP has been prepared in accordance with Condition C10 of the Development Consent and the Guidelines for the Preparation of Extraction Plans (draft) (DP&E/DRE, 2015).

- **Section 1** outlines background information, the EP structure and details of the mining processes approved under the Development Consent.
- **Section 2** outlines the project description including project staging.
- **Section 3** summarises the findings of the Russell Vale Colliery: Subsidence Assessment for PC07-08 and PC21-25 (Stage 1) Extraction Plan (SCT, 2021) and the Russell Vale Colliery: Extraction Plan Subsidence Assessment for PC27-34 (Stage 2) Mining (SCT, 2022) (Updated Subsidence Assessments).
- **Section 4** describes the development of this EP, the outcomes of the risk assessments for both Stage 1 and Stage 2 areas, undertaken in 2021 and 2022 respectively, the stakeholder consultation and baseline data.
- **Section 5** summarises the monitoring and management measures including Trigger Action Response Plans (TARP) to be implemented in the event of an incident, non-compliance or in the event that subsidence impacts are greater than predicted.
- **Section 6** summarises the key component plans and programs required under Condition C10 of the Development Consent and the management framework adopted under the EP.
- **Section 7** outlines the procedures for implementing and maintaining this EP and the key component plans.
- **Section 8** depicts the graphical plans for the EP Area.
- **Section 9** defines the abbreviations and acronyms used in this EP.
- **Section 10** lists the sources referred to in this document.

A summary of the appendices to this EP is provided within **Table 1** below.

**Table 1 Summary of Appendices**

| Appendix | Description |
|---|---|
| **Appendix A: Master Trigger Action Response Plans** | Combines all necessary TARPs from each relevant Key Component Plan. Relevant to Stage 1 and Stage 2 second workings. |
| **Appendix B: Consultation** | Documents the stakeholder consultation undertaken as part of the preparation of the EP. |
| **Appendix C: Risk Assessment** | Provides for a Risk Assessment prepared for Stage 1 and Stage 2, relevant to this EP. |
| **Appendix D: Subsidence Assessment** | Provides updated subsidence assessments for Stage 1 and Stage 2, relevant to this EP. |
| **Appendix E: Built Features Management Plan** | Contains monitoring and management measures for built features potentially affected by Stage 1 and Stage 2 second workings. |
| **Appendix F: Public Safety Management Plan** | Contains monitoring and management measures relevant to the protection of public safety where this may be affected by Stage 1 and Stage 2 second workings. |

| Appendix | Description |
|---|---|
| **Appendix G: Water Management Plan** | Contains monitoring and management measures for water resources potentially affected by Stage 1 and Stage 2 second workings. |
| **Appendix H: Groundwater Management Plan** | Contains monitoring and management measures for groundwater within the UEP and, in particular, groundwater features potentially impacted by Stage 1 and Stage 2 second workings.<br>This document also forms Appendix B of the WMP |
| **Appendix I: Biodiversity Management Plan** | Contains monitoring and management measures for biodiversity features (other than coastal upland swamps) potentially affected by Stage 1 and Stage 2 second workings. |
| **Appendix J: Upland Swamp Monitoring Plan** | Contains monitoring and management measures for coastal upland swamps potentially affected by Stage 1 and Stage 2 second workings. |
| **Appendix K: Land Management Plan** | Contains monitoring and management measures for landscape features potentially affected by Stage 1 and Stage 2 second workings. |
| **Appendix L: Heritage Management Plan** | Contains monitoring and management measures for Aboriginal cultural heritage and historic heritage potentially affected by Stage 1 and Stage 2 second workings. |
| **Appendix M: Subsidence Monitoring Program** | Details the monitoring to be undertaken to inform and detect changes to the landform and terrain associated with subsidence from Stage 1 and Stage 2 second workings. |

## 1.3 Extraction Plan Team

Condition C10 of the Development Consent states: *the Proponent must prepare an Extraction Plan for all second workings on site*. This plan must:

a) Be prepared in consultation with RR, DPIE Water and WaterNSW by a suitable qualified and experienced person/s whose appointment has been endorsed by the Secretary.

The team to prepare this EP for Stage 1 (PC07-08 and PC21-PC25) was endorsed by DPIE on 9 February 2021 and the team to update this EP for Stage 2 (PC27-PC34) was endorsed by DPE on 20 January 2022. The EP team is outlined in **Table 2** below and a copy of DPIE/DPE's approval of the team is included within **Appendix B.**

**Table 2 Extraction Plan Team**

| Consent Condition | Extraction Plan Requirement | Company – Stage 1 | Resource – Stage 1 | Company – Stage 2 | Resource – Stage 2 |
|---|---|---|---|---|---|
| C10 | Extraction Plan | Various subconsultants as listed below. | Warwick Lidbury – RVC Mine Manager<br>Luke Bettridge – Principal Environmental Consultant<br>David Holmes – Principal Environmental Consultant | Umwelt Environmental and Social Consultants | Luke Bettridge – Principal Environmental Consultant<br>David Holmes – Principal Environmental Consultant |
| C10 (g) (i) | Subsidence Monitoring Plan | SCT | Dr Ken Mills – Principal Subsidence Engineer<br>Stephen Wilson – Mine Planner | SCT | Dr Ken Mills – Principal Subsidence Engineer<br>Stephen Wilson – Mine Planner |
| C10 (g) (ii) | Built Features Management Plan | SCT | Dr Ken Mills – Principal Subsidence Engineer<br>Stephen Wilson – Mine Planner | SCT | Dr Ken Mills – Principal Subsidence Engineer<br>Stephen Wilson – Mine Planner |
| C10 (g) (iii) | Water Management Plan | Engeny Water Management<br>Umwelt Environmental and Social Consultants | Susan Shield – Principal Engineer<br>Claire Stephenson – Principal Hydrogeologist | Umwelt Environmental and Social Consultants | Chris Bonomini – Principal Engineer<br>Claire Stephenson – Principal Hydrogeologist |
| C10 (g) (iv) | Biodiversity Management Plan | Biosis Pty Ltd | Paul Price – Restoration Ecologist | Biosis Pty Ltd | Jane Raithby-Veall – Associate Director (Ecology) (Quality Assurance)<br>Caragh Heenan – Project Zoologist (Project management and reporting)<br>Zoe Goold – Project Zoologist (Reporting) |
| C10 (g) (v) | Upland Swamp Monitoring Plan | Biosis Pty Ltd | Luke Stone – Consultant Aquatic Ecologist | Biosis Pty Ltd | Jane Raithby-Veall – Associate Director (Ecology) (Quality Assurance)<br>Caragh Heenan – Project Zoologist (Project management and reporting)<br>Zoe Goold – Project Zoologist (Reporting) |

| Consent Condition | Extraction Plan Requirement | Company – Stage 1 | Resource – Stage 1 | Company – Stage 2 | Resource – Stage 2 |
|---|---|---|---|---|---|
| C10 (g) (vi) | Land Management Plan | Umwelt Environmental and Social Consultants | Luke Bettridge – Principal Environmental Consultant<br>David Holmes – Principal Environmental Consultant | Umwelt Environmental and Social Consultants | Luke Bettridge – Principal Environmental Consultant<br>David Holmes – Principal Environmental Consultant |
| C10 (g) (vi)* | Heritage Management Plan | Biosis Pty Ltd | Dr Amanda Markham – Senior Archaeologist /Anthropologist | Biosis Pty Ltd | Taryn Gooley – Biosis Manager Heritage (NSW) (Quality Assurance)<br>Samantha Keats – Senior Archaeologist (Project management)<br>Matthew Smith – Consultant Archaeologist (Reporting) |
| C10 (g) (vii) | Public Safety Management Plan | Wollongong Coal | Warwick Lidbury – RVC Mine Manager | Umwelt Environmental and Social Consultants | Luke Bettridge – Principal Environmental Consultant<br>David Holmes – Principal Environmental Consultant |
| C10 (g) (viii) | Trigger Action Response Plan/s | Umwelt Environmental and Social Consultants | Warwick Lidbury – RVC Mine Manager<br>Luke Bettridge – Principal Environmental Consultant<br>David Holmes – Principal Environmental Consultant | Umwelt Environmental and Social Consultants | Luke Bettridge – Principal Environmental Consultant<br>David Holmes – Principal Environmental Consultant |
| C10 (g) (ix) | Contingency Plan | Umwelt Environmental and Social Consultants | Warwick Lidbury – RVC Mine Manager<br>Luke Bettridge – Principal Environmental Consultant<br>David Holmes – Principal Environmental Consultant | Umwelt Environmental and Social Consultants | Luke Bettridge – Principal Environmental Consultant<br>David Holmes – Principal Environmental Consultant |

*As per Development Consent.

## 1.4 Regulatory Requirements and Performance Measures

### 1.4.1 Approval Conditions

The requirement for an EP is established by Condition C10 of the Development Consent.

**Table 3** outlines the requirements under this condition and identifies where these requirements have been addressed in this EP. Additionally, WCL is subject to conditions outlined in the EPBC approval 2020/8702 (refer to **Section 1.4.3**).

**Table 3 Extraction Plan Requirements**

| Condition | Requirement | Where Addressed |
|---|---|---|
| **Development Consent** | | |
| **Part A** | | |
| A1. | In addition to meeting the specific performance measures and criteria established under this consent, the Applicant must implement all reasonable and feasible measures to prevent, and if prevention is not reasonable and feasible, minimise, any material harm to the environment that may result from the construction and operation of the development, and any rehabilitation required under this consent. | **Section 5**<br>**Section 6** |
| A24. | Unless the Applicant and the applicable authority agree otherwise, the Applicant must:<br>(a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the development; and<br>(b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the development.<br>Note: This condition does not apply to damage to roads caused as a result of general road usage or otherwise addressed by contributions required by condition B28 of this consent. | **Appendix E:** |
| A28. | The Applicant must ensure that all of its employees, contractors (and their sub-contractors) are made aware of, and are instructed to comply with, the conditions of this consent relevant to activities they carry out in respect of the development. | **Section 7.8** |
| **Part C** | | |
| C2. | Measurement and monitoring of compliance with performance measures and performance indicators in this consent is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans and monitoring programs. In the event of a dispute over the appropriateness of proposed methods, the Planning Secretary will be the final arbiter. | **Section 7.11** |

| Condition | Requirement | Where Addressed |
|---|---|---|
| C8. | Any dispute between the Applicant and the owner of any built feature over the interpretation, application or implementation of the performance measures in Table 7 is to be settled by the Secretary, following consultation with RR. Any decision by the Secretary shall be final and not subject to further dispute resolution under this consent | **Section 7.11** |
| C9. | The Applicant may carry out first workings within the underground mining area, other than in accordance with an approved Extraction Plan, provided that the RR is satisfied that the first workings are designed to remain stable and non-subsiding, except insofar as they may be impacted by approved second workings.<br>*Note: the intent of this condition is not to require additional approval for first workings, but to ensure that first workings are built to geotechnical and engineering standards sufficient to ensure long term stability, with negligible resulting subsidence impacts.* | **Section 2.8** |
| C10. | The Applicant must prepare an Extraction Plan for all second workings on site to the satisfaction of the Secretary. | **This Plan** |
| (a) | [The Extraction Plan must] be prepared in consultation with RR, DPIE Water and WaterNSW and by suitable qualified and experienced person/s whose appointment has been endorsed by the Secretary; | **Section 4.2** |
| (b) | [The Extraction Plan must] be approved by the Secretary before the Applicant carries out any second workings covered by the plan; | **Noted** |
| (c) | [The Extraction Plan must] include detailed plans of existing and proposed first and second workings, previously mined overlying seams and overlying surface features, including any applicable adaptive management measures; | **Section 2.8**<br>**Section 5.4**<br>**Appendix A** |
| (d) | [The Extraction Plan must] include adequate consideration of mine roof and floor conditions, pillar width to height ratio, final pillar design dimensions and the long-term stability of pillars which has been undertaken in consultation with RR; | **Section 2.8.2**<br>**Appendix D** |
| (e) | [The Extraction Plan must] provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed mining covered by the Extraction Plan, incorporating any relevant information obtained since this consent; | **Section 3**<br>**Appendix D** |
| (f) | [The Extraction Plan must] describe in detail the performance indicators that would be implemented to ensure compliance with the performance measures in Tables 5 and 6 (of the Development Consent), and manage or remediate any impacts and/or environmental consequences to meet the rehabilitation objectives in Table 4 (of the Development Consent); | **Section 5** |

| Condition | Requirement | Where Addressed |
|---|---|---|
| (g) | [The Extraction Plan must] include a: | |
| (i) | Subsidence Monitoring Program which has been prepared in consultation with RR to:<br>• describe the ongoing conventional and non-conventional subsidence monitoring program, including consideration of contemporary subsidence monitoring methods such as InSAR (Interferometric Synthetic Aperture Radar) and LIDAR (Light Detection and Ranging);<br>• provide data to assist with the management of risks associated with conventional and non-conventional subsidence;<br>• confirm the status of the Bulli Seam goaf areas yet to be confirmed as subsided through observation of development roadway conditions driven below the edges of these extracted goaf areas;<br>• validate the conventional and non-conventional subsidence predictions;<br>• analyse the relationship between the predicted and resulting conventional and non-conventional subsidence effects and predicted and resulting impacts under the plan and any ensuring [*sic*] environmental consequences;<br>• ensure that the development does not cause any exceedances of the maximum vertical subsidence limit in Table 7; and<br>• inform the adaptive management process in paragraph (viii) below. | **Section 6.1**<br>**Appendix M** |
| (ii) | Built Features Management Plan which has been prepared in consultation with RR, to manage the potential subsidence impacts of the proposed underground workings on built features, and which:<br>• has been prepared in consultation with the owner/s of potentially affected feature/s;<br>• addresses in appropriate detail all items of key public infrastructure (with particular consideration of transmission lines and towers (including angle towers), other public infrastructure and all classes of other built features;<br>• recommends appropriate pre-mining mitigation measures to reduce subsidence impacts;<br>• recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate predicted impacts on potentially affected built features in a timely manner, and<br>• in the case of all key public infrastructure, and other public infrastructure except roads, trails, and associated structures, reports external auditing for compliance with ISO 31000 (or alternative standard agreed with the infrastructure owner), and provides for annual auditing of compliance and effectiveness during extraction which may impact the infrastructure. | **Section 6.7**<br>**Appendix E** |

| Condition | Requirement | Where Addressed |
|---|---|---|
| (iii) | Water Management Plan, which has been prepared in consultation with WCC, EPA, DPIE Water and WaterNSW, which provides for the management of potential impacts and/or environmental consequences of the proposed underground workings on watercourses and aquifers, including:<br>• detailed baseline data on:<br>  o surface water flows and quality in water bodies that could be affected by subsidence, including Cataract River, Cataract Creek and all major associated tributaries;<br>  o groundwater levels, yield and quality in the region:<br>• surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;<br>• surface water monitoring program to monitor and report on:<br>  o stream flows and quality;<br>  o stream and riparian vegetation health; and<br>  o channel and bank stability;<br>• a groundwater monitoring program to monitor and report on:<br>  o springs, their discharge quantity and quality, as well as associated groundwater dependent ecosystems;<br>  o groundwater inflows to the underground mining operations;<br>  o the height of groundwater depressurisation;<br>  o background changes in groundwater yield/quality against mine-induced changes, in particular, on groundwater bore users in the vicinity of the site;<br>  o permeability, hydraulic gradient, flow direction and connectivity of the deep and shallow groundwater aquifers; and<br>  o impacts of the development on upland swamps (refer to condition C10(v) below) and other groundwater dependent ecosystems;<br>• a description of any adaptive management practices implemented to guide future mining activities in the event of greater than predicted impacts on aquatic habitat;<br>• a program to validate the surface water and groundwater models for the development, and compare monitoring results with modelled predictions; and<br>• a plan to respond to any exceedances of the surface water and groundwater assessment criteria; | **Section 6.2**<br>**Appendix G**<br>**Appendix H**<br>**Appendix I** |
| (iv) | Biodiversity Management Plan which has been prepared in consultation with BCD, which establishes a baseline data for the existing habitat on the site, including water table depth, vegetation condition, stream morphology and threatened species habitat, and provides for the management of potential impacts and/or environmental consequences of the proposed first workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats, EECs and water dependent ecosystems; | **Section 6.3**<br>**Appendix I** |

| Condition | Requirement | Where Addressed |
|---|---|---|
| (v) | Swamp Monitoring Program which has been prepared in consultation with BCD, DPI Water and WaterNSW, and which includes (as a minimum):<br>• outcome of updated surveys of existing biodiversity, species distribution and swamp condition for potentially impacted and control swamps;<br>• further consideration of the location of existing piezometers and the installation of upslope and downslope piezometers in shrub swamps, in order to better understand the down-slope movement of shallow groundwater;<br>• installation of flow monitoring points, nested monitoring bores and environmental water tracers to define hydraulic connection between swamps and associated aquifers;<br>• measures to record the nature and condition of terrestrial and aquatic flora and fauna within all swamps;<br>• measures to characterise soils or peat layers within the swamps to determine:<br>  o porosity;<br>  o a basis for relating water levels to rainfall and evapotranspiration; and<br>  o the presence, or absence, of clay materials at the interface with the underlying bedrock;<br>• a program for review of the water balance of all monitored swamps based on recorded rainfall, estimated evapotranspiration and recorded surface and shallow groundwater levels and outflow measurements;<br>• detailed performance indicators for the relevant performance measures in Table 6 (of the Development Consent), including performance indicators relating to surface and shallow groundwater levels and outflow measurements;<br>• baseline data for swamp hydrology and swamp vegetation;<br>• hydrological and vegetative monitoring which fully satisfies Before After Control Impact (BACI) design principles;<br>• consideration of post-mining swamp monitoring, including for the initial 12 month post-mining period and longer-term monitoring for inclusion into regional data bases;<br>• a program for consideration of long-term monitoring data for swamp hydrology and swamp vegetation (including baseline, during and post mining) to identify any statically [*sic*] significant changes;<br>• provision of raw piezometer and other monitoring data to the Department, BCD and WaterNSW, if requested; and<br>• incorporation of any relevant findings from swamp research developments into the swamp monitoring program; | **Section 6.4**<br>**Appendix J** |
| (vi) | Land Management Plan which has been prepared in consultation with any affected public authorities, which provides for the management of potential impacts and/or environmental consequences of the proposed underground workings on land in general, with a specific focus on cliffs, minor cliffs, rock face features, steep slopes and gorges; | **Section 6.5**<br>**Appendix K** |

| Condition | Requirement | Where Addressed |
|---|---|---|
| (vi) | Heritage Management Plan which has been prepared in consultation with BCD and the Heritage Branch and relevant stakeholders for both Aboriginal and non-Aboriginal heritage, which provides for the management of potential environmental consequences of the proposed second workings on Aboriginal and non-Aboriginal heritage; | **Section 6.6**<br>**Appendix L** |
| (vii) | Public Safety Management Plan which has been prepared in consultation with RR and WaterNSW, which ensures public safety and manages access on the site; | **Section 6.8**<br>**Appendix F** |
| (viii) | Trigger Action Response Plan/s addressing all features in Table 6 and Table 7 (of the Development Consent), which contain:<br>• appropriate triggers to warn of increased risk of exceedance of any performance measure;<br>• specific actions to respond to high risk of exceedance of any performance measure to ensure that the measure is not exceeded;<br>• adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Table 6 and Table 7 (of the Development Consent), or where any such exceedance appears likely; and<br>• an assessment of remediation measures that may be required if exceedances occur and the capacity to implement those measures; | **Section 5.3**<br>**Section 5.4**<br>**Section 6**<br>**Appendix A** |
| (ix) | Contingency Plan that expressly provides for:<br>• adaptive management where monitoring indicates that there has been an exceedance of any performance measures in Table 6 and Table 7 (of the Development Consent), or where exceedance appears likely; and<br>• an assessment of remediation measures that may be required if exceedances occur and the capacity to implement those measures; | **Section 5.6**<br>**Section 6.** |
| (x) | proposes appropriate revisions to the Rehabilitation Management Plan required under condition B45: and | **Section 5** |
| (xi) | includes a program to collect sufficient baseline data for future Extraction Plans. | **Section 4.3**<br>**Section 6.** |
| **Part F** | | |
| **Adaptive Management** | | |
| F4 | The Applicant must assess and manage development-related risks to ensure that there are no exceedances of the criteria and/or performance measures in this consent. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation, notwithstanding offsetting actions taken.<br>Where any exceedance of these criteria and/or performance measures has occurred, the Applicant must, at the earliest opportunity: | **N/A** |
| (a) | take all reasonable and feasible steps to ensure that the exceedance ceases and does not re-occur; | **Section 5.4** |

| Condition | Requirement | Where Addressed |
|---|---|---|
| (b) | consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; | **Section 5.4** |
| (c) | within 14 days of the exceedance occurring, submit a report to the Secretary describing these remediation options and any preferred remediation measures or other course of action; and | **Section 5.4** |
| (d) | implement remediation measures as directed by the Planning Secretary;<br>to the satisfaction of the Secretary. | **Section 5.4** |
| **Management Plan Requirements** | | |
| F5 | Management plans required under this consent must be prepared in accordance with relevant guidelines, and include: | |
| (a) | a summary of relevant background or baseline data; | **Section 4.3**<br>**Sub-plan appendices as applicable** |
| (b) | details of: | |
| (i) | the relevant statutory requirements (including any relevant consent, licence or lease conditions); | **Section 1.4** |
| (ii) | any relevant limits or performance measures and criteria; and | **Section 1.4.2** |
| (iii) | the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures; | **Section 1.4.2**<br>**Appendix A** |
| (c) | any relevant commitments or recommendations identified in the document/s listed in condition A2; | **This Plan** |
| (d) | a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria; | **Section 5**<br>**Section 6** |
| (e) | a program to monitor and report on the: | |
| (i) | impacts and environmental performance of the development; and | **Section 6**<br>**Sub-plan appendices as applicable** |
| (ii) | effectiveness of the management measures set out pursuant to condition F5(c); | **Section 6**<br>**Sub-plan appendices as applicable** |
| (f) | a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible; | **Section 5.6** |
| (g) | a program to investigate and implement ways to improve the environmental performance of the development over time; | **Section 7** |
| (h) | a protocol for managing and reporting any: | |

| Condition | Requirement | Where Addressed |
|---|---|---|
| (i) | incident, non-compliance or exceedance of any impact assessment criterion or performance criterion; | **Section 5.2** |
| (ii) | complaint; or | **Section 7.1** |
| (iii) | failure to comply with other statutory requirements; | **Section 7** |
| (i) | public sources of information and data to assist stakeholders in understanding environmental impacts of the development; and | **Section 7.1** |
| (j) | a protocol for periodic review of the plan. | **Section 7.4** |
| F7 | Within three months of:<br>(a) the submission of an incident report under condition F9;<br>(b) the submission of an Annual Review under condition F11;<br>(c) the submission of an Independent Environmental Audit under condition F13; or<br>(d) the approval of any modification of the conditions of this consent (unless the conditions require otherwise);<br>the suitability of existing strategies, plans and programs required under this consent must be reviewed by the Applicant. | **Section 7.4** |
| F8 | If necessary, to either improve the environmental performance of the development, cater for a modification or comply with a direction, the strategies, plans and programs required under this consent must be revised, to the satisfaction of the Planning Secretary. Where revisions are required, the revised document must be submitted to the Planning Secretary for approval within 6 weeks of the review.<br>Note: This is to ensure strategies, plans and programs are updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the development. | **Section 7.4** |
| **Incident Notification** | | |
| F9 | The Applicant must immediately notify the Department and any other relevant agencies immediately after it becomes aware of an incident. The notification must identify the development (including the development application number and name) and set out the location and nature of the incident. | **Section 7.2** |
| **Non-Compliance Notification** | | |
| F10 | Within seven days of becoming aware of a non-compliance, the Applicant must notify the Department of the non-compliance. The notification must set out the condition of this consent that the development is non-compliant with, why it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.<br>*Note: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.* | **Section 7.2.3** |

| Condition | Requirement | Where Addressed |
|---|---|---|
| **Annual Review** | | |
| F11 and F12 | By the end of March each year after the commencement of the development under this consent, or other timeframe agreed by the Planning Secretary, a report must be submitted to the Department reviewing the environmental performance of the development, to the satisfaction of the Planning Secretary. | **Section 7.2.4** |
| **Independent Environmental Audit** | | |
| F13 | Within one year of commencement of development under this consent, and three years after, unless the Planning Secretary directs otherwise the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development. The Applicant must: | **Section 7.3** |
| (a) | be prepared in accordance with the *Independent Audit Post Approval Requirements* (Department 2020 or as updated); | **Section 7.3** |
| (b) | be led and conducted by a suitably qualified, experienced and independent auditor whose appointment has been endorsed by the Planning Secretary; | **Section 7.3** |
| (c) | be conducted by a suitably qualified, experienced and independent team of experts (including any expert in field/s specified by the Planning Secretary) whose appointment has been endorsed by the Planning Secretary; | **Section 7.3** |
| (d) | be carried out in consultation with the relevant agencies and the CCC; | **Section 7.3** |
| (e) | assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent, water licences and mining leases for the development (including any assessment, strategy, plan or program required under these approvals); | **Section 7.3** |
| (f) | review the adequacy of any approved strategy, plan or program required under the abovementioned approvals and this consent; | **Section 7.3** |
| (g) | recommend appropriate measures or actions to improve the environmental performance of the development, and any assessment, strategy, plan or program required under the abovementioned approvals and this consent; and | **Section 7.3** |
| (h) | be conducted and reported to the satisfaction of the Planning Secretary. | **Section 7.3** |
| F14 | Within three months of commencing an Independent Environmental Audit, or other timeframe agreed by the Planning Secretary, the Applicant must submit a copy of the audit report to the Planning Secretary, and any other NSW agency that requests it, together with its response to any recommendations contained in the audit report, and a timetable for the implementation of recommendations. The recommendations must be implemented to the satisfaction of the Planning Secretary. | **Section 7.3** |

### 1.4.2 Performance Measures

WCL is required to ensure that subsidence impacts do not exceed the subsidence performance measures in the Development Consent. Performance measures are included in the Development Consent for natural and heritage features as well as built features.

Performance measures for natural and heritage features are imposed by Condition C1 of the Development Consent. The relevant performance measures from the Development Consent are outlined in **Table 4**.

**Table 4 Natural and Heritage Features Performance Measures**

| Features | Performance Measure |
|---|---|
| **Watercourses** | |
| Watercourse, including Cataract River, Cataract Creek and associated tributaries | • Negligible subsidence impacts or environmental consequences including:<br>o negligible diversion of flows or changes in the natural drainage behaviour of pools;<br>o negligible gas releases;<br>o negligible increase in water cloudiness;<br>o negligible increase in bank erosion; and<br>o negligible increase in sediment load. |
| **Water Supply** | |
| Cataract Reservoir | • Negligible leakage from reservoir<br>• Negligible reduction in water quality of reservoir<br>• No connective cracking between the reservoir surface and the underground workings |
| **Land** | |
| Cliffs, steep slopes and rock face features | • Negligible environmental consequences (including subsidence induced rockfalls, displacement or dislodgement of boulders or slabs, or fracturing) |
| **Swamps** | |
| Upland swamps identified in the figure in Appendix 5 (of Development Consent) | • Negligible environmental consequences including negligible change to the structural integrity of the bedrock base or any controlling rockbar of the swamp |
| **Biodiversity** | |
| Threatened species, threatened populations, or endangered ecological communities | • Negligible environmental consequences |
| **Heritage Sites** | |
| Aboriginal heritage sites identified in the figure in Appendix 6 (of Development Consent) | • Negligible subsidence impacts and environmental consequences<br>• Negligible loss of heritage value |
| Historic heritage sites identified in the figure in Appendix 7 (of Development Consent) | • Negligible subsidence impacts and environmental consequences<br>• Negligible loss of heritage value |

| Features | Performance Measure |
|---|---|
| Other Aboriginal and historic heritage sites | • Negligible subsidence impacts and environmental consequences<br>• Negligible loss of heritage value |
| **Mine Workings** | |
| First workings and second workings | • To remain long-term stable and non-subsiding |

Notes: The Applicant will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this consent.

Condition C7 of the Development Consent imposes performance measures for built features and public safety, see **Tabl e 5** below.

**Table 5 Built Features Performance Measures**

| Features | Performance Measure |
|---|---|
| **Key Public Infrastructure** | |
| M1 Princes Motorway (formally known as Mount Ousley Road), electricity transmission lines and towers (330kV, 132 kV, 2x33kV) and telecommunications lines | • Always safe and serviceable.<br>• Damage that does not affect safety or serviceability must be fully repairable and must be fully repaired. |
| **Other Infrastructure** | |
| Access roads, fire trails and other public infrastructure and built features | • Always safe.<br>• Serviceability should be maintained wherever practicable.<br>• Loss of serviceability must be fully compensated.<br>• Damage must be fully repairable and must be fully repaired or else replaced or fully compensated. |
| **Public Safety** | |
| Public Safety | • Negligible additional risk. |
| **Vertical Subsidence** | |
| All areas of the site affected by the development | • Vertical subsidence limit of not more than 300 mm |

Notes:

- The applicant will be required to define more detailed performance measures in the Bult Features Management Plans or Public Safety Management Plans (see Condition C10).
- Requirements regarding safety or serviceability do not prevent preventative or mitigatory actions being taken prior to or during mining in order to achieve or maintain these outcomes.
- Requirements under this condition may be met by measures undertaken in accordance with the Coal Mine Subsidence Compensation Act 2017.

**Section 6** includes details regarding performance indicators for these performance measures and the monitoring to be undertaken to assess compliance with these performance measures.

In addition to the contingency plan and adaptive measures required to be identified in the Extraction Plan and associated sub plans, the Development Consent includes specific obligations in relation to offsetting subsidence related impacts in certain circumstance where performance measures are not met. Condition C4 of the Development Consent provides:

***Part C Condition C4 – SUBSIDENCE - Offsets***

*If the Applicant exceeds the performance measures in Table 6 and the Secretary determines that:*

*a) it is not reasonable or feasible to remediate the subsidence impact or environmental consequence; or*

*b) remediation measures implemented by the Applicant have failed to satisfactorily remediate the subsidence impact or environmental consequence;*

*Then the Applicant must provide a suitable offset to compensate for the subsidence impact or environmental consequence, to the satisfaction of the Secretary.*

*Notes:*

- *Any offset required under this condition must be proportionate with the significance of the subsidence impact or environmental consequence.*
- *Any offset required under this condition does not limit other actions by the Department under the penalty powers or enforcement provisions of the EP&A Act.*

"Table 6" as described in Condition C4 above, relates to **Table 4** in this document.

### 1.4.3 EPBC Approval Conditions

The Revised Preferred Project for the UEP was referred under the EPBC Act for approval (2020/8702) on 4 August 2020 and subsequently approved by Department of Agriculture, Water and the Environment (DAWE) on 31 August 2021. EPBC conditions are outlined in **Table 6** below.

**Table 6 EPBC 2020/8702 Approval Conditions**

| Condition | Requirement | Where addressed |
|---|---|---|
| **EPBC Approval 2020/8702** | | |
| **Part A – Conditions specific to the action (Water Resources)**<br>**The objective of conditions 1 to 14 is to minimise the impacts of the action on a water resource.** | | |
| 1. | For the protection of water resources, the approval holder must comply with State development consent conditions B12-B20, C1-C3, and C10-C11. | **Sections 6.2 & 6.4**<br>**Appendix G, H, J** |
| 2. | The approval holder must ensure there is no adverse effect on the function of a water resource as a result of the mining activities of the action. | **Sections 6.2 & 6.4**<br>**Appendix G, H, J** |
| 5. | The approval holder must provide the Department with the final version of the Plans within 10 business days of their approval by the NSW Planning Secretary. | **Section 7.4** |
| 6. | The approval holder must notify the Department, in writing, within two business days of proposing to the NSW Planning Secretary any changes to a version of the Plan/s, explaining what changes are requested and any implications for protected matters if the proposed changes are made. If the NSW Planning Secretary approves a revised version of the Plan/s, the approval holder must provide the Department | **Section 7.4** |

| Condition | Requirement | Where addressed |
|---|---|---|
| | with the approved revised Plan/s within 10 business days of its approval by the NSW Planning Secretary, explaining what changes have been made and any implications for protected matters. | |
| 7. | In addition to the monitoring requirements specified in and/or required under condition B17 and condition C10 of the State development consent, the approval holder must: | **Noted** |
| 7a. | establish, at least 12 months prior to any potential impact at each proposed monitoring site, and then maintain, a network of groundwater monitoring bores across the Development Application Area designed to detect changes in groundwater levels in all potentially impacted aquifers, including shallow aquifers used by Coastal Upland Swamps, and any changes in connectivity between aquifers;<br>Note: This does not apply to bores installed to inform the management of post closure adit discharges as required under the Adit Discharge Water Management Plan required under condition B19 of the State development consent. | **Section 6.2 & 7**<br>**Appendix G, H, J** |
| 7b. | monitor groundwater levels as [*sic*] each monitoring bore (established as required under condition 7.a) at least once every three months, from installation until:<br>(i) 12 months after the cessation of mining for all monitoring bores within Coastal Upland Swamps;<br>(ii) five years after the cessation of mining for other monitoring bores excepting those required to monitor groundwater recovery and potential discharge from adits; and<br>(iii) for the period for which the approval has effect for any other monitoring site required to monitor groundwater recovery and potential discharge from adits. | **Appendix G, H, J** |
| 7c. | within 20 business days of the end of the three-month monitoring period, publish on the website and submit to the Department, all monitoring data collected in accordance with condition 7.b, updated at least once every three months to include the most recent monitoring data. Maintain the data on the website for:<br>(i) at least five years after the cessation of mining for all monitoring bores within Coastal Upland Swamps;<br>(ii) at least five years after the cessation of mining for other monitoring bores excepting those required to monitor groundwater recovery and potential discharge from adits; and<br>(iii) the period for which the approval has effect for any monitoring site required to monitor groundwater recovery and potential discharge form [*sic*] adits.<br>The monitoring data must include hydrographs for all bores and be accompanied by an explanation of what the data means in relation to meeting and maintenance of the performance measures relevant to groundwater specified in the State development consent; | **Appendix J** |
| 7d. | establish, at least 12 months prior to second workings being within 350 m (horizontal distance from the closest boundary) of each Coastal Upland Swamp, and maintain, in all potentially impacted Coastal Upland Swamps, and in multiple reference swamps that demonstrate baseline condition, monitoring capable of determining individual water balances for each potentially impacted Coastal Upland Swamp; | **Appendix J** |

| Condition | Requirement | Where addressed |
|---|---|---|
| 7e. | monitor all components of the network established as required under 7.d, at least once every three months from installation until at least 12 months after the cessation of mining; | **Appendix J** |
| 7f. | within 20 business days of the end of the three-monthly monitoring period, publish on the website and submit to the Department all monitoring data collected in accordance with condition 7.e, updated at least once every three months to include the most recent monitoring data. Maintain the data on the website for at least five years after the monitoring program has been completed. Include an evaluation of what the data means in relation to meeting and maintenance of the performance measures relevant to water resources specified in the State development consent; and | **Appendix J** |
| 7g. | include, in each compliance report, the monitoring data collected in accordance with condition 7.b and 7.e, in relation to the period covered by each compliance report. Include an evaluation of performance against the performance measures relevant to water resources specified in the State development consent. | **Appendix J** |
| 8. | In addition to the requirements specified in and/or required under condition B19 of the State development consent, the approval holder must: | **N/A** |
| 8a. | from the commencement of second workings, ensure that all water discharges to Bellambi Gully do not result in water quality within Bellambi Gully at point 11 (as shown at Attachment D) exceeding the Australian and New Zealand guidelines for fresh and marine water quality (2018), (or any subsequent version) default guideline values for relevant metals and metalloids, as identified at Attachment C unless otherwise agreed in writing by the Minister;<br>Note: the approval holder can request that the Minister agree to site-specific water quality limits for water discharges to Bellambi Gully. Such a request must be submitted to the department accompanied by a peer-reviewed analysis of monitoring data from the monitoring site point 12 located upstream of the mine site as shown in Attachment D. Any other monitoring sites used in this analysis must have comparable catchment characteristics and must not be impacted by discharges or runoff from current or historic coal mines, coal storage/stockpile facilities or industrial activities. The analysis must provide data and evidence to justify the request. | **Appendix G** |
| **Part A – Conditions specific to the action (Listed threatened species and ecological communities)**<br>**The objective of conditions 15 to 18 is to minimise, and if necessary, compensate for, the impacts of the action on Listed threatened species and ecological communities.** | | |
| 15. | In addition to the monitoring requirements specified in and/or required under condition C10 of the State development consent, the approval holder must: | **N/A** |
| 15a. | undertake surveys prior to the commencement of the action, using a method consistent with the requirements of condition C2 of the State development consent, to determine the baseline condition in relation to subsidence at each potentially impacted Coastal Upland Swamp; | **Appendix I** |

| Condition | Requirement | Where addressed |
|---|---|---|
| 15b. | monitor for, and measure any, vertical subsidence using an approach consistent with the requirements of condition C2 of the State development consent, at least weekly at any potentially impacted Coastal Upland Swamp when second workings are within 350 m (horizontal distance from the closest boundary) of the particular Coastal Upland Swamp, starting at least one week prior to the commencement of second workings within 350 m of the particular Coastal Upland Swamp and continuing until at least 12 months after the cessation of mining; | **Appendix I** |
| 15c. | publish on the website and submit to the Department the monitoring data collected in accordance with condition 15.b, updated at least once every three months to include the most recent monitoring data, and accompanied by an evaluation of the risk of the subsidence limit being reached or exceeded. Maintain the data and evaluation on the website for at least 5 years after the cessation of mining; | **Appendix I** |
| 15d. | include, in each compliance report, the monitoring data collected in accordance with condition 15.b, in relation to the period covered by each compliance report. Include an evaluation of the risk of any subsidence limit being reached or exceeded. | **Appendix I**<br>**Section 7.2.5** |
| 16. | If, at any time during the period for which the approval has effect, the approval holder detects that any subsidence limits have been reached or exceeded the approval holder must cease second workings and notify the Department of this within two business days of detecting the exceedance. | **Appendix A**<br>**Sections 5.2 & 7.2** |
| 17. | If the approval holder has been required to cease second workings pursuant to condition 16, the approval holder must not recommence second workings until it can be demonstrated that new or increased impacts will not occur and the Minister approves, in writing, the recommencement of second workings. | **Section 5.2** |
| 18. | If the approval holder exceeds the performance measure required by State development consent condition C1, and the NSW Planning Secretary determines that an offset is required under State development consent condition C4, the approval holder must provide the Department with details of the offset(s) approved by the NSW Planning Secretary within 10 business days of the approval by the NSW Planning Secretary. | **Section 5.2** |
| **Part B – Standard Administrative Conditions** | | |
| 23. | **Submission and publication of plans**<br>The approval holder must: | |
| 23a. | submit any plans required by these conditions electronically to the Department within 10 business days of being approved by the NSW Planning Secretary; | **Section 7.2** |
| 23b. | publish each plan on the website within 20 business days of the date the plan is approved by the NSW Planning Secretary, unless otherwise agreed to in writing by the Minister; | **Section 7.2** |
| 23c. | exclude or redact sensitive ecological data from plans published on the website or provided to a member of the public; and | **Section 7.2** |
| 23d. | keep plans published on the website until the end date of this approval. | **Section 7.2** |

| Condition | Requirement | Where addressed |
|---|---|---|
| 24. | The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under a plan or conditions of this approval, is prepared in accordance with the Department's Guidelines for biological survey and mapped data (2018) and submitted electronically to the Department in accordance with the requirements of the plan or within 10 business days. | **Section 7.2** |
| 25. | **Annual compliance reporting**<br>The approval holder must by the end of each 12-month period following the date of commencement of the action, or as otherwise agreed to in writing by the Minister, prepare a compliance report. The approval holder must: | |
| 25a. | publish each compliance report on the website within 60 business days following the end of the 12-month period for which that compliance report is prepared; | **Section 7.2.5** |
| 25b. | notify the Department by email that each compliance report has been published on the website and provide the weblink for the compliance report within five business days of the date of publication of each compliance report; | **Section 7.2.5** |
| 25c. | keep all compliance reports publicly available on the website until this approval expires; | **Section 7.2.5** |
| 25d. | exclude or redact sensitive ecological data from compliance reports published on the website; and | **Section 7.2.5** |
| 25e. | where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication on the website.<br>Note: This approval decision requires that a compliance report be submitted every year until the end date of this approval because data from monitoring of discharge from adits must be submitted until at least 2067. Compliance reports may be published on the Department's website. | **Section 7.2.5** |
| 26. | **Reporting non-compliance**<br>The approval holder must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify: | |
| 26a. | any condition which has been or may have been in breach; | **Section 7.2.1** |
| 26b. | a short description of the incident and/or non-compliance; and | **Section 7.2.1** |
| 26c. | the location (including co-ordinates), date, and time of the incident and/or non-compliance. In the event the exact information cannot be provided, provide the best information available. | **Section 7.2.1** |
| 27. | The approval holder must provide to the Department the details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying: | |

| Condition | Requirement | Where addressed |
|---|---|---|
| 27a. | any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future; | **Section 7.2.1** |
| 27b. | the potential impacts of the incident or non-compliance; and | **Section 7.2.1** |
| 27c. | the method and timing of any remedial action that will be undertaken by the approval holder. | **Section 7.2.1** |
| 28. | **Independent audit**<br>The approval holder must ensure that an independent audit of compliance with the conditions is conducted for the three-year period from the date of this approval and subsequently for every three-year period for the life of the approval, or as otherwise requested in writing by the Minister. | **Section 7.3** |
| 29. | For each independent audit, the approval holder must: | **Section 7.3** |
| 29a. | provide the name and qualifications of the independent auditor and the draft audit criteria to the Department; | **Section 7.3** |
| 29b. | only commence the independent audit once the audit criteria have been approved in writing by the Department; and | **Section 7.3** |
| 29c. | submit an audit report to the Department within the timeframe specified in the approved audit criteria. | **Section 7.3** |
| 30. | The approval holder must publish the audit report on the website within 10 business days of receiving the Department's approval of the audit report and keep the audit report published on the website until the end date of this approval. | **Section 7.3** |

### 1.4.4 Mining Lease Conditions

Mining of pillars PC21, PC07, PC08 and PC22 to PC25 (Stage 1) and PC27 to PC34 (Stage 2) under the Development Consent will occur within Consolidated Coal Lease (CCL) 745. EP conditions were included as an amendment to CCL 745 and Mining Lease 1575 (ML1575) in 2014 and are reproduced in **Table 7**.

**Table 7 Mining Lease Conditions**

| Condition | Requirement | Where Addressed |
|---|---|---|
| 4 (CCL 745)<br>8 (ML1575) | Extraction Plan Condition | **This plan** |
| a) | In this condition:<br>• approved Extraction Plan means a plan, being:<br>  ○ An extraction plan or subsidence management plan approved in accordance with the conditions of a relevant development consent and provided to the Secretary; or<br>  ○ A subsidence management plan relating to the mining operations subject to this lease:<br>  ▪ submitted to the Secretary on or before December 31 2014; and<br>  ▪ approved by the Secretary.<br>• relevant development consent means a development consent or project approval issued under the Environmental *Planning and Assessment Act 1979* relating to the mining operations subject to this lease. | **This Plan** |
| b) | The lease holder must not undertake any underground mining operations that may cause subsidence except in accordance with an approved Extraction Plan. | **Noted** |
| c) | The lease holder must ensure that the approved Extraction Plan provides for the effective management of risks associated with any subsidence resulting from mining operations carried out under this lease. | **Noted** |
| d) | The lease holder must notify the Secretary within 48 hours of any:<br>• incident caused by subsidence which has the potential to expose any person to health and safety risks;<br>• significant deviation from the predicted nature, magnitude, distribution, timing and duration of subsidence effects, and of the potential impacts and consequences of those deviations on built features and the health and safety of any person; or<br>• significant failure or malfunction of a monitoring device or risk control measure set out in the approved Extraction Plan addressing;<br>  ○ built features;<br>  ○ public safety; or<br>  ○ subsidence monitoring. | **Noted** |

# 2 PROJECT DESCRIPTION

## 2.1 Surface Infrastructure - Project Overview

The project includes a mine plan that has been designed to have negligible subsidence to address potential subsidence-related mining impacts on groundwater, surface water and biodiversity within the Cataract Reservoir catchment.

The project also involves changes to the Russell Vale Pit Top (the Pit Top), which includes key project components (i.e., surface infrastructure) requiring construction. The current and proposed surface infrastructure are presented in **Figure 2**, **Figure 3** and **Figure 4** respectively.

It is noted that the surface infrastructure changes in **Sections 2.1** to **2.3** are managed by a range of separate environmental management plans developed in accordance with the requirements of the Development Consent (refer to **Figure 10** and **Section 5.1** which details Surface Operations Managements Plans which are utilised to manage surface operations). The mining which is to be undertaken in accordance with this EP is detailed in **Sections 2.6** and **2.7**.

The key elements of the project are:

- mining by bord and pillar mining techniques only, with the workings designed to be long-term stable and non-subsiding with minimal subsidence impacts
- extraction of approximately 3.7 million tonnes of Run-of-Mine (ROM) coal at a production rate of up to 1 million tonnes of product coal per year (equivalent to approximately 1.2 million tonnes of ROM coal per year)
- redesign of the Pit Top layout to relocate infrastructure to more shielded locations to reduce amenity impacts
- operation of surface facilities and product transport, typically limited to daytime hours (7.00am to 6.00pm Mondays to Friday, 8.00am to 6.00pm Saturday, no Sundays and Public Holidays), with provision for occasional operation until 10.00pm Monday to Friday to cater for unexpected port closures or interruptions
- reduced product trucking rates with a maximum of 17 trucks permitted per hour
- extension to the height of existing bunds, construction of new bunds and noise walls within the existing surface infrastructure area for improved noise mitigation and
- construction of a new truck loading facility and associated conveyors.

## 2.2 Surface Infrastructure - Project Staging

The project will be implemented in stages as per below with the scope of surface infrastructure works including:

**Stage 1 (Monitoring and Construction)**

Installation of environmental monitoring controls and mitigation measures, truck access roads, construction of new noise walls, noise bunds and new primary sizer.

Commencement of mining operations ramping up to approximately 0.5 Mtpa with crushed coal transferred to ROM stockpile and coal loading via front-end loader to trucks to be transported to Port Kembla Coal Terminal (PKCT).

Evaluation of the feasibility of a coal processing plant (CPP) to be installed as part of the new Stage 2 (Mining and Production) surface infrastructure. WCL have since ascertained that this CPP is no longer necessary.

Key elements in Stage 1 (Monitoring and Construction) include (see **Figure 3**):

- Development and mining by bord and pillar mining
- Up to 500,000 tonnes of product coal per year
- Installation of new inline sizer
- Front end loading ROM coal onto trucks
- ROM Stockpile 30,000 tonnes
- Construction of surface infrastructure works, including construction of new noise walls, noise bunds, truck access roads, and commissioning the design and construction of the truck loading bin and associated conveyers.

**Stage 2 (Mining and Production)**

Finalise the construction and commissioning of new surface infrastructure, comprising truck loading bins and associated conveyors. The coal will be transferred from the ROM stockpile through a series of conveyors to the truck loading bin to be loaded onto the trucks for transportation to PKCT or transferred to a new stockpile area for temporary stockpiling before being loaded onto trucks by front-end loader for transportation to PKCT (**Figure 4**).

Commencement of full mining operations ramping up to 1.2 Mtpa to align when the new coal handling facilities and associated infrastructure is fully operational.

### 2.2.1 Coal Handling and Processing

The proposed coal handling facilities and surface infrastructure upgrades proposed as part of the Revised Preferred Project will be undertaken in accordance with the Development Consent to improve the quality of ROM coal in order to meet market demands and to minimise impacts on the environment and local community.

Works associated with the planned upgrade are all located within the existing disturbance footprint of the study area. The planned upgrades to the existing surface infrastructure within the UEP Project Application area (**Figure 2**) are shown on **Figure 3** and **Figure 4**.

### 2.2.2 Reject Material Handling

Following commissioning of a suitable CPP, it is anticipated that approximately 0.2 Mtpa of reject material will be produced at full production. Reject material consisting of rock material from the CPP will be transferred via the rejects conveyor to the reject stockpile.

Beneficial reuse would be dependent on further application and or approval, whilst underground emplacement would only be undertaken if testing determines the material to be suitable, refer to the RVC Waste Management Plan.

### 2.2.3 Coal Stockpiling

Two main coal stockpiles will operate within the Pit Top operational area, these being the main ROM stockpile (30,000 tonne (t) capacity) and product stockpile (14,000 t capacity).

## 2.3 Bellambi Gully Creek

The Revised Preferred Project Report (RPPR) describes proposed Bellambi Gully Creek realignment works as being a part of a modification to the previous project consent MP10_0046, i.e., MOD 4. The Modification was subsequently withdrawn, and the project was included in the UEP major project application. Subsequent to the issue of the RPPR in July 2019, and the UEP Additional Information Response Report in June 2020, on 23 July 2020 WCL was issued with an enforcement order by DPIE in relation to the replacement of the underground section of Bellambi Gully pipe. Generally, the order requires WCL to engage a suitably qualified independent licensed engineer to develop detailed plans for the replacement of the underground pipe section of Bellambi Gully Creek with a suitably designed and engineered open channel, generally in accordance with the design parameters outlined in *Cardno 2020 Phase 1 and 2 Bellambi Gully Flood Assessment Proposed Stormwater Diversion Drain*.

The detailed design for the Bellambi Gully Diversion and associated site water management system improvements was completed in late 2020 with works commencing onsite following DPIE's approval of the Construction Management Plan (CMP) in April 2021. The construction works associated with the diversion channel and associated site water management system improvements are detailed in the Bellambi Gully Creek Diversion CMP. The operation of this channel will be detailed in an updated RV Surface Operations Water Management Plan.

## 2.4 Rehabilitation

Decommissioning and closure of the Russell Vale Colliery Pit Top facilities are not proposed following the completion of the UEP project. If there are delays to expected future planning assessment processes such that mining operations are required to cease, the site would be maintained in care and maintenance capacity until such time as a planning consent for further mining operations is obtained. For the term of this EP, the existing rehabilitation and mine closure strategy will be outlined in the Russell Vale Colliery Mining Operations Plan (MOP) and Rehabilitation Management Plan (RMP), refer to **Section 7.5.**

Surface impacts are not expected to occur as a result of the proposed first workings and bord and pillar panel mining due to the low levels of predicted subsidence. In the unlikely event that impacts on the surface arise from the underground workings, the Trigger Action Response Plans (TARPs) in **Appendix A** will be implemented.

## 2.5 Environmental Duty of Care

WCL will implement all reasonable and feasible measures to prevent and, if prevention is not reasonable and feasible, minimise any material harm to the environment that may result from the construction and operation of the Project, and any rehabilitation required under the Development Consent.

Legend

- UEP Project Application Area
- Coal Truck Route

FIGURE 2

**Existing Russell Vale Colliery Pit Top**

Image Source: Nearmap (Sep 2021) Data source: Wollongong Coal (2016)

Legend

- UEP Project Application Area
- Water Basins
- Bund to be Raised
- Existing Bund
- Coal Stockpiles
- Bellambi Gully Diversion Alignment

FIGURE 3

Proposed Stage 1 without Surface Infrastructure

Image Source: Nearmap (Dec) 2021) Data source: Wollongong Coal (2021)

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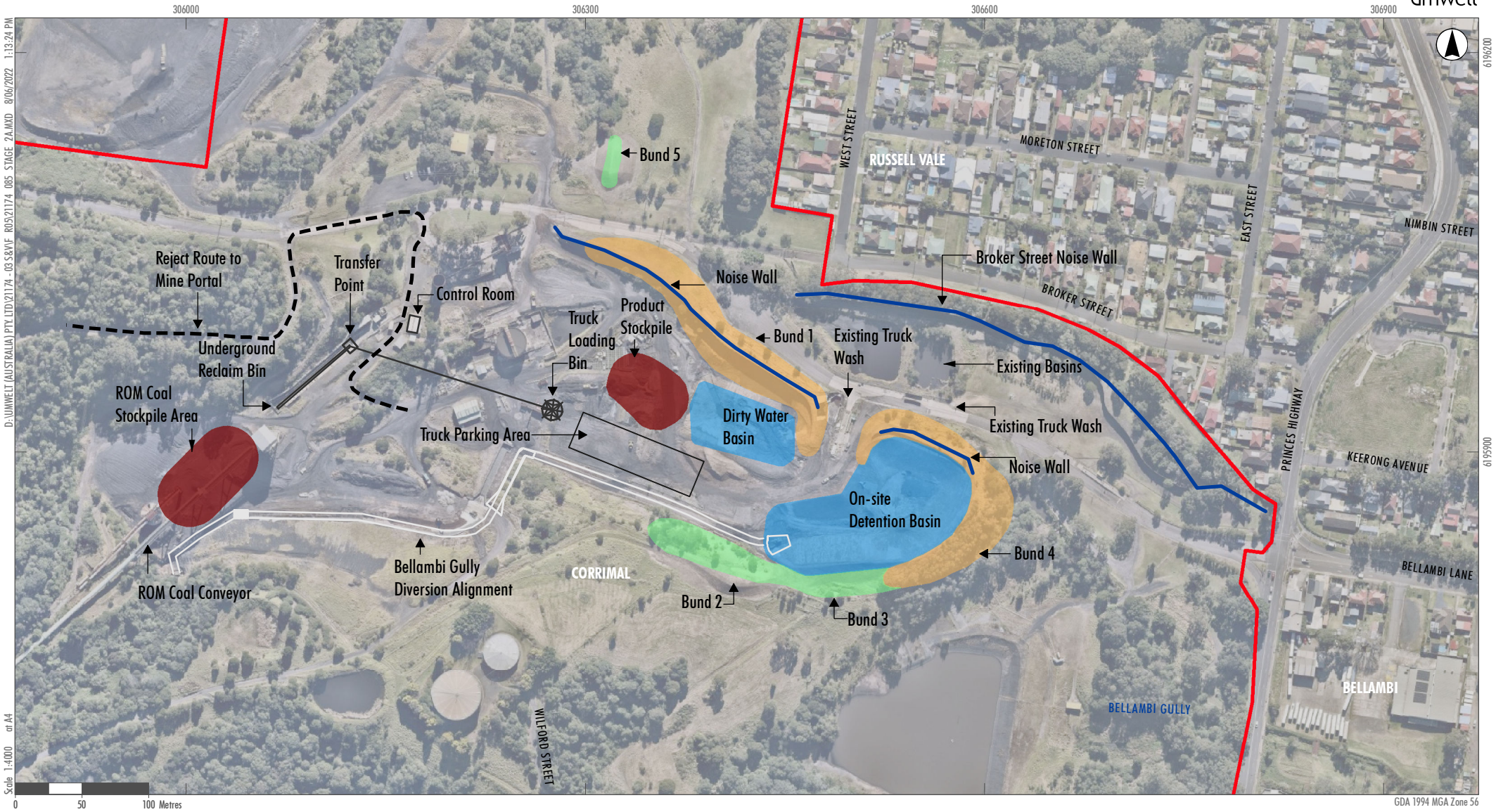



Legend

- UEP Project Application Area
- Bund to be Raised
- Existing Bund
- Coal Stockpiles
- Water Basins
- Bellambi Gully Diversion Alignment

FIGURE 4

Proposed Stage 2A Surface Infrastructure Components without Coal Processing Plant

Image Source: Nearmap (Sep 2021) Data source: Wollongong Coal (2021)

## 2.6 Extraction Plan – Project Overview

In accordance with the Development Consent, WCL have approval to extract up to 3.7 million tonnes of ROM coal at a production rate of up to 1 million tonnes of product coal per year (equivalent to approximately 1.2 million tonnes of ROM coal per year).

This EP has been developed to satisfy Condition C10 of the Development Consent. Specifically, as outlined in **Section 2.7,** the intent of this EP is to act as an overarching management document for Stage 1 (sub-panels PC21 to PC25 and PC07 to PC08) and Stage 2 (sub-panels PC27 to PC34) bord and pillar mining which meet the definition of "second workings" in the Development Consent. Second workings will generally occur in a staged approach (which may be undertaken concurrently) as per the following:

- Stage 1 including panels PC21 to PC25 and panels PC07 and PC08.
- Stage 2 including panels PC27 to PC34.

**Figure 5** shows the locations of the Stage 1 and Stage 2 second workings. **Figure 6** shows the Stage 1 and Stage 2 mining EP areas.

A separate EP (approved under the Project Approval originally authorising the mining of LW6) applies to the removal of the longwall miner from LW6. Additional EP's will be developed to cover later stages of the second workings approved under the Development Consent.

This EP is accompanied by the technical information provided within the key component plans and programs forming part of this EP, as required by Condition C10 of the Development Consent. The key component plans and programs that accompany this EP have been prepared to manage impacts associated with the Stage 1 and Stage 2 second workings on:

- built features
- landscape features
- public safety
- water (incorporating groundwater and surface water)
- biodiversity values (including coastal upland swamps) and
- Aboriginal and historic heritage values.

In addition to these key component plans and programs, TARPs and a contingency plan have been prepared to address the performance criteria included in Conditions C1 and C7 of the Development Consent.

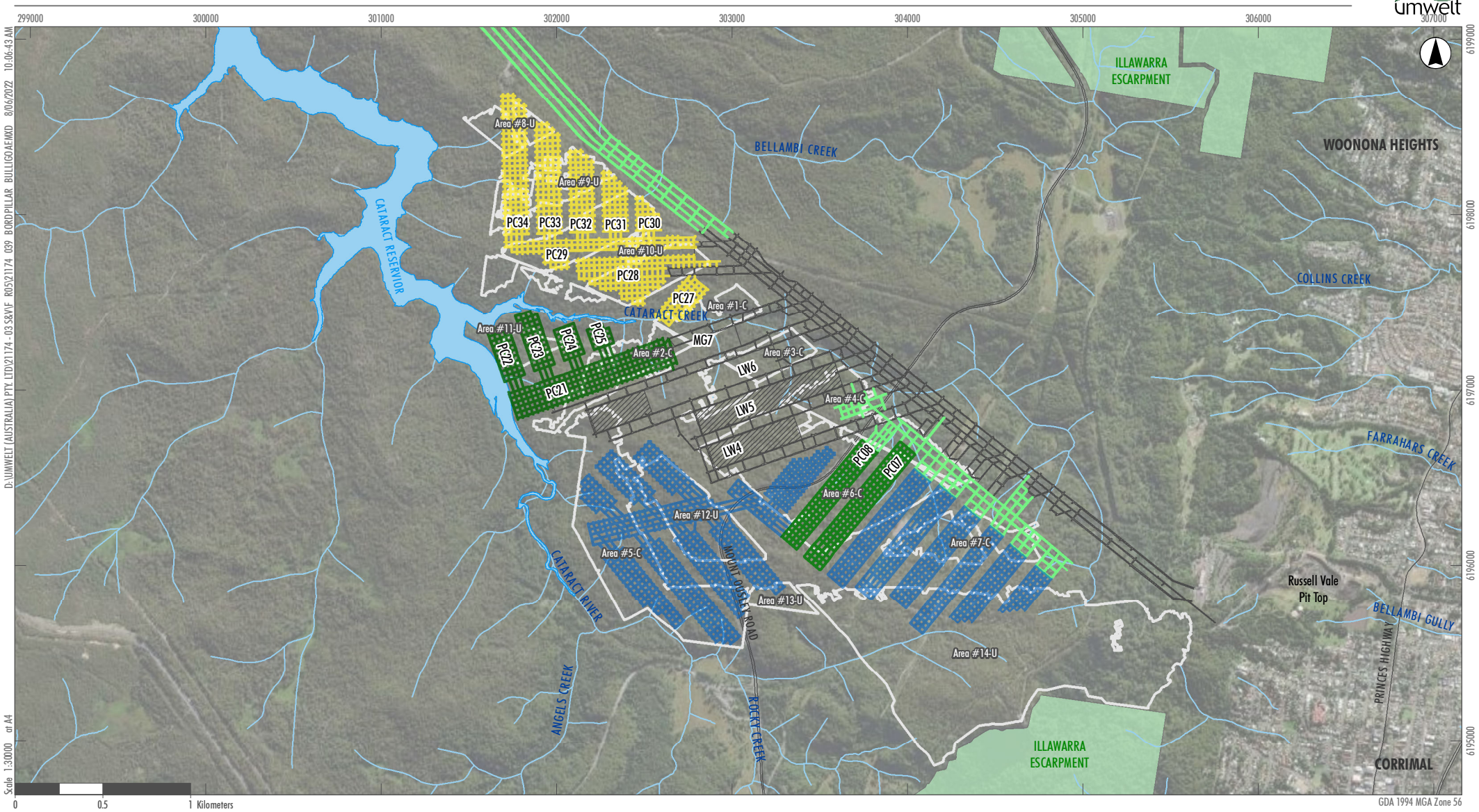
This EP (and associated subplans) include details of monitoring to be undertaken to monitor any potential impacts associated with extraction of the Stage 1 and Stage 2 second workings. This EP also includes consideration of baseline monitoring relevant to the features managed under this EP and future stages of second workings.

This EP is informed by an updated assessment of the predicted subsidence impacts from the Stage 1 and Stage 2 second workings prepared by SCT, 2021 and SCT, 2022 respectively (refer to **Section 3** and **Appendix D**).

Different to many conventional secondary extraction management plans covering other underground mining techniques, only negligible subsidence impacts are predicted from the bord, and pillar mining covered by this EP. The management of subsidence is undertaken through mine design (including the location of workings) and the use of long-term stable pillars. No secondary extraction (longwall mining), within the common usage of the phrase, is proposed and there is no goaf formation associated with the proposed mining covered by this EP. Accordingly, the magnitude of predicted subsidence impacts, and their location are well understood and there is a high degree of confidence in impact predictions. The mine design and subsidence impact predictions are discussed further in **Section 3**.

As a result of there being only negligible subsidence impacts predicted, this EP is focussed primarily on the monitoring of subsidence and groundwater to confirm the low impact predictions and potential impacts to environmental aspects affected by higher than predicted subsidence and groundwater impacts. This enables the detection of any unexpected changes in the environment that may be due to the Stage 1 and Stage 2 second workings.

Given the absence of any credible impact causal pathways from the negligible level of subsidence predicted, contingency measures and adaptive management measures identified in the EP are limited to observed surface or underground conditions which indicate higher than predicted levels of subsidence have occurred or have the potential to occur. Identification of specific contingency measures related to potential impacts (other than notification requirements) are not proposed as it is not reasonable nor feasible to identify specific responses to possible impacts that are not reasonably foreseeable in terms of either likelihood of occurrence or location of occurrence. As a result, the EP is focussed on the development of strategies to prompt investigations into the causes of any observed changes in the environment, and the identification of potential investigation and adaptive management tools that may be available in the event that monitoring indicates changes outside of that predicted.



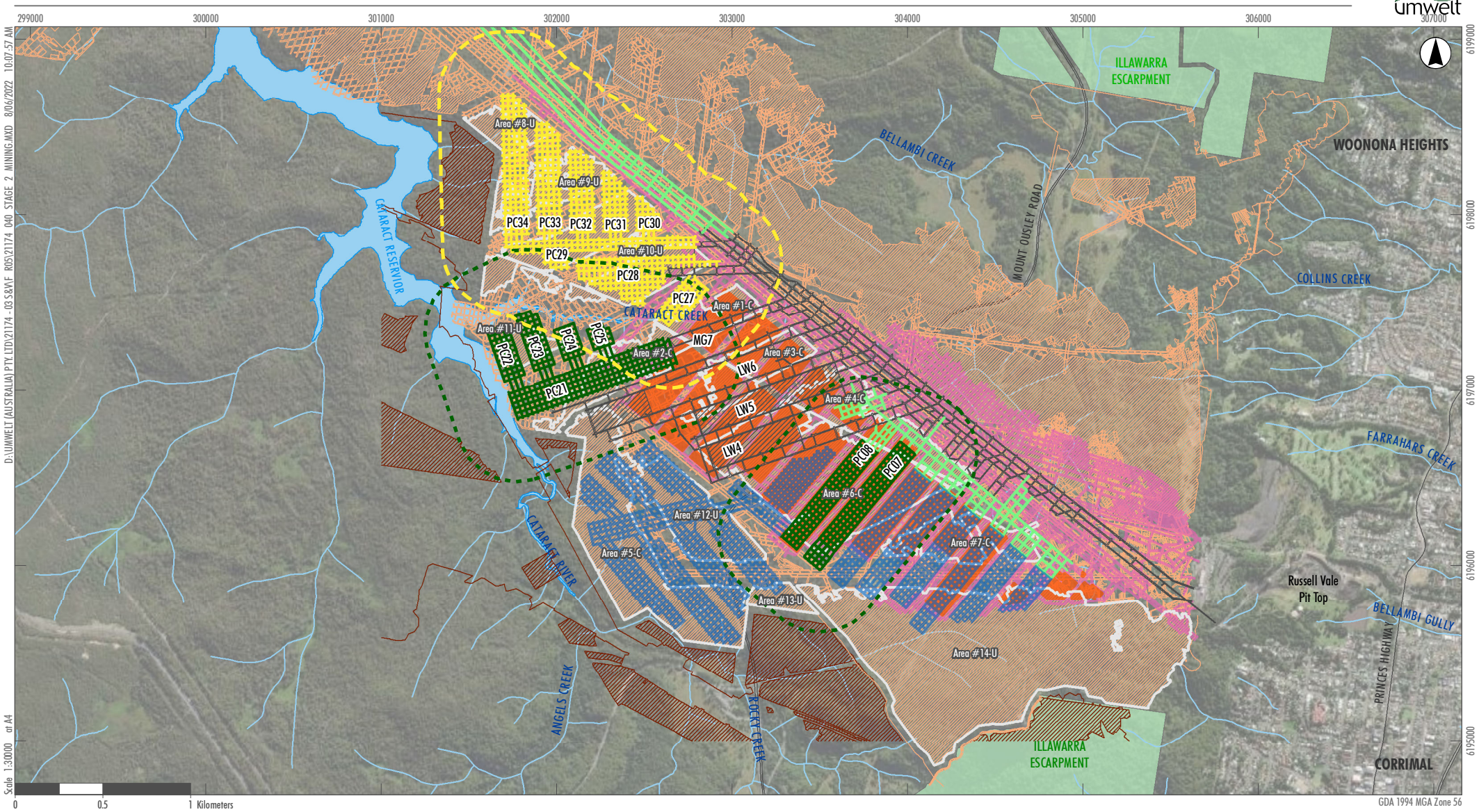

Legend

- Stage 2 Panels
- Stage 1 Panels
- Future Wongawilli Seam Workings (not subject to this EP)
- Existing Wongawilli Seam Workings
- Wongawilli Seam First Workings (Approved under MP09_0013)
- Bulli Seam Goaf Areas -
  - C - Confirmed as collapsed/subsided
  - U - Unconfirmed as collapsed/subsided
- State Conservation Area
- Road

FIGURE 5

Extraction Plan Mining Area: Proposed Bord and Pillar Panels and Existing Bulli Goaf

Image Source: ESRI (2021) Data source: DFSI (2020)




Legend

- Stage 2 Area PC27-34
- Stage 1 Areas PC07-08 and PC21-25
- Stage 2 Panels
- Stage 1 Panels
- Future Wongawilli Seam Workings (not subject to this EP)
- Existing Wongawilli Seam Workings
- Wongawilli Seam First Workings (Approved under MP09_0013)
- Historical Balgownie Seam Workings
- Balgownie Seam Longwall Goaf Areas
- Historical Corrimal Colliery Outline and Goaf
- Historical Bulli Seam Workings
- Bulli Seam Goaf Areas -
  - C - Confirmed as collapsed/subsided
  - U - Unconfirmed as collapsed/subsided
- State Conservation Area
- Road

FIGURE 6

**Stage 1 and Stage 2 Mining Areas and Historical Workings**

Image Source: ESRI (2021) Data source: DFSI (2020)

## 2.7 Extraction Plan – Project Staging

Mining within the UEP will be completed in a staged approach. Consistent with Condition C10 of the Development Consent, this EP covers Stage 1 and Stage 2, which includes the approved 'second workings' for the following:

- **Stage 1**covers:
  - Stage 1(a) - PC21 and 4 sub-panels (PC22, PC23, PC24 and PC25) to the west of Mount Ousley Road adjacent to the Cataract Storage Reservoir. These panels to the west of Mount Ousley Road do not undermine any built features (refer to **Appendix E**)
  - Stage 1 (b) **-** two panels (PC07 and PC08) to the east of Mount Ousley Road
- **Stage 2** covers panels PC27 to PC34 inclusive to the west of Mount Ousley Road adjacent to the Cataract Storage Reservoir. These panels to the west of Mount Ousley Road do not undermine any built features (refer to **Appendix E**).

The indicative location of proposed bord and pillar panels that will be the subject of future EPs is also shown in **Figure 5.** The EP Area shown on **Figure 6** represents the conservative subsidence assessment areas identified by SCT (2021 and 2022) in the updated subsidence assessments for the Stage 1 and Stage 2 workings (refer to **Section 3** and **Appendix D**). Historical mining areas are also shown in **Figure 6**.

**Section 2.8** includes further details regarding the staging of mining and proposed mining methods. **Table 8** contains the indicative timing of project stages.

**Table 8 Extraction Plan Staging and Relevance to this Plan**

| Stage | Description | Extraction Plan Relevance |
|---|---|---|
| Stage 1(a) | Mining of panels:<br>PC21<br>PC22 to PC25 | Entirely covered by this EP and its associated management plans. |
| Stage 1 (b) | Mining of panels:<br>PC07, PC08 | Entirely covered by this EP and its associated management plans. The secondary workings will be commenced in PC07 and PC08 following data acquisition obtained from PC21 monitoring. |
| Stage 2 | Mining of panels:<br>PC27 to PC34 | Entirely covered by this EP and its associated management plans. |
| Future Stages | Further mining within the approved UEP area. Panel configuration with schedule to be included within subsequent extraction plans. | Pre-mining monitoring referenced within this EP and its associated key component management plans. |

## 2.8 Mine Planning and Design

The Wongawilli Seam ranges in thickness from about 8 m to 12 m. The mine plan will target the bottom 2.4 m of the seam containing the best quality coal.

WCL has developed mains headings to service mining panels PC21and associated sub-panels PC22 – PC25 followed by the development of first workings servicing PC01 - PC08. The mains headings for PC21 extend off the existing main gate 7 (MG7) workings. The mains headings servicing PC01-PC08 would be located parallel to the existing mains headings. These mains headings (**Figure 6**) are first workings as defined in the Development Consent and are not covered by this EP. Condition C9 of the Development Consent states that WCL may carry out first workings within the underground mining area, other than in accordance with an approved Extraction Plan, provided that the NSW RR is satisfied that the first workings are designed to remain stable and non-subsiding, except insofar as they may be impacted by approved second workings.

Second workings commenced with the mining of PC21. The primary purpose of mining PC21 initially was to demonstrate the proposed approach to bord, and pillar mining overlaid by previous workings. As discussed in the Built Features Management Plan (refer to **Appendix E**), the management of potential impacts to road and electricity infrastructure was informed by a risk assessment undertaken by a technical committee comprising relevant specialists and stakeholders. Finalisation of monitoring and management measures for these built features will be further informed by monitoring results from PC21 prior to mining in PC07 and PC08.

**Figure 5** shows the proposed layout of bord and pillar panels, including Stage 1 and Stage 2 mining. **Figure 6** also shows the historical underground mining workings within the vicinity of the EP Area.

**Table 9** below summarises the mining parameters relevant to this EP.

**Table 9 Mining Parameters in the EP Area**

| Parameter | Russell Vale EP Area |
|---|---|
| UEP Life | Approximately 5 Years. |
| Relevant Mining Lease | CCL 745. |
| Mining Method | Non-caving bord and pillar mining second workings within the Wonga East area. |
| Target Seam | Wongawilli Seam. |
| Seam Thickness | The Wongawilli Seam is located approximately 20m below the Balgownie Seam and ranges in thickness from about 8m to 12m across the UEP Area. |
| Mining Height | 2.4 m for all second workings. The planned working sections of the Wongawilli Seam are at the base of the seam. |
| Depth of Cover (Wongawilli Seam) | PC07-PC08: approximately 250 m to 350 m.<br>PC21-25: approximately 280 m to 340 m.<br>PC27-34: approximately 280 m to 390 m. |
| Mining Schedule | Mining of panels will generally occur from the West to the East with panels capable of being extracted simultaneously. |
| Panel Dimensions | Each mining panel typically has five headings of 5.5 m wide roadways.<br>Each panel is separated from adjacent panels by solid coal barriers. |

| Parameter | Russell Vale EP Area |
|---|---|
| Pillar Dimensions | PC07-08: 22.5 x 24.5 (Pillars in southern extent of PC07 increased to 24.5 x 24.5 m where not located below Balgownie Seam longwall goaf).<br>PC21-25: 24.5m x 24.5 m.<br>PC27-34: minimum 24.5 x 24.5 m. |
| Total Reserves to be Recovered | Approximately 3.7 Mt of ROM coal (for the UEP).<br>Stage 1 total: 732,200 tonnes<br>(PC07 – 08 and PC21-25)<br>Stage 2:<br>PC27-34: TBD |
| Annual ROM Coal Extraction | Up to 1.2 Mt ROM coal per year. |
| Annual Product Coal | Up to 1 Mt of product coal per year. |
| Roof and Floor Conditions | See **Section 2.8.2** below. |
| Hours of Operation | As per Conditions A15 and A16 of the Development Consent. |
| Ongoing Activities within Mining Tenements | Exploration activities, environmental monitoring and maintenance of access to the existing underground workings and surface infrastructure within exploration and mining tenements in the Wonga West domain.<br>Ongoing maintenance and refurbishment of ventilation shafts, water and electrical facilities. |
| Rehabilitation | Rehabilitation is covered by Rehabilitation Management Plan (Mining Operations Plan, refer to **Section 7.5**). |

A key feature of the project design is the use of non-caving, long term stable bord and pillar mining methods to manage potential subsidence and related groundwater and surface impacts. The use of this mining methods limits strata deformation and associated subsidence effects such that no more than negligible impacts due to subsidence are expected. In most cases, the impacts associated with subsidence are expected to be imperceptible (SCT 2021, SCT 2022).

The mine design dimensions as outlined in Table 9 have a high factor of safety, equivalent to a risk of failure of less than 1 in 1,000,000 (SCT 2021, SCT 2022).

The sections below provide a summary of the geological conditions relevant to mine design considerations and a summary of the updated assessment of subsidence impacts associated with the mining of PC07-08 and PC21-25 (Stage 1) and PC27-34 (Stage 2), with further detail provided in the updated subsidence assessment (see **Appendix D**).

### 2.8.1 Geology and Stratigraphy

RVC is located in the southern extent of the Permo-Triassic Sydney Basin. The strata dips at between 1 in 25 and 1 in 30 to the west-north-west from its outcrop on the Illawarra Escarpment.

Triassic age Hawkesbury Sandstone is present on the surface over most of the EP Area. The Bald Hill Claystone that underlies the Hawkesbury Sandstone outcrops in Cataract Creek and its tributaries. The Bulgo Sandstone that underlies the Bald Hill Claystone outcrops along the main channel of Cataract Creek on both sides of Mount Ousley Road (SCT, 2019).

### 2.8.2 Mine Roof and Floor Conditions

In accordance with Development Consent Condition C10(d), a description of the mine roof and floor conditions within the planned Wongawilli Seam pillars has been provided within the Subsidence Assessments (SCT 2021; SCT2022) and is summarised below.

The assessment recognises that pillar width to height ratio and pillar strength are sensitive to mining height (SCT, 2021; SCT, 2022). Mining height for the entire EP Area is planned to be 2.4 m and maximum roadway width 5.5m. Mining will be undertaken in the lower 2-3m of the seam.

Despite Wongawilli Seam workings being categorised as having a weak coal/shale roof in a thick seam environment, monitoring of pillar behaviour reported in AMIRA (1995) indicates that Wongawilli Seam pillars display similar strength and deformation characteristics to the Bulli Seam pillars in strong roof and floor conditions. Strong roof and floor conditions typical of the Wongawilli Seam are therefore expected throughout the EP Area.

### 2.8.3 Status of Overlying Workings

#### 2.8.3.1 Historical Workings

The historical Bulli Seam workings of South Bulli and Corrimal Collieries are separated by a 40 m wide barrier of coal along the boundary of the mining leases. Coal has previously been mined in three seams within the EP Areas, the Bulli Seam, the Balgownie Seam and the Wongawilli Seam. The historical RVC workings are shown on **Figure 6.**

The Bulli Seam was mined extensively at Russell Vale (East) from the late 1800's until circa 1950. This seam is also referred to in historical records as the "Top", "Upper" or "No1" Seam. The Bulli Seam thickness and mining height is approximately 2.2 m. The early mining layouts of the Bulli Seam were irregular compared to later mining methods. The layouts include the full evolution of hand-working bord and pillar methods from the early 'Welsh bords' technique that resulted in very wide roadways and very narrow pillars in "worked out" areas through to complete pillar extraction by hand. Hand-working techniques were superseded with the introduction of mechanised mining from the 1950s. There are areas of completed pillar extraction and areas of standing coal pillars remaining as first workings. Some of these areas are under and around the current Full Storage Level (FSL) of the Cataract Reservoir. Reliable (accurate and complete) mine plan records (mine working plans and the record tracing copy) are available for areas of interest to this EP recognising that more detail is shown after 1931 when legislated standards required plans to be certified as accurate by a surveyor.

The Balgownie Seam is approximately 10m below the Bulli Seam. The seam thickness is 1.2 - 1.3 m but anecdotal and survey plan evidence indicates the actual mining height in later panels and on the longwall, faces was increased to 1.5 m by including some floor material. Most of the Balgownie Seam workings in RVE were mined with continuous miners and longwall methods from 1968 to 1982. Eleven longwall panels of various lengths and widths were extracted from 1970 to 1982.

The floor of the Wongawilli Seam is approximately 25 m below the Balgownie Seam. The seam is approximately 10 m thick but only the bottom 2-3 m is economic due to coal quality. Three short longwall panels (LW4, LW5 and LW6) were extracted between 2012 and 2015.

#### 2.8.3.2 Potential interactions between approved and historical workings

The potential for the mining of the proposed bord and pillar workings to destabilise or interact with overlying workings was identified and considered during the development application assessment process. The primary concern was that the destabilisation of pillars in the overlying workings may result in higher levels of subsidence than would be expected from the proposed bord and pillars workings alone.

The two key areas relate to:

- areas of Bulli Seam workings shown as being fully extracted (Bulli Seam goaf areas) which may contain remnant standing pillars within the areas shown as being fully extracted in record tracings; and
- areas of Bulli seam workings which contain pillars which may not be long term stable to the dimensions of the pillars.

The updated subsidence Assessments prepared by SCT (**Appendix D**) include comprehensive reviews of the record tracings and other historical information related to mining at RVC as well as historical subsidence monitoring data from the mining of the Balgownie and Wongawilli longwall panels.

The analysis includes consideration of the potential proposed mining of the panels PC07 and PC08 to cause a "pillar run" or otherwise destabilise pillars in the overlying Balgownie and Bulli seam workings and impact on built features such as transmissions lines and the Princes Motorway or other sensitive natural features such as coastal upland swamps. The analyses also considered the likely status of goaf areas overlying PC21-PC25 and PC27-34. These Bulli Seam goaf areas and potentially unstable remnant pillars in the Bulli Seam workings are discussed further in **Appendix D**.

Most of the planned bord and pillar panels in the PC07-08 area are below known Bulli Seam goaf areas and historical Balgownie Seam longwall panels. Detailed mine working plans and record tracings are available for the two Bulli Seam goaf areas referred to as "Area#4" and "Area#6" in SCT 2020a and SCT 2021 (**Appendix D**). Subsidence profiles from longwall mining in the Balgownie Seam, inspections of the Balgownie Seam goaf edge, at the Bulli Seam horizon, and historical experience from mining the Wongawilli Seam below these areas confirm that Bulli Seam pillars above Balgownie Seam longwall goafs are collapsed as would be expected with full extraction less than 10m below the Bulli Seam horizon.

The planned PC21 and PC22-25 bord and pillar panels are located below two areas of Bulli Seam goaf and some first workings. The edges of some of the goaf area above PC21 (identified as "Area #2" in SCT 2020a and SCT 2021 (**Appendix D**) have already been confirmed as collapsed from the Balgownie Seam subsidence profiles and from experience of difficult mining conditions in the Wongawilli Seam below the edge of this goaf area. A second area of Bulli Seam goaf above the planned PC22-25 bord and pillar sub-panels (identified as "Area #11" in SCT 2020a and SCT 2021 (**Appendix D**) is unable to be confirmed as collapsed and subsided as access to this area is no longer possible and there has not been any Balgownie or Wongawilli Seam mining at this location from which the status can be confirmed or inferred. Further consideration of this area is included within SCT 2021 (**Appendix D**).

The majority of planned mining in the Stage 2 panels PC27-34 is below Bulli Seam workings only. The boundary of the planned mining in PC27-34 is below the worked-out area on the south side of the main headings in the Bulli Seam. Although expected to be collapsed, the goaf areas are

unconfirmed as collapsed and subsided, as outlined on **Figure 5.** The potential for additional subsidence from the Bulli Seam cannot be eliminated, but that potential exists irrespective of any planned mining, and planned mining is not expected to cause a significant change at the Bulli seam mining horizon. Vertical subsidence of greater than 500 mm is considered possible but unlikely, and if it were to occur, it would be expected in small, isolated areas within and near the edges of the Bulli Seam goaf areas where any "marginally stable" remnant pillars not already collapsed become unstable. A full treatment of potential Bulli Seam interactions with mining in PC27-34 is presented in SCT 2022 (Appendix D).

In Area #2, secondary workings that form this goaf area were undertaken between 1943 and 1949 according to the original mine working plan and record tracing copy. There are some small pillars shown as not mined. These remnant pillars are considered by SCT (Appendix D) to be unlikely to still be standing as they are generally less than 10 m wide and 15m long surrounded by secondary extraction at a depth of 285 m. These pillars have lower width to height ratios and are expected to have collapsed at the time of secondary extraction in the Bulli Seam because of the high abutment loads generated by the secondary extraction process.

In Area #11, the original mine working plan and record tracing copy indicate the secondary extraction of the first workings pillars was undertaken from 1942 to 1945. Only two small remnant pillars are shown as not mined, but these are likely to have collapsed at the time of secondary extraction because they are less than 8 m wide and 10m long and surrounded by secondary extraction at a depth of 280 m. Figure 8 in **Appendix D** shows sections of the mine working plan and the record tracing copy for Area #11 demonstrating the reliability of the Bulli Seam records. These are two hand-drawn plans drafted at different times, updated at different intervals, and using different depictions for secondary extraction. Similar records are available for Area #2.

The potential for additional subsidence above these two Bulli Seam goaf areas cannot be eliminated, but this potential exists irrespective of the planned mining, and the planned mining is not expected to cause a significant change at the Bulli Seam mining horizon. In the unlikely event that remnant pillars are still standing and were to collapse at the time of mining the Wongawilli Seam below, additional subsidence associated with the collapse of these pillars is expected to be less than 300 mm over an area with a radius of approximately 50 m (SCT, 2021).

### 2.8.4 Selection of Mine Design

The key environmental features within the mine area of the Russell Vale UEP and EP Area that are sensitive to subsidence are the streams and the coastal upland swamps. The mine planning for the Russell Vale UEP and EP Area has been specifically designed to avoid and/or minimise the risks to these sensitive features.

The original UEP major project application was submitted for approval in 2009, with a supporting Environmental Assessment publicly exhibited in 2013 (ERM, 2013). A Preferred Project was exhibited in 2014 based on a reduced longwall mine plan of eight longwalls in the Wonga East area only. The Preferred Project was referred to the Planning and Assessment Commission (PAC) and the PAC released its first Review Report on the UEP Preferred Project in April 2015. The report recommended that further work and assessments were required before a determination could be made. In July and then September 2015, WCL submitted its responses to the first PAC Review Report following consultation with various agencies.

In October 2015, the Minister for Planning referred the responses to the PAC for a second review. The PAC's Second Review Report was released in March 2016 and required further consideration and assessment of water and subsidence, risks of water loss and impact to coastal upland swamps, the estimated cost associated with water loss, and the noise assessment (PAC, 2016).

Through the course of the UEP application process various reports and amendments of the UEP were prepared, including:

- Environmental Assessment (ERM, February 2013) to support the original UEP application;
- Preferred Project Report including Response to Submissions (Natural Resources Environment (NRE), undated) and the Residual Matters Report (Hansen Bailey, June 2014);
- Response to the PAC's First Review Report Part 1 (Hansen Bailey, July 2015) and Part 2 (Hansen Bailey, September 2015) including an Independent Risk Assessment (Broadleaf, 2015); and
- Russell Vale Revised Underground Expansion Project – Revised Preferred Project Report and Response to Second PAC Review (Umwelt 2019).

In order to address residual uncertainty regarding the impacts of longwall mining raised by the PAC Second Review Report, a revised mine design was developed by WCL based on a non-caving bord and pillar mining system. The revised and subsequently approved mine plan was designed to be long term stable with negligible risk of pillar failure to address potential subsidence-related mining impacts on groundwater, surface water and biodiversity within the Cataract Reservoir catchment.

Measures taken by WCL to reduce the potential for perceptible subsidence from the proposed bord and pillar workings included in this mine plan as covered by this EP include (SCT 2021; SCT 2022):

- Avoiding mining below the abutment load bearing (and subsidence controlling) Balgownie Seam chain pillars between longwall goafs.
- Positioning PC07 and PC08 bord and pillar panels below the goaf of Longwall 5 and Longwall 6 in the Balgownie Seam and separating them by a barrier pillar of coal. Panel layout in PC07 and PC08 maintains an offset from being directly below the Balgownie Seam chain pillar edges.
- Pillar dimensions in PC07 and PC08 have been increased from 19.5m by 24.5m (as originally identified in the Response to Second PAC Review and Revised Project Assessment (Umwelt 2019) to 22.5 m by 24.5 m to accommodate full tributary load below the Balgownie Seam longwall goafs. In the southern extent of PC07, which is not below the Balgownie Seam longwall goaf, pillars increase in size to 24.5 x 24.5 m.
- In PC21 and PC22-25, the pillars have been designed to be generally square in shape with minimum coal pillar dimensions of 24.5m by 24.5 m.
- Longer rectangular barrier type pillars are incorporated into the three headings entries to the PC22-25 sub-panels.
- Three barrier pillars (coal) separate the PC22-PC25 sub-panels.
- Lengthening the pillars in PC28 and incorporating into the three heading entries to the PC30-33 subpanels as part of the barrier between these panels.

- Including longer panels in PC29 as a result of the geometry for PC30-34 sub-panels and slightly longer pillars have been included in the southern section of PC32, all of PC33 and the northern section of PC34. Overall, this has resulted in the layout extending marginally to the north with PC32 approximately 10 m longer; PC33 approximately 20 m longer and PC34 approximately 10 m longer than the approved layout in MP09_0013.

The PC07-08 pillars have a width to height ratio of greater than 9. Assuming full tributary overburden load, these pillars have a factor of safety (FOS) of greater than 2.11 at depths up to 350m based on the University of NSW pillar design formulae (UNSW, 1999).

PC21-25 bord and pillar panels are planned to be a minimum size of 24.5 m wide and 24.5 m long. The minimum sized pillars have a width to height ratio of greater than 10. Assuming full tributary overburden load, these pillars have an assessed factor of safety of greater than 2.11 for the maximum 330 m depth above these panels.

Strong roof and floor conditions typical of the Wongawilli Seam are expected in PC27-34. Assuming full tributary overburden load, these pillars have a factor of safety of 2.11 or greater at depths of up to 390 m.

There is no experience in Australia or South Africa of pillars failing when the factor of safety is 2.11. The potential for perceptible subsidence should pillars become overloaded and deform over time is significantly reduced by limiting the panels to five headings and incorporating a barrier greater than 50 m wide between panels.

Summaries of the stability of the Balgownie Seam Pillars and Bulli Seam Pillars are discussed in detail within the Updated Subsidence Assessment prepared by SCT (refer to **Appendix D**).

# 3. SUBSIDENCE PREDICTIONS

The revised mine plan is designed to be long term stable with negligible risk of pillar failure, significantly reducing the potential for subsidence-related mining impacts on groundwater, surface water and biodiversity within the Cataract Reservoir catchment.

The mine design dimensions as outlined in Table 9 of **Section 2.8** have a high factor of safety, equivalent to a risk of failure of less than 1 in 1,000,000 (SCT 2021, SCT 2022).

Updated subsidence predictions for PC07-08 and PC21-25 (Stage 1) and PC27-34 (Stage 2) have been prepared and are provided in in **Appendix D**. Vertical subsidence predictions for PC07-08, PC21-25 and PC27-34 are displayed in **Figure 7, Figure 8** and **Figure 9** respectively. **Table 10** summarises the predicted subsidence effects from the mining of PC07-08 and PC21-25 (Stage 1) and PC27-34 (Stage 2).

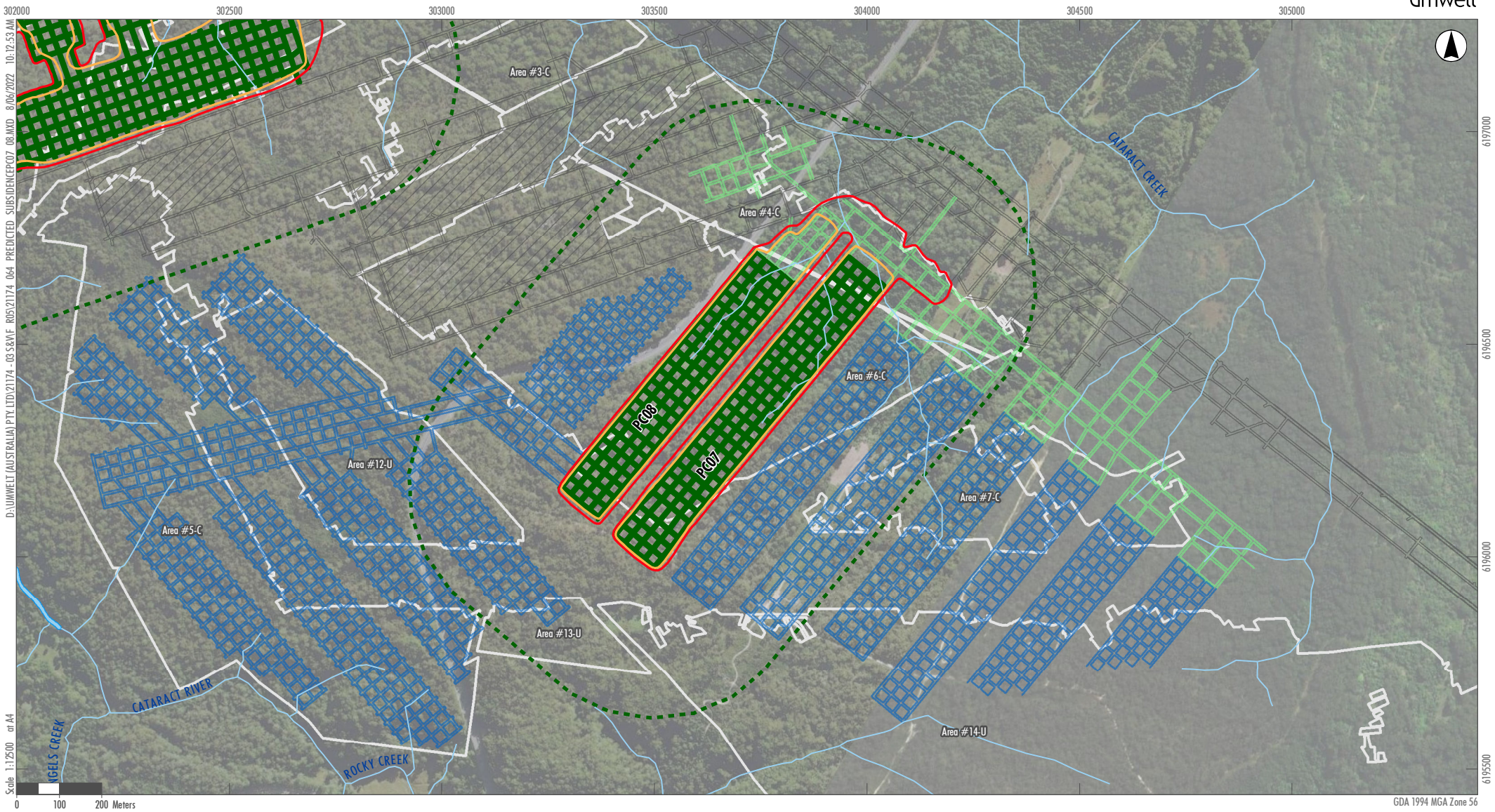
**Table 10 Subsidence Predictions**

| Subsidence Movement | Prediction – Stage 1 (PC07-08 and PC21-25) (SCT, 2021) | Prediction – Stage 2 (PC27-34) (SCT, 2022) |
|---|---|---|
| Vertical Subsidence | • Vertical subsidence overlying the second workings is expected to be less than 100 mm and generally less than 30mm.<br>• The potential for additional vertical subsidence is considered possible, but most unlikely, in isolated areas near goaf edges or below Bulli Seam goaf areas #2 and #11 where any remnant pillars not already collapsed are destabilised. This is discussed in further detail in **Appendix D**.<br>• Vertical subsidence within the EP Area but outside the areas directly over bord and pillar panels will be generally less than 20 mm. These levels of subsidence are expected to be imperceptible for all practical purposes.<br>• A previously identified and inspected area of Welsh bords in the Bulli Seam adjacent to the main headings is outside the EP Area for PC07-08 and not expected to be affected by the planned mining. Although considered to be marginally stable based on pillar stability calculations, these pillars have been standing for 120 years. The expected 300 mm subsidence associated with failure of these pillars would occur in a small area that would not affect surface infrastructure. | • Vertical subsidence overlying the second workings is expected to be generally less than 100 mm.<br>• The potential for additional subsidence is considered possible but unlikely, in small, isolated areas near Bulli Goaf edges or above goaf areas where any 'marginally stable remnant pillars not already collapsed are destabilised. This is discussed in further detail in SCT 2022 (**Appendix D**). |

| Subsidence Movement | Prediction – Stage 1 (PC07-08 and PC21-25) (SCT, 2021) | Prediction – Stage 2 (PC27-34) (SCT, 2022) |
| --- | --- | --- |
| Tilt and Strain | • Changes to the surface from tilt and strain are expected to be generally imperceptible. For 100 mm of vertical subsidence at 280 m depth the following maximum values can be estimated for the EP Area as:<br>o Tilt of less than 2.0 mm/m.<br>o Tensile strain of approximately 0.5 mm/m.<br>o Compressive strain of approximately 1.0 mm/m. | • Changes to the surface from tilt and strain are expected to be generally imperceptible. For 100 mm of vertical subsidence at 280 m depth the following maximum values can be estimated for the EP Area as:<br>o Tilt of less than 2.0 mm/m.<br>o Tensile strain of approximately 0.5 mm/m.<br>o Compressive strain of approximately 1.0 mm/m. |
| Horizontal Movements | • Systematic horizontal ground movements from vertical subsidence are expected to be generally imperceptible. However, ongoing low-level horizontal movements of the southern slope down to Cataract Creek are expected to continue irrespective of the planned mining due to previous mining within the EP Area. These horizontal movements are expected to continue to cause horizontal strains that increase cracking at the top of the ridge line, cause minor cracks in the slope and cause minor compression at the Cataract Creek crossing point. | • Systematic horizontal ground movements from vertical subsidence are expected to be generally imperceptible. However, ongoing low-level horizontal movements of the southern slope down to Cataract Creek are expected to continue irrespective of the planned mining due to previous mining within the EP Area. These horizontal movements are expected to continue to cause horizontal strains that increase cracking at the top of the ridge line, cause minor cracks in the slope and cause minor compression or valley closure effects at the Cataract Creek |

| Subsidence Movement | Prediction – Stage 1 (PC07-08 and PC21-25) (SCT, 2021) | Prediction – Stage 2 (PC27-34) (SCT, 2022) |
| --- | --- | --- |
| Unconventional Subsidence Effects | • No significant unconventional subsidence movements are expected from the planned mining. Valley closure movements are expected but far-field movements from stress relief in the overburden strata are not envisaged.<br>• Ongoing low-level valley closure movements are expected irrespective of the planned mining. The current incremental closure at Cataract Creek from the Wongawilli Seam mining is approximately 60 mm. This incremental closure is expected to remain well below the 150 mm threshold set for the previously approved longwall mining in the Wongawilli Seam.<br>• Any far-field horizontal movements from stress relief in the overburden strata are expected to have already occurred from the previous secondary extraction mining in the Bulli and Balgownie Seams and to a lesser extent, in the Wongawilli Seam. The planned mining in the Wongawilli Seam involves a non-caving method so additional far-field movements are not expected. | • No significant unconventional subsidence movements are expected from the planned mining. Valley closure movements are expected but far-field movements from stress relief in the overburden strata are not envisaged.<br>• Ongoing low-level valley closure movements are expected irrespective of the planned mining. The current incremental closure at Cataract Creek from the Wongawilli Seam mining is approximately 60 mm. This incremental closure is expected to remain well below the 150 mm threshold set for the previously approved longwall mining in the Wongawilli Seam.<br>• Any far-field horizontal movements from stress relief in the overburden strata are expected to have already occurred from the previous secondary extraction mining in the Bulli and Balgownie Seams and to a lesser extent, in the Wongawilli Seam. The planned mining in the Wongawilli Seam involves a non-caving method so additional far-field movements are not expected. |

Detailed information on the predicted subsidence can be found within the updated subsidence assessments completed by SCT (2021, 2022) and provided in **Appendix D**. The predicted impacts on environmental, Aboriginal, historic heritage, built features, landscape features and public safety is discussed further in **Section 6** and within key component management plans.




D:\UMWELT (AUSTRALIA) PTY LTD\21174 - 03 S&WF R05\21174 064 PREDICTED SUBSIDENCEPC07 08.MXD 8/06/2022 10:12:53 AM

Scale 1:12500 at A4

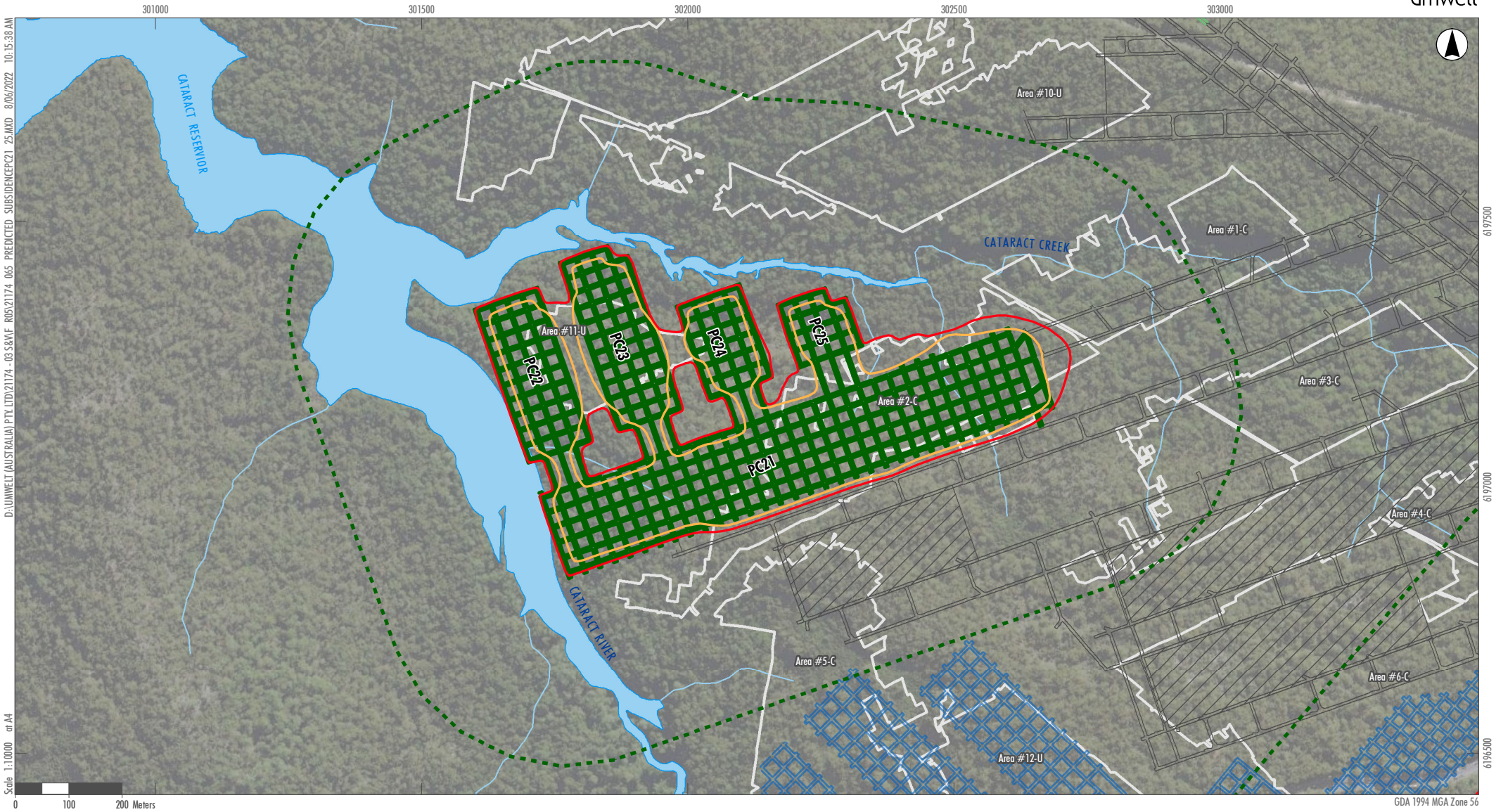
Legend

- Stage 1 Areas PC07-08 and PC21-25
- Stage 1 Panels
- Future Wongawilli Seam Workings (not subject to this EP)
- Existing Wongawilli Seam Workings
- Wongawilli Seam First Workings (Approved under MP09_0013)
- Bulli Seam Goaf Areas -
  - C - Confirmed as collapsed/subsided
  - U - Unconfirmed as collapsed/subsided
- 100mm Subsidence Contours EP1
- 20mm Subsidence Contours EP1
- Drainage Line

FIGURE 7

**Subsidence Predictions PC07-08**

Image Source: ESRI (2021) Data source: DFSI (2020); SCT (2021)

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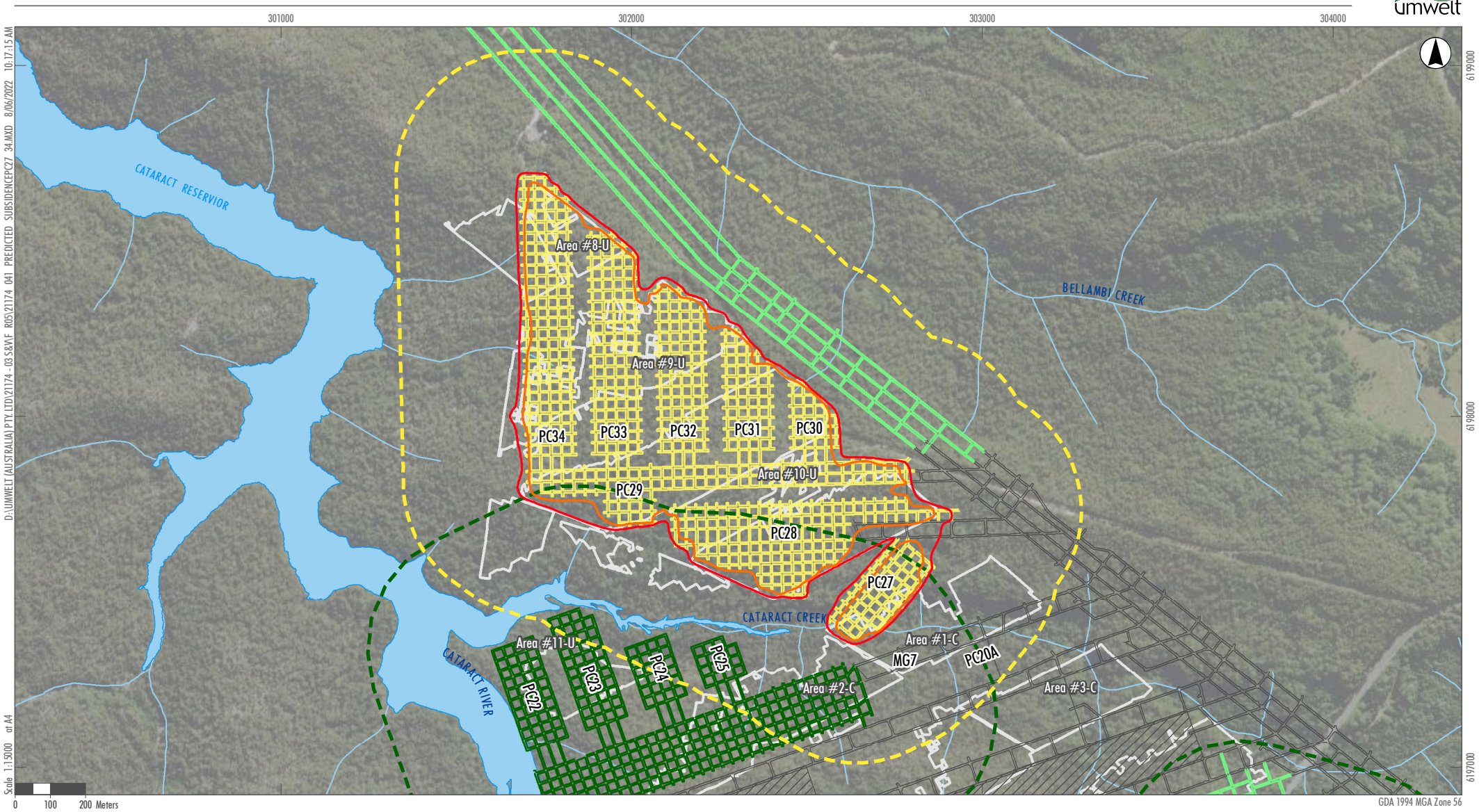
Legend

- Stage 1 Areas PC07-08 and PC21-25
- Stage 1 Panels
- Future Wongawilli Seam Workings (not subject to this EP)
- Existing Wongawilli Seam Workings
- Wongawilli Seam First Workings (Approved under MP09_0013)
- Bulli Seam Goaf Areas -
  - C - Confirmed as collapsed/subsided
  - U - Unconfirmed as collapsed/subsided
- 100mm Subsidence Contours EP1
- 20mm Subsidence Contours EP1
- Drainage Line

FIGURE 8

Subsidence Predictions PC21-25

Image Source: ESRI (2021) Data source: DFSI (2020); SCT (2021)




Legend

- Stage 2 Area PC27-34
- Stage 1 Areas PC07-08 and PC21-25
- EP2 Layout PC27-34
- EP1 Layout PC07-08 and PC21-25
- Existing Wongawilli Seam Workings
- Wongawilli Seam First Workings (Approved under MP09_0013)
- Bulli Seam Goaf Areas -
  - C - Confirmed as collapsed/subsided
  - U - Unconfirmed as collapsed/subsided
- 100mm Subsidence Contours EP2
- 20mm Subsidence Contours EP2

FIGURE 9

Subsidence Predictions PC27-34

Image Source: ESRI (2021) Data source: DFSI (2020); SCT (2021)

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# 4. DEVELOPMENT OF THE EXTRACTION PLAN

## 4.1 Risk Assessment

Risk assessment is fundamental to the management approach adopted by WCL. Environmental Risk Assessments (RA) were conducted on 10 March 2021 for the Stage 1 EP Area and on 01 February 2022 for the Stage 2 EP Area. The RAs were prepared and facilitated by suitably qualified and experienced experts endorsed by DPIE. A copy of the RAs and their outcomes can be found in **Appendix C**.

The RAs determined that the main mitigating measure for both of the EP Areas for reducing potential hazards, was utilising the bord and pillar mining techniques, with the workings designed to be long-term stable with imperceptible subsidence impacts. Due to the conservative mining method implemented, the majority of risks identified were low to medium.

## 4.2 Stakeholder Consultation

### 4.2.1 Consultation During the Environmental Assessment Process

Extensive community and government consultation has been carried out prior to, and during the preparation of the original Environmental Assessment, the Revised Preferred Project Report, the Submissions Report and other project-related assessment documentation. The primary objective of consultation was to keep the community, government agencies and other stakeholders informed and involved during the project development process.

Community engagement was carried out in two phases and is summarised in Section 4.1.2 and Section 4.1.3 of the Revised Preferred Project Report (Umwelt 2019).

A complete summary of previous and ongoing government agency and stakeholder consultation is provided in Table 4.5 of the Revised Preferred Project Report (Umwelt 2019). Consulted parties included the following State and local government agencies, and roads and utilities authorities:

- Department of Planning, Industry and Environment (DPIE)
- Department of Resources and Geosciences (DRG)
- Department of Environment and Energy (DoEE)
- NSW Environment Protection Authority (EPA)
- Wollongong City Council (WCC)
- WaterNSW
- The former Office of Environment and Heritage (OEH) now DPE Biodiversity Conservation Department (BCD)
- DPIE Water
- Natural Resource Access Regulators (NRAR)
- TfNSW
- RMS
- TransGrid
- Endeavour Energy

- The Independent Expert Panel for Mining in the Catchment.

### 4.2.2 Consultation During the Preparation of the Management Plan

A draft version of this EP and its associated key component management plans was distributed to the following stakeholders for review and feedback:

- DPIE (Stage 1), now referred to as Department of Planning and Environment (DPE) (Stage 2);
- RR;
- WaterNSW;
- Department of Regional NSW - Mining, Exploration and Geoscience (MEG); and
- Heritage NSW.

These stakeholders also received a copy of the changes proposed to incorporate the Stage 2 EP Area into the Extraction Plan.

The feedback provided on the draft EP and updated EP by stakeholders is summarised within **Table 11** below and is found in **Appendix B**. Specific feedback on key component management plans can be found in the consultation sections of those plans (refer to **Appendix E** to **Appendix M** ).

**Table 11 Consultation to Date for the EP**

| Agency name and timing of consultation | Issue | Where issue is addressed in Management Plan |
|---|---|---|
| **Stage 1** | | |
| DPIE (Planning) (November 2021) | Request for clarification on:<br>• General comments on baseline data and response to BCD/EES comments on USMP.<br>• TARPs, including surface water, groundwater and subsidence.<br>Conditional Approval granted 03 December 2021 | **Appendix A, Appendix G Appendix H Appendix M** |
| EPA<br>(October 2021) | No issue noted. | **N/A** |
| Heritage NSW (November 2021) | Comments from Heritage NSW specifically relating to HMP. | **Appendix L** |
| Department of Regional NSW - MEG<br>(November 2021) | No issue noted. | **N/A** |

| | | |
|---|---|---|
| RR<br>(November 2021) | Comments from RR relating to rehabilitation commitments, as well as finalisation of consultation for the BFMP. | **Appendix E** |
| Water NSW<br>(November 2021) | No issue noted. | **N/A** |
| **Stage 2** | | |
| DPIE (Planning)<br>(18 January 2022) | Regular consultation throughout preparation of the EP. DPE reviewed EP as part of EP Approval Processes. | Consultation records to be updated following approval for any matters raised. |
| DPE (24 August 2022) | Request for information (RFI) submitted via the Major Projects Portal. The RFI included queries specifically related to the BMP (frog monitoring) and SMP (GNSS locations and LiDAR accuracy). | Refer to response provided to DPE on 9 September 2022 in **Appendix B** . |
| DPE Water | Comments from DPE Water specifically relating to the WMP. | **Appendix G** |
| EPA | No issue noted. | N/A |
| Heritage NSW | Comments from Heritage NSW specifically relating to HMP. | **Appendix L** |
| RR | A response was received by NSW RR on 13 May 2022. No specific comments provided in response to Stage 2 bord and pillar workings. | Refer to response provided to NSW RR on 31 May 2022 outlined in **Appendix B**. |
| Water NSW | No issue noted. | N/A |

### 4.2.3 Landowner Consultation

WaterNSW and WCL own all the land within the Stage 1 and Stage 2 EP Areas other than the road reserve associated with Mount Ousley Road which is owned by Transport for NSW Roads and Maritime Services (TfNSW RMS). Consultation with WaterNSW and TfNSW RMS was undertaken as described in **Section 4.2.1** and **Appendix E.**

## 4.3 Baseline Data

### 4.3.1 Baseline Data Relevant to Stage 1 and Stage 2

Due to the long history of mining in the area, the monitoring required for LW4, LW5 and LW6 and assessment data obtained as part of the NSW and Commonwealth approval processes, WCL has comprehensive baseline data for groundwater, surface water, biodiversity, and Aboriginal heritage sites within the EP Area as well as downstream environments potentially impacted by mining operations. This baseline data is included in each of the component management plans, refer to **Appendix E** to **Appendix M.**

Vertical subsidence monitoring data is also available for the mining of LW4, LW5 and LW6 and the Balgownie Seam longwalls. The Updated Subsidence Assessment (SCT 2021, 2022 - **Appendix D**) includes a review of historical subsidence monitoring information.

### 4.3.2 Reference Data Relevant to Stage 1 and Stage 2

Due to the negligible nature of predicted impacts on biodiversity, hydrology, heritage and landscape features, a key aspect of the EP management processes will be a review of any observed impacts against impacts associated with natural variability. The triggers for these investigations are set out in the TARPs (refer to **Section 5.3** and **Appendix A**). To better inform these investigations, a range of sites outside of the area potentially impacted by these proposed secondary workings will be monitored to provide reference data for natural variability to assist in determining the likely cause of any observed changes in monitoring data. In the case of monitoring associated with swamps (biodiversity and groundwater), these reference sites include sites located outside of the EP Area that are unaffected by any mining proposed as part of the UEP. Long term groundwater, surface water and ecological monitoring of swamps from within the broader UEP area (i.e., swamps that may potentially be impacted by mining from later stages of the UEP) also have potential to be used as reference sites to inform the investigation of any cause(s) of observed changes in the environment at sites within the potential impact area.

The use of control sites and their appropriateness for use in investigations of potential impacts is outlined in the relevant key component management plans.

### 4.3.3 Monitoring to Establish Baseline Data for Future Extraction Plans

Several key component management plans outlined below include monitoring programs for the broader UEP Area, including the:

- Water Management Plan (including a Surface Water Monitoring Program and Groundwater Management Plan inclusive of a groundwater monitoring program)
- Biodiversity Management Plan
- Upland Swamp Monitoring Plan
- Heritage Management Plan
- Built Features Management Plan
- Land Management Plan
- Public Safety Management Plan
- Subsidence Monitoring Program.

In accordance with Condition C10 xi of the Development Consent, these monitoring programs will provide baseline data for future stages of mining within the UEP Area. As noted in **Section 4.3.2**, this monitoring may also serve as reference data for TARP investigation processes.

# 5. MANAGEMENT FRAMEWORK

## 5.1 RVC Environmental Management System

RVC operates under the RVC Environmental Management Strategy (RVC EMS) (RVC EC STD 001) which provides a framework to ensure activities at WCL are undertaken in an environmentally responsible manner and in general accordance with the following:

- Russell Vale Revised Preferred Underground Expansion Project Development Consent;
- EPBC approval 2020/8702;
- ISO14001 Environmental Management Standard; and
- Legislative and other requirements.

While the EMS includes general requirements for the reporting and management of incidents, this EP provides specific requirements in relation to the management of subsidence related impacts associated with the mining covered by this EP and the EP requirements (including the requirements set out in this management plan) prevail to the extent of any inconsistency between documents. A graphical representation of the Environmental Management Framework at RVC is presented in **Figure 10.**

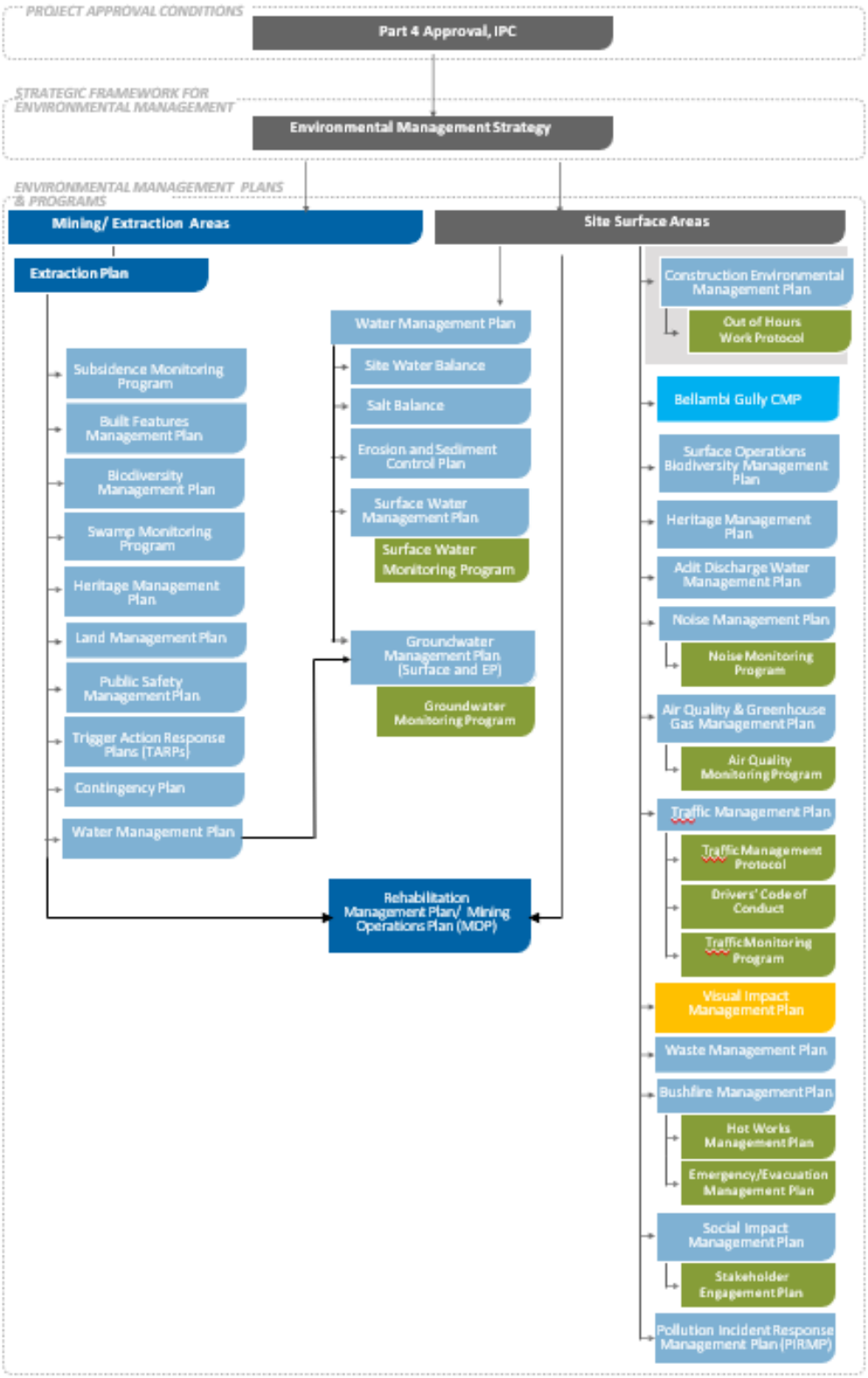



**Figure 10: WCL RVC Environmental Management Framework**

## 5.2 Incidents, Exceedances and Non-Compliances

The Development Consent defines:

- An 'incident' to be "an occurrence or a set of circumstances that causes or threatens to cause material harm and which may or not be or cause a non-compliance". Examples may include a breach of specific development consent criteria or performance measure.
- Exceedance or non-compliance as "an occurrence, set of circumstances or development that is a breach of this consent".

In both circumstances, an Incident or non-compliance must be attributable to the development approved under the Development Consent.

Material harm is defined in the Development Consent as:

- involves actual or potential harm to the health or safety of human beings or to the environment that is not trivial, or
- results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000 (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable costs and expenses that would be incurred in taking all reasonable and practical measures to prevent, mitigate or make good harm to the environment).

This definition excludes "harm" that is authorised under either this consent or any other consent.

As discussed in **Section 3**, the proposed 'second workings' which trigger the requirement for this extraction plan are long term stable bord and pillar workings which are predicted to have only negligible subsidence effects. The predicted levels of subsidence are not anticipated to have any observable impacts on natural, heritage or other built features over the proposed working area, and there are no predicted adverse impacts on public safety. Accordingly, the monitoring program has been designed on the following principles:

- monitoring to confirm impact predictions with respect to matters that are identified as being associated with mining (e.g., vertical subsidence effects and groundwater changes in the Permian aquifer systems)
- monitoring to detect any changes in the environment or built features that may potentially be associated with mining related impacts and
- monitoring to inform future investigations regarding the causation of any observed changes in the environment.

The key performance criteria related to subsidence impacts are those set out in tables 6 and 7 of the Development Consent and reproduced in **Section 1.4.2.** Of these, only the performance criteria for vertical subsidence sets a quantitative limit. The infrastructure related performance measures are based on the infrastructure remaining safe and serviceable while the environmental and public safety performance measures are based around the principle of no more than negligible impacts due to the proposed development.

Negligible is defined in the Development Consent as: "Small and unimportant, such as to be not worth considering". This definition closely aligns to the common language meaning of "trivial". Accordingly, for practical purposes, the threshold for an exceedance of a negligible environmental impact performance measures associated with subsidence and a circumstance resulting from mining causing "material harm" to the environment are the same.

Accordingly, any environmental 'incident' associated with subsidence from mining is also likely to constitute a non-compliance with environmental performance measures, however there may be circumstances where an incident does not constitute a non-compliance. The threshold for notifying incidents in relation to impacts to built features, landscape features and public safety are also different to the material harm threshold.

Importantly, it is worth noting that the Project is not predicted to result in any subsidence related impacts that may constitute an incident and, in the absence of any obvious causal pathway between observed changes in the environment or infrastructure and mining, it will be necessary to undertake further investigations to ascertain whether the observed changes are due to mining. Conversely however, an exceedance of the vertical subsidence criteria will almost certainly be due to either the Project or past mining in the area however, an exceedance of this subsidence criteria, may not result in any adverse environmental impacts which would amount to material harm to the environment.

Subsidence monitoring results are to be compared against the 300 mm performance measure in Table 7 of the Development Consent to confirm compliance to the Development Consent. Any exceedance of this criteria will be notified as a non-compliance in accordance with Condition F10 of the Development Consent.

For environmental related matters, the threshold for non-compliance with the performance measures set out in Table 6 of the Development Consent is met if the change is attributable to the development approved under the Development Consent and:

- there is a significant change in measured environmental conditions, or
- there is an observed change in environmental conditions of features monitored through observational means that exceeds the relevant performance measure.

The relevant performance indicators, thresholds and statistical analysis to be considered in determining whether a particular environmental performance measure has been breached are set out in the relevant component plans (**Appendix E** to **Appendix M**).

For matters where the performance criteria are safe and serviceable, or in the case of public safety, negligible additional risk, the performance indicators and thresholds are a combination of objective and subjective assessment and will depend on the nature of any subsidence impacts observed. This is discussed further in the **Section 5.3** and **Appendix E** and **Appendix F**.

An exceedance or non-compliance may be detected from routine inspections, audits or monitoring, or it can be from an external complaint or an internal incident.

## 5.3 Trigger Action Response Plans

In accordance with Condition C10(g)(viii) of the Development Consent, the Extraction Plan and associated sub plans will identify TARPs to be implemented to manage potential impacts associated with underground mining.

These TARPS include the following:

- monitoring requirements (may include different locations);
- trigger levels that indicate a potential non-compliance or flag implementation of contingency measures;
- management and contingency actions (i.e., corrective and preventative actions) and reporting requirements;
- responsibilities; and
- timing.

TARPs detail how the various predicted subsidence impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant statutory requirements. They also form the framework for adaptive management and contingency actions. These TARPS relate to subsidence related impacts and are based on the management of predicted impacts associated with subsidence up to the 300mm permitted under the Development Consent.

The TARP system provides a simple, transparent and useable reference of the monitoring of environmental performance and the implementation of management and/or contingency measures.

### 5.3.1 TARP Levels

TARPS are designed with consideration of baseline conditions and predicted negligible subsidence impacts.

**Table 12** below outlines the trigger level definitions to be applied to the TARPS provided within **Appendix A.**

**Table 12 Extraction Plan Trigger Levels**

| TRIGGER LEVEL | DESCRIPTION |
|---|---|
| **Level 1** | Monitoring indicates performance criteria are satisfied.<br>Operations continue as normal. |
| **Level 2** | Minor or persistent changes in monitoring results indicate potential alteration of the environment (could be natural or mining related) or impacts outside of predictions.<br>Internal investigation of potential causes required to determine if there is potential to cause material harm due to mining operations.<br>Exceedances of subsidence triggers may result in implementation of adaptive management measures. |
| **Level 3** | Significant change in monitoring results indicates a likely alteration of the environment (could be natural or mining related) or impacts outside of predictions.<br>Investigation into potential causes required to determine if material harm has been caused due to mining operations. External notification of *potential* incident required for TARPs.<br>Exceedances of subsidence triggers likely to result in implementation of adaptive management measures. |

If monitoring indicates a Level 2 or 3 trigger has been reached, an investigation will occur in all circumstances. The nature of the investigation will depend on the feature being monitored, the location of the trigger exceedance and trigger level exceeded among other matters. Different investigation options are discussed in detail in the management plans specific to the feature being monitored.

**Note: Level 3 TARP triggers related to performance measures (referred to as 'Performance Measure TARPs') do not, of themselves, constitute an incident or non-compliance under the Development Consent. Investigations following a Level 3 trigger will determine whether an exceedance or non-compliance of the performance measures or Development Consent conditions is likely or has occurred.**

In the unlikely event that investigations of Level 3 Performance Measure for TARP trigger exceedances determine that material harm has occurred and is attributable to the development approved under the Development Consent, the contingency plan and adaptive management measures outlined within **Section 5.6** will be implemented. In certain cases, management measures may be implemented in the absence of any clear link between the approved development and the observed impact to mitigate adverse environmental outcomes. Responses to matters which are identified as incidents or non-compliances will be implemented in consultation with relevant stakeholders.

**Figure 11** provides a flow chart covering the TARP Process.

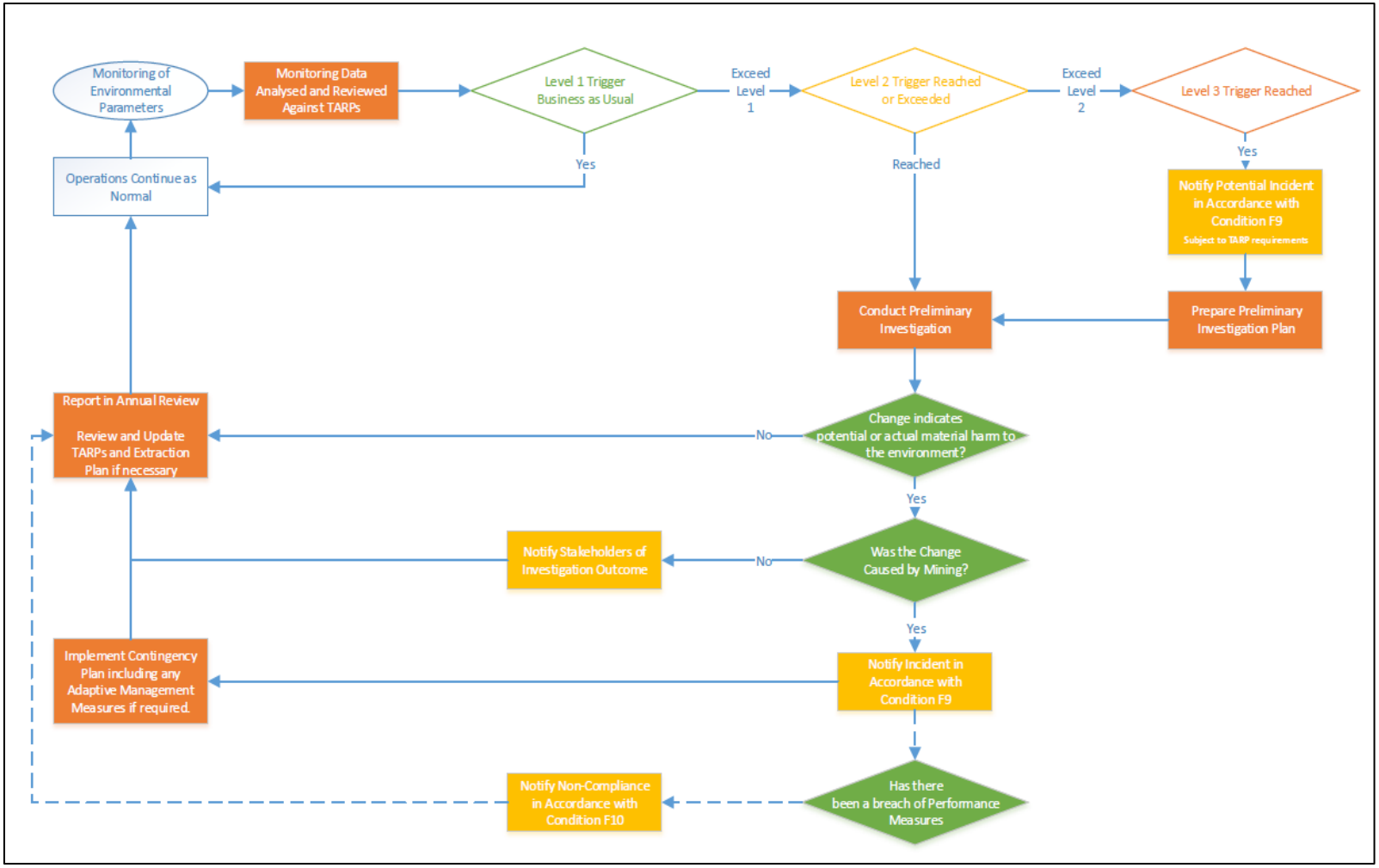



**Figure 11: TARP Process**

## 5.4 Adaptive Management

Where investigations triggered by the performance measure TARPS indicate that the changed conditions of sites have been, or are likely to have been, caused by mining operations, the response to these impacts include adaptive management measures to ensure further impacts to the site will not occur, or be mitigated, or that similar impacts to other sites do not occur in the future. Due to the nature of the proposed mining and low likelihood of underground mining resulting in any impacts to the site provided subsidence impacts remain within predictions, the adaptive management measures that will be implemented will be considered in the investigation process. These potential adaptive management measures include:

- stop mining and investigate potential causes for exceeding subsidence predictions
- undertake a review of the panel design parameters in consultation with the resource regulator.

The adaptive management process is shown on **Figure 12** and the contingency planning process set out in **Section 5.6** also covers this process.

The TARPS in **Appendix A** show the adaptive management measures for subsidence which inform decisions regarding underground mining operations, should higher than predicted vertical subsidence effects be observed. The purpose of these adaptive management measures is to implement additional measures where necessary to:

- enable potential impacts associated with higher than predicted subsidence impacts to be monitored; and/or
- the implementation of changes in mining operations to prevent performance criteria from being exceeded.

WCL will assess and manage development-related risks to ensure that there are no exceedances of the criteria and/or performance measures in this Development Consent in accordance with Condition F4 of the Development Consent. Any exceedance of the subsidence criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation, notwithstanding offsetting actions taken. Where any exceedance of these criteria and/or performance measures has occurred, WCL will at the earliest opportunity:

- take all reasonable and feasible steps to ensure the exceedance ceases and does not re-occur;
- consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action;
- within 14 days of the exceedance occurring, submit a report to the Secretary describing these remediation options and any preferred remediation measures or other course of action; and
- implement remediation measures as directed by the Planning Secretary,

to the satisfaction of the Secretary.

Additional adaptive management measures may also be imposed by DPE in relation to "substantial" exceedances of performance measures for watercourses or water supply in the event that the impacts are not capable of being offset under Condition C4 of the Development Consent.

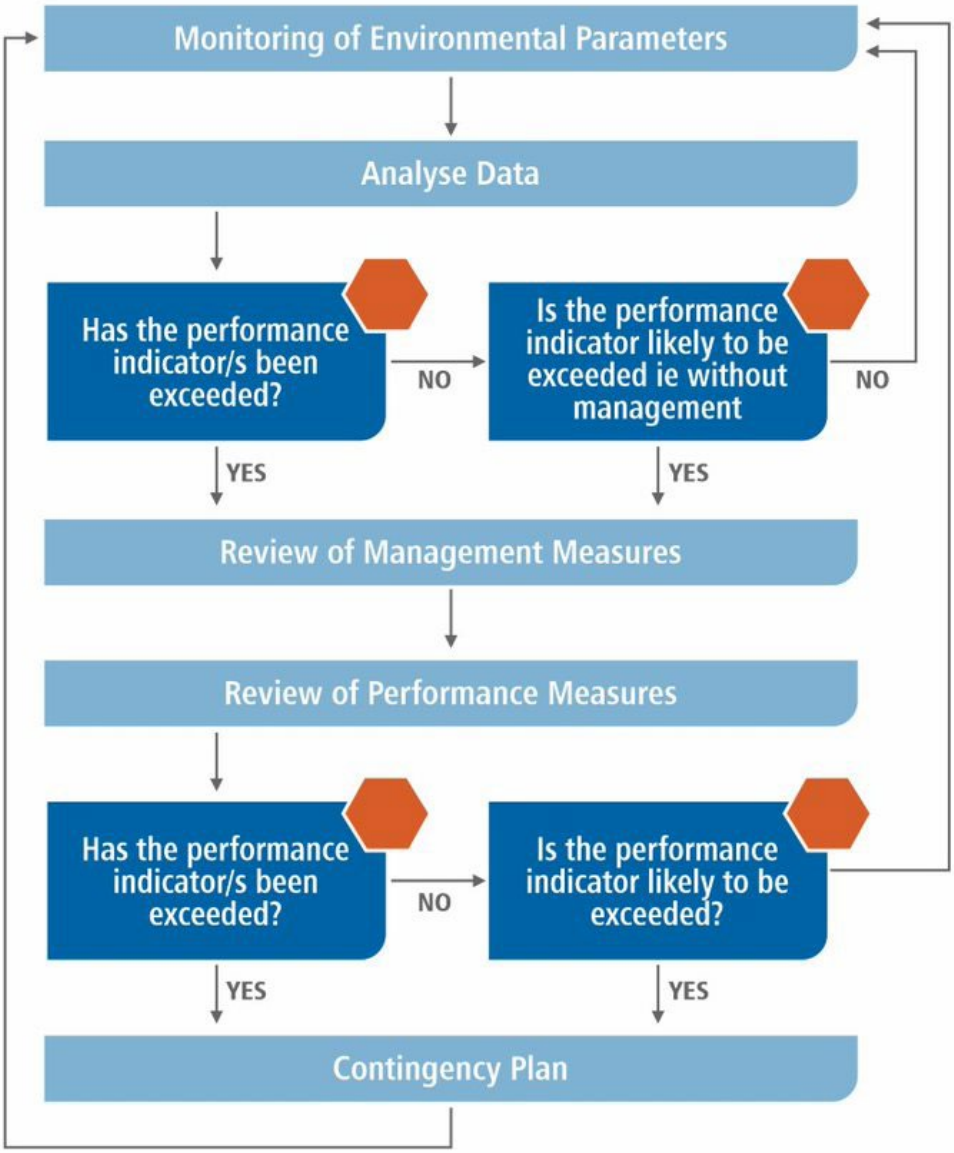



**Figure 12: Adaptive Management Process**

## 5.5 Potential Incident Notifications

Level 3 TARPs are set at a level that may indicate more than trivial environmental harm if exceeded. Where monitoring indicates a Level 3 TARP trigger has been exceeded but the cause of the trigger being exceeded is unclear, DPE (and other relevant stakeholders) will be notified of a *potential* Incident. The notification will include the same matters required to be included in an Incident Notification as required by Condition F9 of the Development Consent and Condition 16 of the EPBC approval.

Unless the cause of the exceedance is clearly identifiable at the time the exceedance, the first step will be to investigate the likely cause or causes of the exceedance. A preliminary investigation plan will be developed to guide the investigation process and a copy provided to DPE and other relevant stakeholders.

The investigation process will also consider any remedial action that may be required to prevent any actual or potential material harm from occurring.

## 5.6 Contingency Plans

In accordance with Conditions E1, F4, F9 and F10 of the Development Consent, WCL will notify DPE and other relevant agencies of any incidents that have caused or have the potential to cause significant risk of material harm to the environment. A detailed report of the incident shall be provided to the Secretary of DPE within 7 days of the incident occurring consistent with Condition F10 of the Development Consent. In the event of an incident or non-compliance with the Development Consent conditions, WCL will implement the following measures in conjunction with the RVC EMS and Pollution Incident Response Management Plan (PIRMP) (if required):

- The observation will be reported to the WCL Group Group Environment Manager as soon as possible;
- The observation will be recorded;
- An investigation will be undertaken to identify the cause of the observed impacts;
- WCL will report any exceedances of the performance measure to the Secretary of DPE and other relevant stakeholders as soon as practicable after WCL becomes aware of the exceedances;
- WCL will assess the exceedances referred to in the TARP and where appropriate, implement safety measures in accordance with the appropriate Management Plan/s;
- The Group Group Environment Manager will investigate any potential contributing factors and identify an appropriate action plan to manage the identified impact(s), in consultation with specialists and/or relevant agencies if necessary;
- WCL will identify an appropriate action plan to manage the identified impact(s), in consultation with other specialists and/or key stakeholders;
- WCL will submit the proposed course of action to DPE for approval; and
- WCL will implement the approved course of action to the satisfaction of DPE.

WCL will continue to monitor performance with the new action plan in place and, if successful, will formalise these actions as part of the Management Plan. Contingency measures will be developed in consideration of the specific circumstances of the issue and the assessment of consequences.

In circumstances where it is not reasonable or feasible to remediate the subsidence impact or environmental consequence, or the remediation measures implemented have failed to satisfactorily remediate the subsidence impact or environmental consequence, potential offsetting options will be discussed with relevant Government stakeholders. Suitable offsets to compensate for the subsidence impact or environmental consequence will be provided for any residual impacts, to the satisfaction of the Secretary in accordance with Condition C4 of the Development Consent.

# 6. SUBSIDENCE MANAGEMENT AND MONITORING

This EP has been developed for the mining of Stage 1 (PC21, PC22 to PC25 and PC07 to PC08) and Stage 2 (PC27 to PC34). The key component management plans discussed below have been prepared to address identified environmental aspects within the Stage 1 and Stage 2 EP Area and the monitoring of surface areas that may be subject to subsidence resulting from the extraction of coal from future second workings within the UEP.

## 6.1 Subsidence Monitoring Program

### 6.1.1 Overview

As impact predictions are based on the low levels of subsidence predicted, subsidence monitoring provides an effective precautionary control to manage subsidence impacts more broadly within the Stage 1 and Stage 2 EP Areas. With the minimal subsidence effects and impacts expected, the Subsidence Monitoring Program proposes a shift from the existing conventional monitoring techniques in the difficult surveying environment within the Stage 1 and Stage 2 EP Areas (**Appendix M**).

Subsidence monitoring is conducted to:

- provide data to assist with the management of the risks associated with subsidence
- confirm the status of the Bulli Seam goaf areas
- validate the subsidence predictions
- provide a basis to analyse the relationship between the forecast and actual subsidence effects and impacts including any environmental consequences
- ensure compliance with subsidence performance measures
- inform adaptive management processes for compliance with performance measures
- collect sufficient baseline data for future mining applications
- enhance general understanding of subsidence behaviour at RVC.

The Subsidence Monitoring Program has been developed for the Stage 1 and Stage 2 EP Areas, in accordance with Development Consent conditions and considers recommendations contained within the subsidence assessment (**Appendix D**). The full Subsidence Monitoring Program can be found in **Appendix M**.

### 6.1.2 Performance Measures and Triggers

Condition C7 of the Development Consent imposes performance measures for subsidence. Performance triggers are outlined in the TARPs as defined within **Appendix A.**

### 6.1.3 Management and Monitoring Measures

To monitor and assess the potential subsidence impacts on the identified surface, natural and built features, the following subsidence monitoring will be completed during mining:

- a system of real time recording, Global Navigation Satellite System (GNSS) (a Global Positioning System (GPS)) based monitoring units established at key surface features

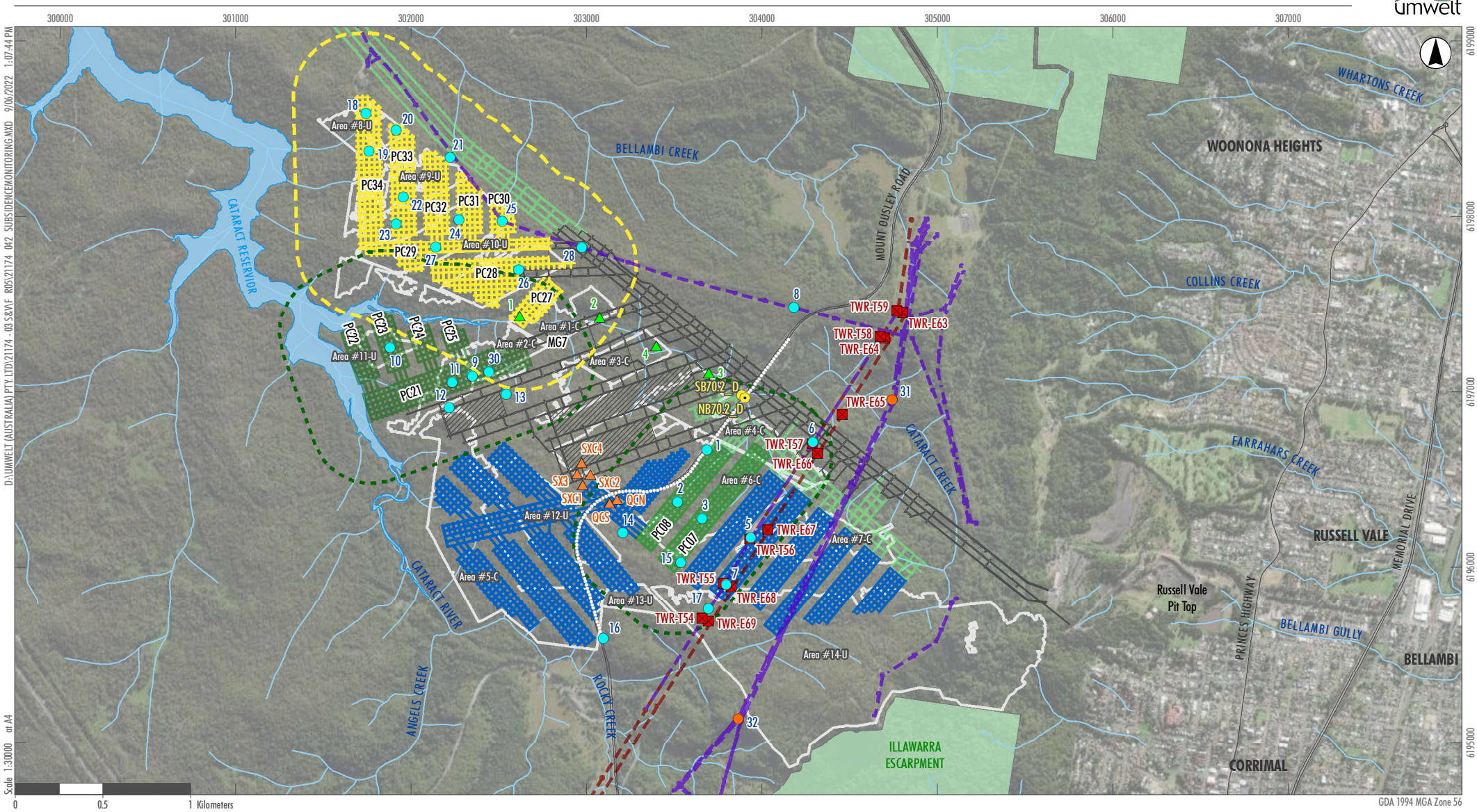
- broad-area monitoring using LiDAR (light detection and ranging)
- monitoring of underground conditions, including the monitoring of vertical and horizontal stress conditions and observational monitoring of rib conditions.

Subsidence monitoring locations are shown on **Figure 13**.

Mapping of changes to the observed vertical and horizontal underground roadway conditions in the Wongawilli Seam is expected to be a strong indicator of the status of Bulli Seam goafs and the potential for greater than expected subsidence. Elevated stresses below the edges and under the areas shown as goaf (previously extracted areas) are expected to be apparent. A program of roadway condition mapping by a geotechnical engineer overlain on the original Bulli Seam mine working plans and record tracing is expected to identify where Bulli Seam mine workings have been fully extracted and where they might still be standing.

The results of the monitoring program will be communicated to the respective stakeholders as detailed in **Section 7.2**.

The subsidence monitoring informs the TARPs developed for subsidence (refer to **Appendix A**).




Legend

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- Bulli Seam Goaf Areas -
  - C - Confirmed as collapsed/subsided
  - U - Unconfirmed as collapsed/subsided
- 33kV Powerline
- 132kV and 330kV Powerline
- Tower Locations
- RMS Survey Point
- Subsidence Monitoring GNSS Unit
- Conceptual Subsidence Monitoring GNSS Unit
- Pavement Compression across Cataract Creek 1d Closure Measurement
- Crack Monitoring
- Creek Closure Points
- State Conservation Area
- Road

FIGURE 13

**Subsidence Monitoring**

Image Source: ESRI (2021) Data source: DFSI (2020)

## 6.2 Water Management Plan

In accordance with Condition C10(g)(iii) of the Development Consent, a Water Management Plan (WMP) for the Stage 1 and Stage 2 EP Areas is provided in **Appendix G**. This WMP includes the Surface Water Monitoring Program as outlined in **Section 6.2.1.4**. The WMP also includes and should be read in conjunction with the Groundwater Management Plan (GWMP) (**Appendix H**).

### 6.2.1 Water Management Plan

#### 6.2.1.1 Overview

The EP Area is located within the Upper Nepean Catchment declared Metropolitan Special Area under the NSW Water Act, which forms part of Greater Sydney's drinking water supply catchment. The main drainage lines downstream of the EP Area are Cataract Creek, Cataract River and Bellambi Creek.

The EP Area is situated within the upper catchment of the Cataract Reservoir, adjacent to the full supply level of the reservoir. The reservoir is an artificial storage formed by Cataract Dam and has a maximum capacity of 97,190 ML. Cataract Reservoir has a total catchment area of approximately 127.8 km².

The EP Area consists of undulating topography with natural gullies and depressions. Rain falling within the Cataract Reservoir catchment moves as overland flow towards these depressions and ultimately discharge to the reservoir. There is first, second, third and fourth order streams directly overlying PC07, PC08, PC21 to PC25, PC27, PC30 and PC34 within the EP Area.

Cataract Creek is a fourth order stream draining to Cataract Reservoir. Cataract Creek flows to the west into Cataract Reservoir. The creek is relatively steep, particularly in its headwaters, with a reducing gradient downstream, and flows through a series of short pools, sandy reaches, rock bars and boulder fields. The Creek is characterised by two steeply sloping headwater tributaries which have eroded through the Hawkesbury Sandstone and, in the deeper eroded areas, through to the Bald Hill Claystone and the Bulgo Sandstone downstream of the freeway.

Cataract River is a fourth order stream to the west of the EP Area. Cataract River is approximately 6.7 km long and has a total catchment area of 11.6 km² from its headwaters to the upstream limit of Cataract Reservoir. The dominant vegetation along the riverbanks is well developed rainforest vegetation. No waterfalls or highly stepped zones are present along the river. The banks of the stream are well vegetated and stable, and the bed does not show significant erosion or instability.

The WMP (**Appendix G**) contains further details regarding the hydrology within the EP Area and downstream environment.

#### 6.2.1.2 Potential Impacts

Potential impacts to surface water resources associated with underground coal mining generally include:

- changes to overland flow paths due to subsidence effects which can alter stream bank stability, increase erosion and sedimentation
- loss of surface stream flows due to subsidence related fracturing of bedrock in streams
- changes to water quality due to changes on groundwater baseflow contributions (positive and negative)

- changes in water quality due to changes in overland flow patterns
- increased permeability of material at the base of perched aquifer systems (including swamps) which can reduce the surface outflow from these swamps
- increased connectivity between surface storages (such as Cataract Reservoir) and underlying geology due to reductions in water table and/or connective cracking.

The mine plan has been designed so there are imperceptible subsidence effects, impacts or consequences on Cataract Creek, Cataract River and their associated tributaries as a result of mining. The use of long-term stable and non-caving bord and pillar mining methods also significantly reduces groundwater related impacts. Modelling of the Stage 1 and Stage 2 proposed impacts on groundwater systems (refer to **Appendix H**) indicates that groundwater related impacts associated from mining is likely to have only negligible (and practically unobservable) impacts on surface water resources. As a result, the performance measures set for the project reflect the negligible impacts predicted.

#### 6.2.1.3 Performance Measures and Triggers

The performance measures relevant to surface water systems are outlined in **Table 13**. The performance measures, in part, have been used to inform the development of the TARP.

**Table 13 Water Performance Measures**

| Feature | Performance Measures | Performance Indicator |
|---|---|---|
| **Watercourses**<br>Watercourses, including Cataract River, Cataract Creek, and associated tributaries | Negligible diversion of flows or changes in the natural drainage behaviour of pools | Reduced flow in creeks |
| | Negligible gas releases | Evidence of gas releases into creek water (bubbles) |
| | Negligible increase in water cloudiness | Increased cloudiness of water |
| | Negligible increase in bank erosion | Increased erosion in creek banks<br>Elevated levels of total suspected solids (TSS) |
| | Negligible increase in sediment load | Total suspected solids |
| **Water Supply**<br>Cataract Reservoir | Negligible leakage from reservoir | Increased inflow of water into underground workings |
| | Negligible reduction in water quality of reservoir | Change in water quality within Reservoir |
| | No connective cracking between the reservoir surface and the underground workings | Increased inflow of water into underground workings |

In the event that a surface water related performance measure is exceeded, WCL will implement a contingency plan as outlined within **Section 5.6** of this EP.

The stream and swamp triggers were developed based on baseline monitoring of performance indicators and anticipated subsidence effects. Level 1 triggers indicate monitoring results which are consistent with past results. Level 2 triggers indicate a higher or lower than expected result which requires further investigation. Level 2 triggers do not typically represent results that are outside the range of natural variability but may indicate a higher (or lower) result than generally recorded. Level 3 triggers are set based on either statistically unlikely monitoring results or observed impacts (e.g., visual evidence of bank erosion or gas bubbles).

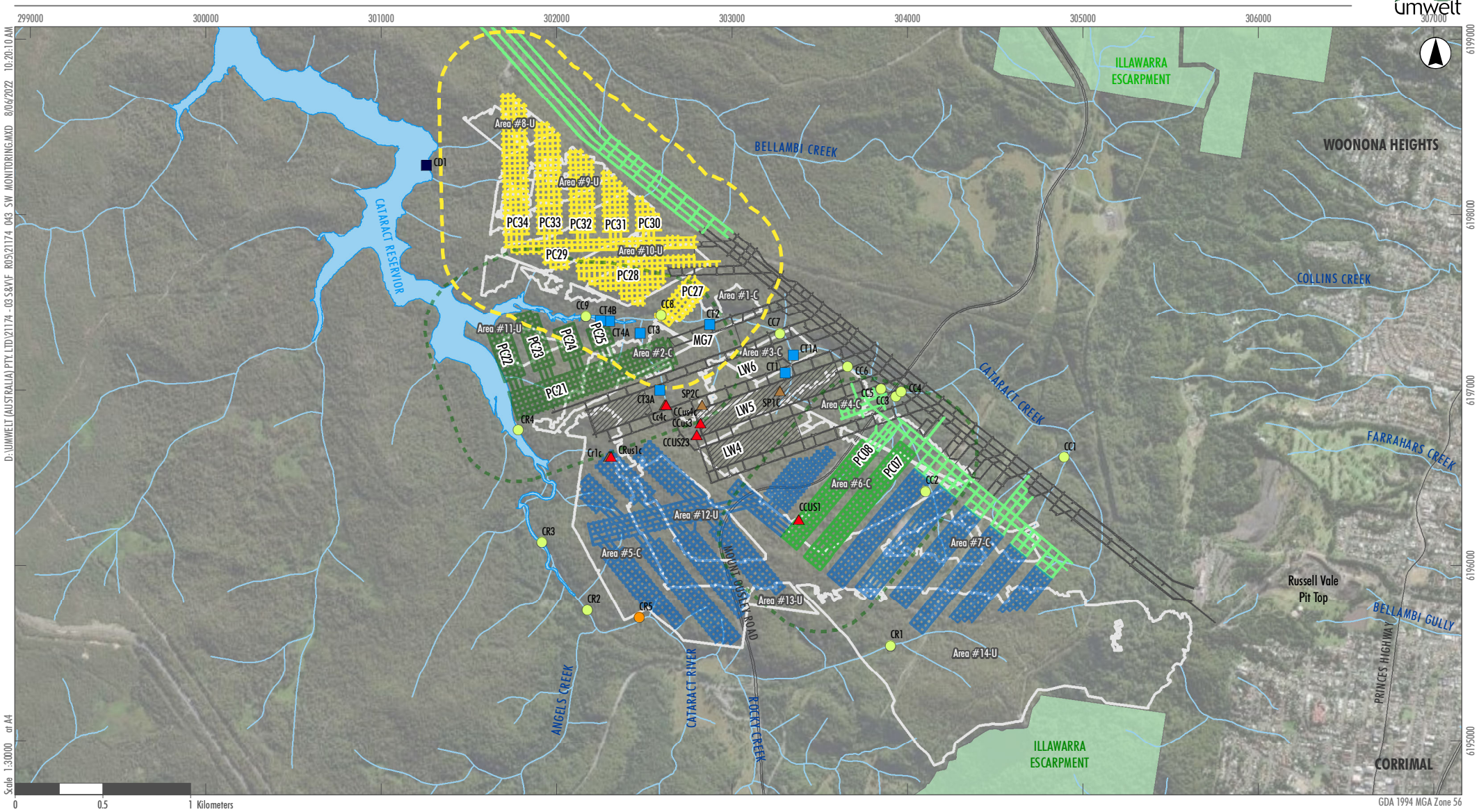
Relevant performance triggers are addressed within the WMP and Performance Management TARPs (refer to **Section 5.3** and **Appendix A**).

#### 6.2.1.4 Management and Monitoring Measures

WCL will implement the surface water monitoring program detailed in the WMP (**Appendix G**). Surface water monitoring will be undertaken along Cataract Creek, Cataract River and at the outlets of swamps CRus1 and CCus23. Monitoring locations are identified in **Figure 14** and include:

- surface water quality analysis
- stream flow and pool depths (water depth)
- channel stability and erosion through visual assessments and photographic record.

Groundwater monitoring (refer to **Appendix H**) will also be utilised to detect potential changes in groundwater inflow rates and quality that may indicate potential interactions with Cataract Reservoir).




## Legend

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  - C - Confirmed as collapsed/subsided
  - U - Unconfirmed as collapsed/subsided
- State Conservation Area
- Road
- Creek
- Potential Monitoring Location
- Swamp Drainage Line
- Swamps
- Tributary
- Dam

FIGURE 14

**Surface Water Monitoring**

Image Source: ESRI (2021) Data source: DFSI (2020)

### 6.2.2 Groundwater Management Plan

#### 6.2.2.1 Overview

The main hydrogeological units within the EP Area include:

- Quaternary alluvium and colluvium
- Quaternary swamps including upland swamps and headwater swamps
- Hawkesbury Sandstone:
  - Shallow weathered Hawkesbury Sandstone
  - Deeper Hawkesbury Sandstone
- Narrabeen Group
- Illawarra Coal Measures, including the Bulli Seam and Balgownie Seam previously mined, and Wongawilli Seam that was mined in LW4 to LW6 and is the target seam for future operations at RVC.
- Basement - sedimentary sequence underlying the Wongawilli Seam.

Due to the steep topography and limited alluvium within the Cataract Reservoir storage, there is no notable groundwater bearing stream-based alluvium within the EP Area.

Monitoring and modelling of groundwater levels in the Permian aquifer systems indicate there is unlikely to be any significant connectivity between the coastal upland swamps within the EP Area and the underlying Permian geology. This supports the general understanding that the water bearing capacity within the swamps is due to localised terrain features and a low permeability or aquitard layer at the base of the swamps.

There are no registered private bores or wells located within the EP Area.

The GWMP RVC EC PLN 006 (**Appendix H**) contains further details regarding the hydrogeology of the area.

#### 6.2.2.2 Potential Impacts

Potential impacts to groundwater from underground coal mining generally include:

- groundwater inflows
- depressurisation of Permian aquifer systems associated with subsidence related fracturing and the removal of coal from within the Wongawilli seam
- induced water table drawdown
- Induced baseflow losses in streams
- changes in groundwater quality
- loss of water holding capacity.

The use of long term stable and non-caving bord and pillar mining methods significantly reduces groundwater related impacts. Modelling of the proposed impacts on groundwater systems indicates that groundwater related impacts from mining are likely to have only negligible impacts on ground water resources. As a result, the performance measures set for the project all reflect the negligible impacts predicted.

Notwithstanding, existing and cumulative impacts associated with the existing approved operations at RVC, Corrimal workings and Bulli Colliery and their residual impacts and recovery post closure will continue to influence groundwater systems within the EP Areas and the monitoring of cumulative impacts is a key feature of the GWMP. The impacts from historical mining are discussed further below.

***Existing Groundwater Impacts***

Historical mining within the area has resulted in depressurisation within the Permian coal measures, Narrabeen Group and drawdown in the Lower Hawkesbury Sandstone in localised areas. These impacts were caused by subsidence and goaf effects associated with the mining methods and groundwater abstraction with mine progression. Recovery in groundwater levels has been observed over time, but residual impacts are present, including:

- Fracturing and subsequent increase in hydraulic conductivity within the Illawarra Coal Measures above the previous Longwall mining areas in the Wongawilli and Balgownie Seams and secondary extraction areas in the Bulli Seam, as well as the Narrabeen Group up to the Bulgo Sandstone above areas of longwall mining and secondary extraction (particularly those areas where multiseam secondary extraction has occurred).
- Groundwater inflows to the existing workings.
- Depressurisation around the active mine area and areas that have experienced goaf effects.
- Reduction in natural seepage and flow to the escarpment with depressurisation during active mining, as well as development of preferential seepage pathways with adits and portals.
- Localised changes in water quality within the Hawkesbury Sandstone, visible as iron staining along incised creeks that receive baseflow contributions.
- There is no evidence of subsidence near Cataract Reservoir to suggest there are any existing links between RVE UEP and the Cataract Reservoir. No further linkages are expected in the future.

The potential groundwater impacts from Stage 1 and Stage 2 mining are discussed in **Appendix G**.

#### 6.2.2.3 Performance Measures and Triggers

No specific performance measures have been provided within the Development Consent for groundwater other than those associated with upland swamps and interrelations with changes to surface water flows and quality (including loss of water from Cataract Reservoir). Performance measures for water management are provided in **Section 6.2.1** while performance measures for swamps are provided in **Section 6.4.**

Due to the absence of specific performance measures for groundwater, WCL have selected groundwater performance indicators based on the existing TARPS for previous mining within the EP Area (including TARPS for the LW6 EP). Baseline data has been used to set trigger values and consideration of current predicted impacts due to the broader UEP Area.

Therefore, only the groundwater quality (physio-chemical properties of pH and EC, as well as $SO_4$) and piezometer groundwater level monitoring within upland swamps has been used in performance measure TARPs.

An exceedance of the performance measures included in the Performance Measure TARPs will trigger an investigation into potential causes of observed changes to identify where the observed changes are due to mining approved under the Development Consent or natural causes. TARPs for groundwater are provided in **Appendix A** and within the Water Management Plan (see **Appendix H**).

#### 6.2.2.4 Management and Monitoring Measures

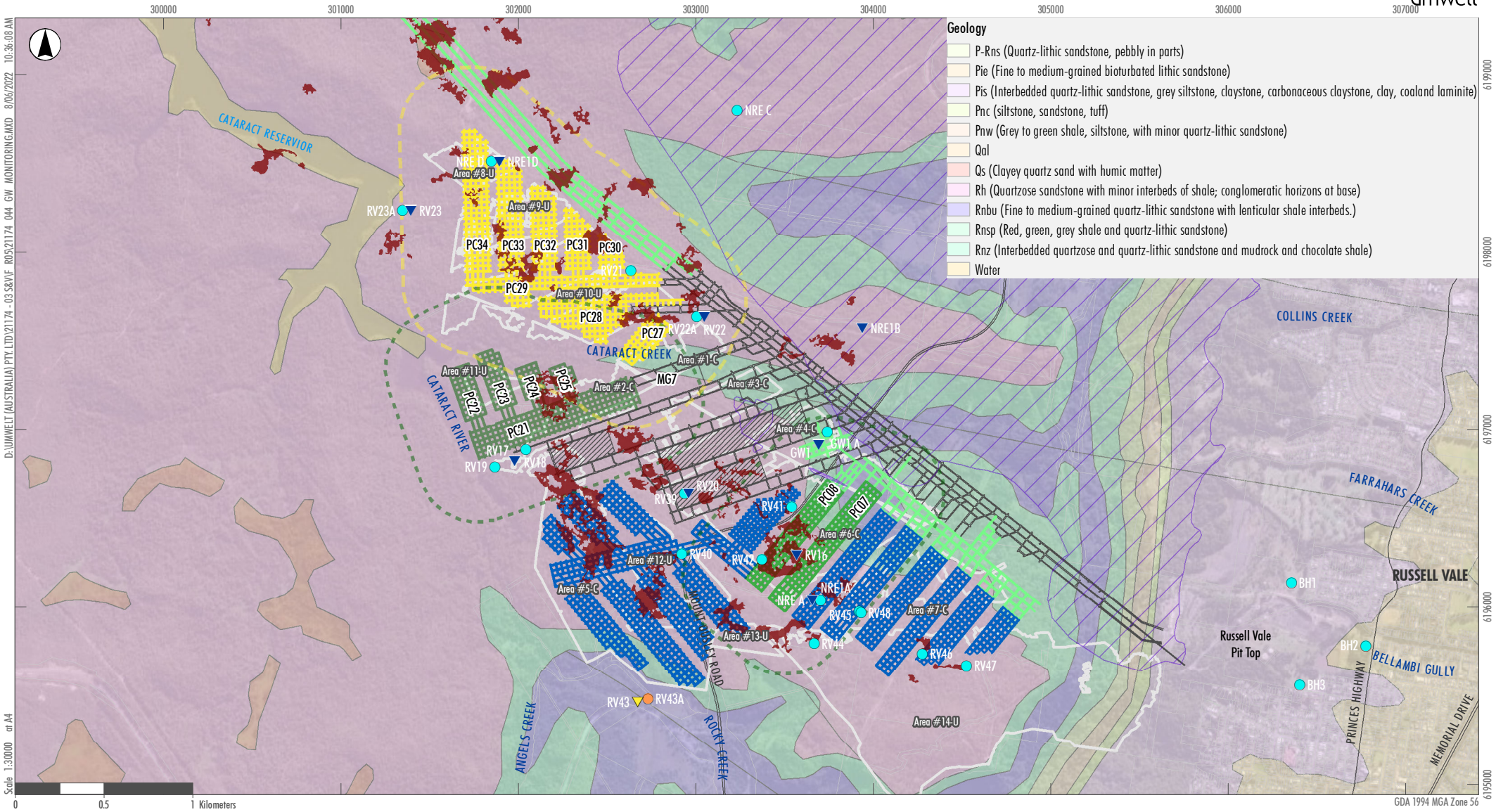
***Groundwater monitoring***

The groundwater monitoring program is described in detail in Section 7 of the GWMP (see **Appendix H**). The Extraction Plan Stage 1 and Stage 2 groundwater monitoring framework utilises a range of monitoring techniques with their role in the monitoring program summarised below:

- **Shallow Swamp Piezometer**: Existing piezometers indicate the swamps are often unsaturated, and the occurrence of groundwater varies between and within the swamp clusters. Some swamps, particularly those in the middle of a large swamp cluster, show a good response to rainfall events. Monitoring will be conducted at all monitoring points, and site-specific water level triggers assigned for the more saturated monitoring locations to enable analysis of any changes in conditions during mining, to inform adaptive management practices.
- **Moisture Probes**: Assist in investigation of any observed changes to vegetation or water levels. Not used as triggers due to the variability within and between swamp clusters, but potential for use as a trigger in subsequent EPs if able to be used to detect trend changes relative to other sites.
- **Water Quality Data – Swamp Piezometers**: Assist in identifying any changes in groundwater quality within the swamp which may indicate an impact. This includes changes in environmental water tracers, including physiochemical properties and major ions that may indicate a change in recharge source. Additional sampling of environmental water isotopes can also be undertaken to inform targeted field investigations if considered warranted.
- **Paired Bores:** Refers to bores near swamp monitoring sites that intersect the shallow weathered and deeper Triassic age sandstone units. Data from these bores and vibrating wire piezometers (VWPs) is used to assess potential changes in interactions between swamp aquifers and the deeper water table within underlying sandstone aquifer. Triggers have been assigned to the groundwater bores as presented in the Groundwater Management Plan (RVC EC PLN 006), which includes water level and vertical head profile triggers.
- **Water Quality Data – Shallow sandstone (paired) bores**: Routine water quality analysis is undertaken within the shallow sandstone bores, including two monthly sampling of physiochemical properties and major ions. In conjunction with the swamp water quality data, this assists with identifying any changes in recharge sources/groundwater mixing. Additional sampling of environmental water isotopes can also be undertaken to inform targeted field investigations if considered warranted.
- Groundwater monitoring locations are presented in **Figure 15**.

This monitoring will be conducted at a range of frequencies, from monthly through to annually. Monitoring frequency in upland swamps will be increased during periods when predicted impacts are more likely.

The monitoring and management of potential groundwater impacts to upland swamps is discussed further in **Appendix J**.

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  - U - Unconfirmed as collapsed/subsided
- Upland Swamp
- Sill
- Road

Monitoring Locations:

- VWP Monitoring Site
- OSP Monitoring Site
- VWP Proposed Monitoring Site
- OSP Proposed Monitoring Site

FIGURE 15

Groundwater Monitoring

Image Source: ESRI (2021) Data source: DFSI (2020)

## 6.3 Biodiversity Management Plan

### 6.3.1 Overview

The EP Area is located on the Woronora plateau in the Sydney Basin bioregion. The Woronora plateau supports a diverse range of vegetation communities and associated flora and fauna species, with disturbance, including weeds, limited to fire trails and infrastructure associated with water storage, electricity easements, transport and mining activities.

- areas of sensitive habitat in the study area include (Biosis 2014a)
  - rocky environments
  - coastal upland swamps (listed as an EEC)
  - ground Water dependent terrestrial vegetation communities
  - aquatic environments (Cataract Creek, Cataract River, Bellambi Creek and their tributaries).

The coastal upland swamps are subject to their own specific monitoring plan and are discussed in further detail in **Appendix J**. The other sensitive habitats as mentioned above are further described below and within the Biodiversity Management Plan (BMP) which can be found in **Appendix I.**

***Aquatic Environments***

The EP Areas are located within the catchment of three major streams and their tributaries: Cataract River, Cataract Creek and Bellambi Creek.

Cataract River is located to the south of the Wonga East area. Within the EP Area, Cataract River is a fourth order stream connecting to the south arm of Cataract Reservoir. Cataract River is bordered by Coachwood Warm Temperate Rainforest vegetation (NPWS 2002). Mining within the EP Area does not propose any second workings under Cataract River. However, second workings will be undertaken beneath some tributaries and the catchment of Cataract River.

Bellambi Creek, a third order stream, is located to the north of the Wonga East area. Vegetation surrounding Bellambi Creek consists of Coachwood Warm Temperate Rainforest (NPWS 2002). Bellambi Creek will not be mined under, however first workings associated with mains development will be undertaken beneath some tributaries and the catchment of Bellambi Creek.

Cataract Creek is located within the Wonga East area, with second workings located external to the south of the main channel on the eastern side. Cataract Creek is bordered by upland swamps, dry sclerophyll forest, wet sclerophyll forest in the upper reaches and wet sclerophyll forest and rainforest vegetation in the lower reaches. In the lower reaches the canopy along Cataract Creek is closed and the creek is shaded, whilst in the upper reaches it is open.

The channel morphology of the creek is characterised by sandstone benches and ephemeral pools in the upper reaches and an alternating series of long pools and shorter bars and riffles in the lower reaches. Bars and riffles are composed of various combinations of bedrock, boulders, cobble, pebble and gravel. Large woody debris is relatively common, forming dams and submerged snags in pools. There is natural variation in water levels both within and between seasons (Cardno Ecology Lab 2012a, Cardno Ecology Lab 2012b, Cardno Ecology Lab 2012c).

Second workings will occur beneath parts of Cataract Creek and beneath tributaries and parts of the broader catchment area of Cataract Creek. Parts of Cataract Creek, including the lower reaches, are located within the EP Area.

Streams in the EP Area provide potential habitat for a number of threatened species listed under the Environment Protection and Biodiversity Conservation (EPBC) Act and/or Biodiversity Conservation (BC) Act, including:

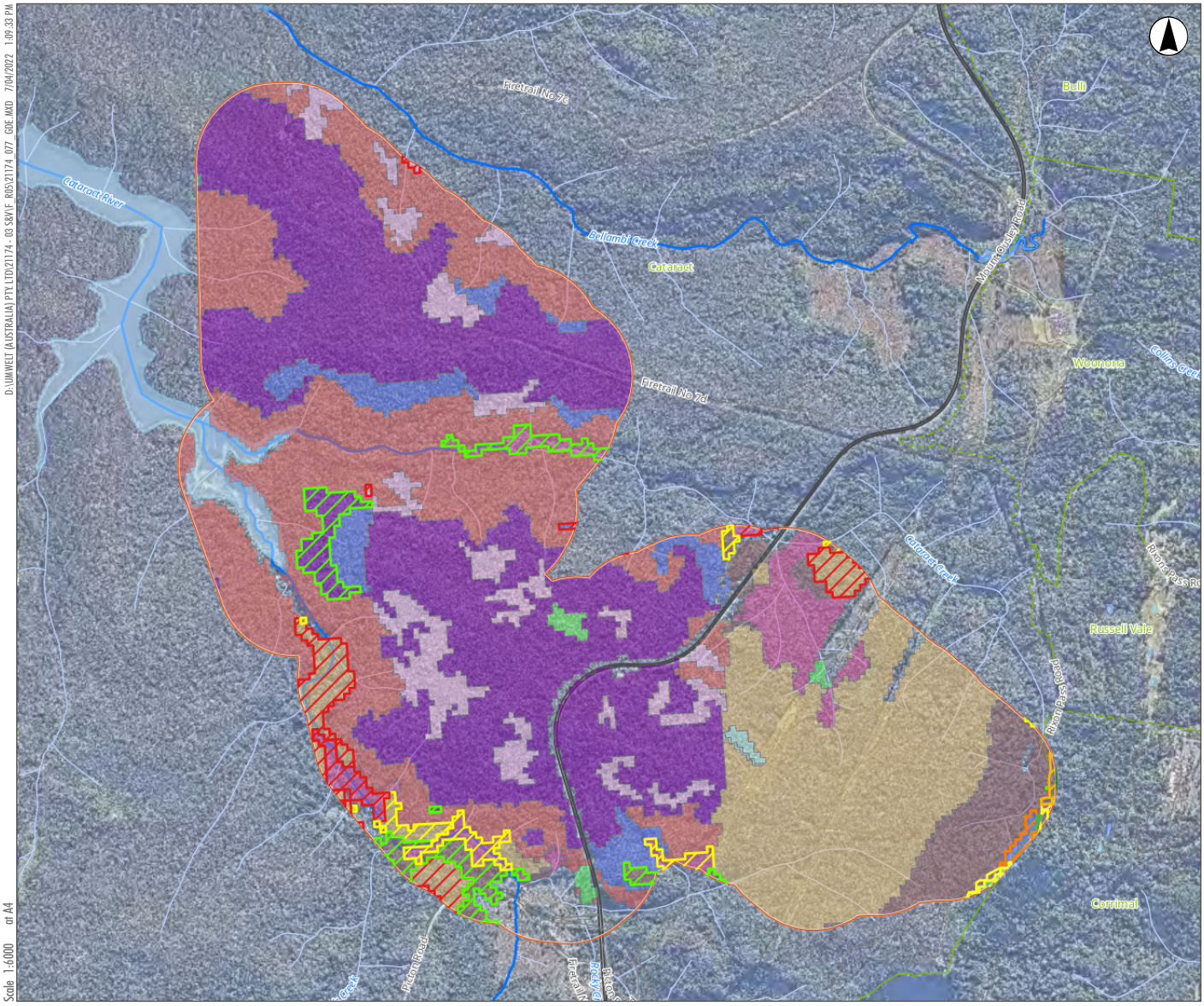
- Giant Burrowing Frog (tributaries only)
- Littlejohn's Tree Frog (tributaries only)
- Macquarie Perch
- Murray Cod (lower reaches adjacent to Lake Cataract)
- Red Crowned Toadlet
- Stuttering Frog (downstream of Mount Ousley Road)
- Silver Perch (lower reaches adjacent to Lake Cataract)
- Southern Myotis
- Stuttering Frog
- Trout Cod (lower reaches adjacent to Lake Cataract).

***Rocky environments***

Rocky outcrops in the EP Area provide potential habitat for a number of threatened species listed under the EPBC Act and/or BC Act, including:

- Broad-headed Snake
- Giant Burrowing Frog
- Large-eared Pied Bat
- Large Bent-winged Bat
- Red Crowned Toadlet
- Rosenberg's Goanna
- Southern Myotis.

The location and extent of vegetation communities and threatened flora and fauna can be found in **Figure 16** and **Figure 17** respectively.




Note: Not to Scale

Legend

UEP Area

**Groundwater Dependent Ecosystems**

- High Potential GDE - from national assessment
- Moderate Potential GDE - from national assessment
- Moderate Potential GDE - from regional studies
- Low Potential GDE - from national assessment
- Low Potential GDE - from regional studies

**Plant Community Types**

- Blackbutt - Turpentine - Bangalay moist open forest on sheltered slopes and gullies, southern Sydney Basin
- Gully Gum - Sydney Peppermint - Yellow Stringybark moist open forest of coastal escarpments, southern Sydney Basin Bioregion
- Hairpin Banksia - Kunzea ambigua - allocasuarina distyla health on coastal sandstone plateaux, Sydney Basin Bioregion
- Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion
- Lilly Pilly - Coachwood warm temperate rainforest on moist sheltered slopes and gullies, Sydney Basin Bioregion and South East Corner Bioregion
- Needlebush - banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion
- Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin
- Sydney Blue GumXBangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin
- Sydney Peppermint - Smooth-barked Apple- Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin
- Tableland swamp meadow on impeded drainage sites of the western Sydney Basin Bioregion and South Eastern Highlands Bioregion

FIGURE 16

## Vegetation Communities

Image Source: Biosis (April 2022)

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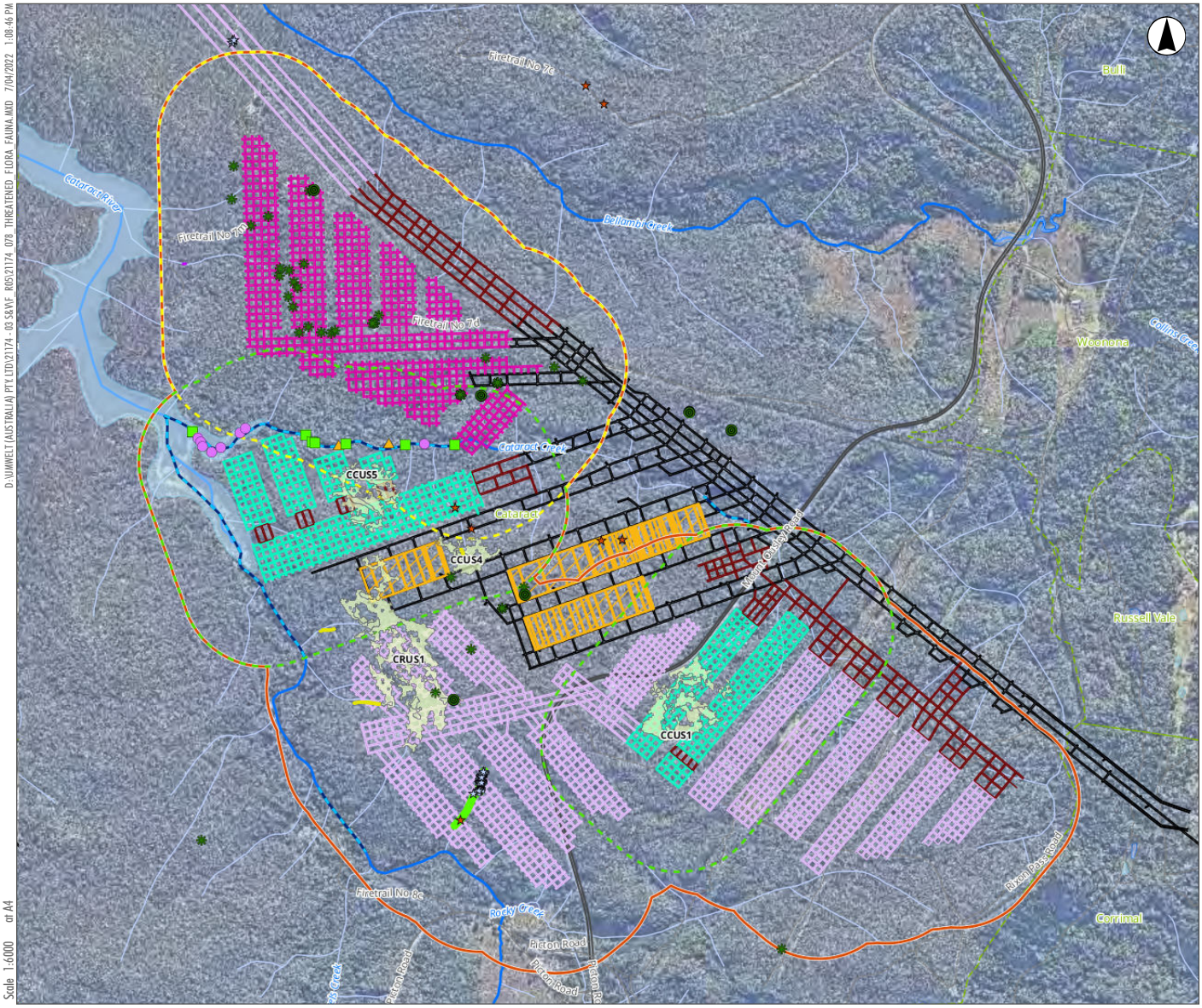



Note: Not to Scale

## Legend

- UEP Area
- RV East old longwall workings
- Pillars
- Past Workings

**EP Areas**

- Stage 1
- Stage 2

**Mine Plan**

- Stage 1
- Stage 2
- Future Stages

**Fish Survey**

- Threatened fish survey reaches

**Recorded Fish Locations**

- Macquarie Perch
- Murray Cod
- Silver Perch

**Threatened Fauna (Biosis Record)**

- Giant Burrowing Frog - *Heleloporus australiacus*

**Threatened Flora (Bionet)**

- Prickly bush-pea - *Pultenaea aristata* (Bionet record)

**Threatened Fauna (Bionet)**

- Red-crowned Toadlet - *Pseudophryne australis*
- Giant Burrowing Frog - *Heleloporus australiacus*

**Threatened Flora (Biosis Record)**

- Prickly bush-pea - *Pultenaea aristata* (Biosis record)
- Giant Dragonfly Habitat

**Threatened Frog Breeding Habitat**

- Red-crowned Toadlet - *Pseudophryne australis*
- Giant Burrowing Frog

**Threatened Frog Non-Breeding Habitat**

- Giant Burrowing Frog

FIGURE 17

Threatened Flora and Fauna

Image Source: Biosis (April 2022)

In Wonga East cliff formations along Cataract Creek are typically less than a few metres high but do extend up to five to 10 metres high in some sections. An assessment of the cliff formations by Biosis did not identify any significant overhangs or caves. Potential roosting habitat for microchiropteran bats is limited in extent and restricted to an area adjacent north of Cataract Creek.

As a result of the lack of cliffs, cave and overhang habitat for microbats (Large-eared Pied Bat, Large Bent-winged Bat, Southern Myotis) were considered to be absent from the study area.

The EP Area does not contain extensive north-western and western facing sandstone benches that could be considered critical wintering habitat for the threatened Broad-headed Snake (EcoLogical 2009). While there are sandstone benches and overhangs present within the broader UEP area, the exfoliating slabs that provide isolated patches of habitat for Broad-headed Snake are largely absent due to the historical removal of bush rock. Based on the limited extent of north-western and western facing sandstone benches, in addition to absence of exfoliating slabs within the EP Area, and the presence of other suitable habitat in the region, potential impacts on the Broad-headed Snake, or other species dependent on rocky habitat are not likely to be significant.

### 6.3.2 Potential Impacts

Mining within the EP Area will not result in the direct removal or clearing of any vegetation. As such there will be no direct impacts to terrestrial and aquatic biodiversity (threatened species and ecological communities), listed under the EPBC Act and/or BC Act, as a result of secondary workings within the EP Area.

Potential impacts to terrestrial and aquatic biodiversity (threatened species and ecological communities), listed under the EPBC Act and/or BC Act, are limited to potential indirect impacts associated with subsidence (such as surface cracking) and hydrological changes affecting surface water regimes or near-surface groundwater.

The secondary workings will not result in any direct impacts to the ecological features identified in the EP area other than minor impacts associated with the installation of monitoring equipment. The management of these minor impacts will be undertaken through the approval process from Water NSW associated with activities carried out in the WaterNSW special area.

In addition, any potential indirect impacts to biodiversity have been avoided by careful mine planning with the current mine plan unlikely to result in significant or detectable impacts to any threatened species or community listed under the EPBC Act or BC Act. It should be noted that the bord and pillar mining method is flexible, can be adapted to different strata conditions and be revised to mitigate or avoid potential surface impacts in response to ongoing hazard assessments and monitoring of strata conditions.

Specific potential subsidence impacts to biodiversity features (other than coastal upland swamps) from underground mining generally (DECC 2007, DoP 2008, PAC 2010), include:

- Impact to aquatic environments, including:
    - Loss of surface flow to the subsurface
    - Loss of aquatic or in-stream habitats, standing pools or changes in water level

- Loss of longitudinal connectivity between pools along streams
- Adverse impacts to water quality
- Simplification of remaining in-stream habitat due to the growth of iron-oxidising bacteria
- Release of gas (methane) into the water column.

- Impacts to rocky environments, including:
  - Cliff falls and rock falls impacting on vegetation or fauna habitat
  - Fracturing of rocky outcrops impacting on vegetation or fauna habitat.

The low levels of subsidence are not predicted to result in any observable impacts to biodiversity outside the EP Area. Impacts on downstream aquatic environments from mining in the form of either changes in water quality, flows, pool depth or sedimentation are also predicted to be negligible.

The predicted subsidence effects from the second workings covered by this EP are not predicted to have any impacts on the rocky environments that would have any more than negligible impacts on threatened species associated with these environments.

Cliff falls and rock falls are not anticipated from the low levels of subsidence predicted however it is noted that rock falls and cliff falls are a natural process associated with the weathering of these features.

### 6.3.3 Performance Measures and Triggers

Performance measures for the EP Area and broader UEP are outlined in Condition C1 of the Development Consent. Performance measures relevant to the BMP are outlined in **Table 14**.

**Table 14 Biodiversity Performance Measures**

| Feature | Performance Measures | Performance Indicator |
|---|---|---|
| **Biodiversity** | | |
| Threatened species, threatened populations, or endangered ecological communities | Negligible environmental consequences | • Change in species abundance<br>• Change in vegetation condition<br>• Change in riparian habitat condition<br>• Refer also to USMP for additional performance indicators as they relate to Coastal Upland Swamps. |
| Aquatic biodiversity: | Negligible environmental consequences | • Change in species abundance<br>• Change in vegetation condition<br>• Change in riparian habitat condition |

The performance triggers relevant to these performance measures are outlined within the TARPs in **Appendix A.**

### 6.3.4 Management and Monitoring Measures

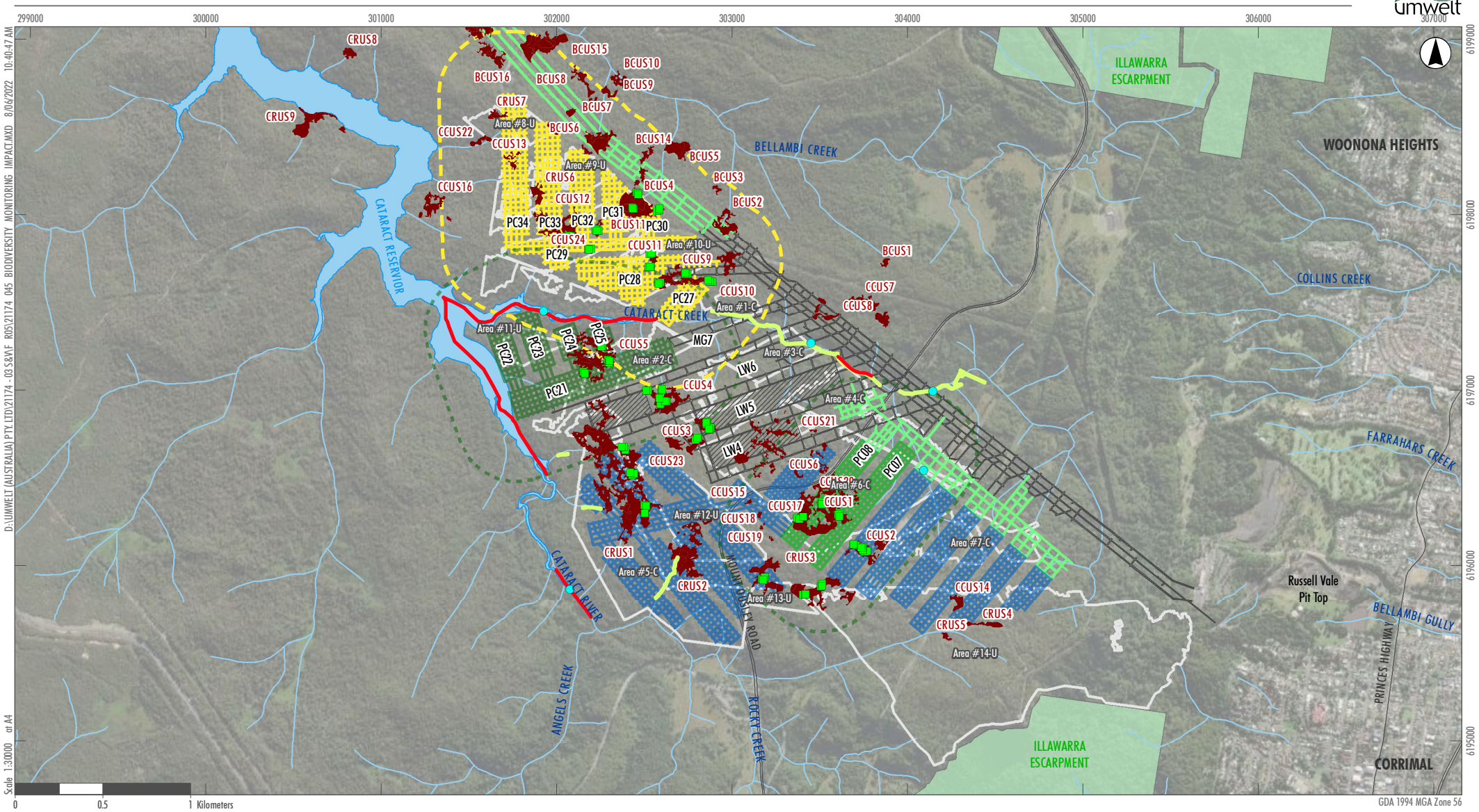
The proposed measures to avoid and reduce potential impacts on terrestrial biodiversity from mining within the EP Area include:

- Selected mining methodology (revision from longwall to bord and pillar mining methods) and a pillar design that is long term stable
- Flexibility in bord and pillar mining method allows for rapid response to changes in loading and other circumstances, providing a more responsive adaptive management system to protect environmental values
- Monitoring and implementation of remediation measures if observed impacts are greater than predicted.

Mining within the EP Area is not anticipated to have any significant impacts on terrestrial or aquatic biodiversity. Monitoring has been designed around the monitoring of responses to higher-than-expected subsidence impacts and/or the investigation of the causes of any observed changes in groundwater levels and vegetation within the swamps. Baseline, reference site and ongoing monitoring will be important in monitoring compliance with biodiversity and upland swamp performance measures.

Groundwater monitoring and vegetation monitoring (qualitative and quantitative) will form the basis of the monitoring. Subsidence monitoring will also be used to identify whether additional monitoring may be required. **Figure 18** and **Figure 19** show the location of proposed biodiversity impact and control monitoring sites respectively within the EP Area. **Appendix I** contains the full Biodiversity Monitoring Program.

The monitoring and management of potential groundwater impacts to upland swamps is discussed further in **Section 6.4** and **Appendix J**.




Legend

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- Stage 1 Areas PC07-08 and PC21-25
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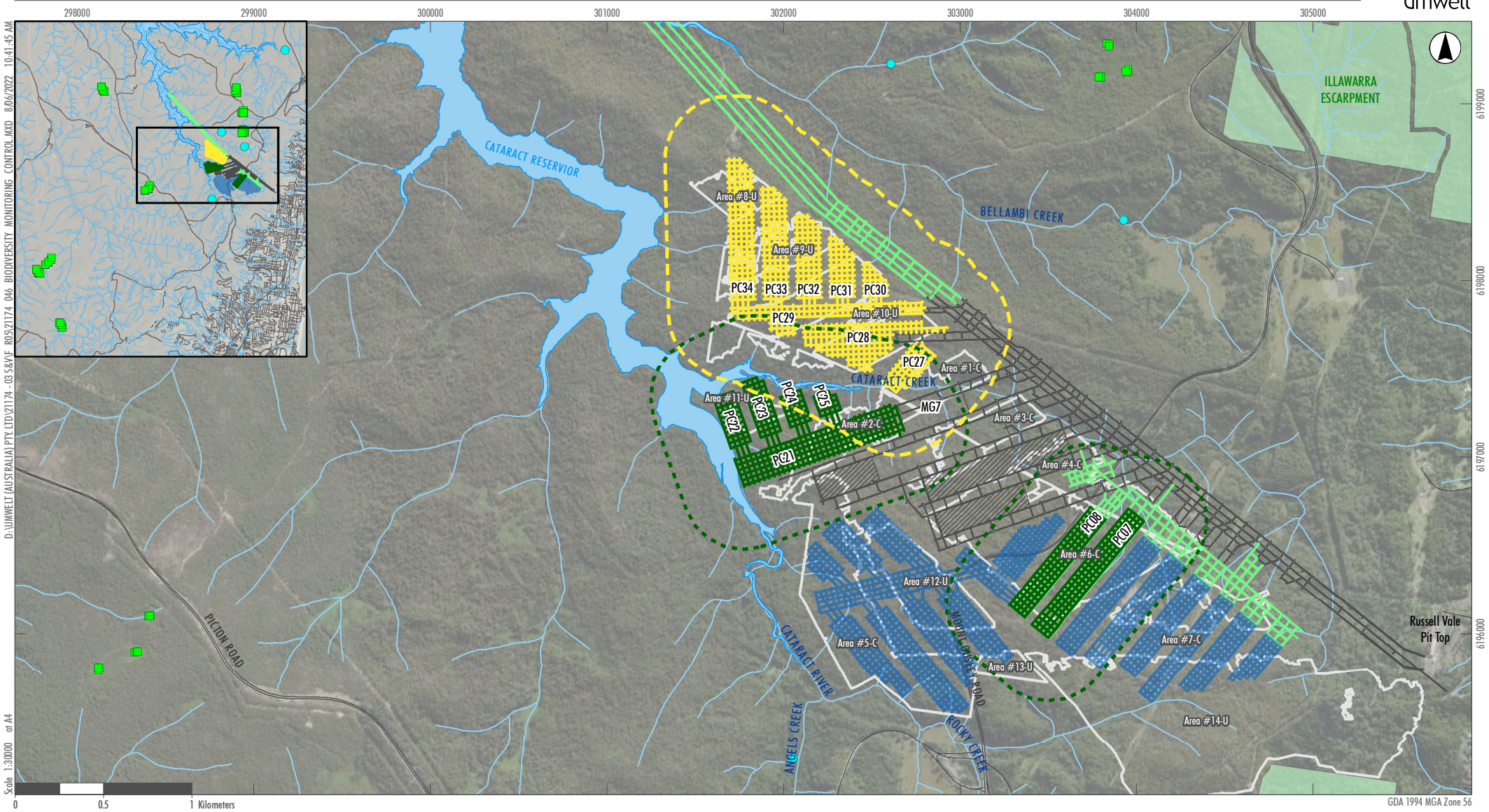
- Wongawilli Seam First Workings (Approved under MP09_0013)
- Bulli Seam Goaf Areas -
  - C - Confirmed as collapsed/subsided
  - U - Unconfirmed as collapsed/subsided
- State Conservation Area
- Upland Swamp
- Threatened Frog Impact Monitoring Transect
- Threatened Fish Monitoring Reaches
- Aquatic Impact Monitoring Site
- Flora Impact Monitoring Site
- Road

FIGURE 18

**Biodiversity Impact Monitoring Sites**

Image Source: ESRI (2021) Data source: DFSI (2020)

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- Bulli Seam Goaf Areas -
  - C - Confirmed as collapsed/subsided
  - U - Unconfirmed as collapsed/subsided
- Road
- State Conservation Area
- Aquatic Impact Monitoring Site
- Flora Impact Monitoring Site

FIGURE 19

**Biodiversity Control Monitoring Sites**

Image Source: ESRI (2021) Data source: DFSI (2020)

## 6.4 Upland Swamp Monitoring Plan

### 6.4.1 Overview

The Upland Swamp Monitoring Plan (USMP) has been prepared in accordance with Condition C10(g)(v) of the Development Consent. The full USMP can be found in **Appendix J**.

***Coastal Upland Swamps***

Detailed mapping and characterisation of Coastal Upland Swamps in the Sydney Basin Bioregion EEC (listed under the EPBC Act and BC Act) was undertaken by Biosis (2012) throughout the UEP area. A total of 37 upland headwater swamps (approximately 29.45 hectares in total) were recorded in the Stage 1 and 2 EP area. All 37 swamps are considered to meet the requirements for listing under the EPBC Act and BC Act.

The coastal upland swamps in the UEP and EP Areas are markedly different to other upland swamps on the Woronora plateau in that they are predominantly drier, generally smaller with shallower soils, have less humic material, have more interspersed sandstone outcrops within their outlines, and are less spatially continuous than a "typical" humic, saturated swamp (Biosis 2014b).

Coastal upland swamps in the EP Area also provide potential habitat for a number of threatened species listed under the EPBC Act and/or BC Act, that are susceptible to subsidence, including:

- Giant Dragonfly
- Leafless Tongue-orchid
- Littlejohn's Tree Frog
- Prickly Bush-pea
- Stuttering Frog.

### 6.4.2 Potential Impacts

No direct impacts to Coastal Upland Swamps will result from the proposed second workings covered by this EP. Second workings covered in this EP will not result in the direct removal or clearing of any vegetation other than minor localised and temporary impacts associated with the installation of monitoring instrumentation.

Potential indirect impacts to the coastal upland swamps associated with subsidence from underground mining generally can include:

- Alteration of hydrological regimes through fracturing of bedrock beneath coastal upland swamps or shearing.
- Changes in concentration of water due to changes in water distribution resulting from changes in tilts.
- Increased scour and erosion potential due to changes in water distribution due to changes in tilts.

Notwithstanding they are within the Stage 1 EP area, there is no potential for subsidence impacts from the proposed Stage 1 second workings to occur at Coastal Upland Swamps CCUS3, CCUS6, CCUS10, CCUS15 CCUS21 and CCUS23, as these swamps will not be directly mined beneath and are outside of conservative angle of draw allowances,

Similarly, there is no potential for subsidence impacts associated with the Stage 2 workings to occur at Coastal Upland Swamps; BCUS2, BCUS3, BCUS5, BCUS8, BCUS9, BCUS14, BCUS15, BCUS16, CCUS4, CCUS16, and CCUS22 for similar reasons.

The predicted levels of incremental vertical subsidence at swamps located directly above Stage 1 and 2 second workings (BCUS4, BCUS6, BCUS7, BCUS11, CCUS1, CCUS5, CCUS9, CCUS10, CCUS11, CCUS12, CCUS13, CCUS24, CRUS6 and CRUS7) are in the order of up to 100 mm. All other coastal upland swamps (CCUS2, CCUS4, CCUS17, CCUS18, CCUS 19, CCUS20, CRUS1, CRUS3) are predicted to experience less than 20 mm of vertical subsidence from Stage 1 and Stage 2 second workings. These levels of subsidence are not considered to result in any observable impact to these coastal upland swamps, even allowing for cumulative impacts associated with past mining in overlying seams.

As discussed in **Section 6.2.2**, there is no predicted increase in drawdown below any swamps located above the proposed EP mining areas however long-term drawdown in the water table is predicted below CCUS3, CCUS6, CCUS6 and near CCUS4. Existing water table levels are already modelled to be below the base of these swamps and the predicted impacts from previously approved operations would result in water table reductions further in these areas in the absence of any impacts associated with the development approved under the Development Consent. The mining proposed under Stage 1 and Stage 2 second workings is not predicted to have any subsidence effects on these three swamps, even under conservative assumptions which have regard to pillar failure. Accordingly, any observed impacts to these swamps are not likely to be due to impacts associated with proposed mining.

In the absence of any likely impacts to the coastal upland swamp vegetation, surface water or groundwater attributes (even in swamps where there is a potential impact pathway), the mining of PC07-08, PC21 to PC25 and PC27 to PC34 are not predicted to have any impacts on threatened flora and fauna species associated with these swamps, including:

- Giant Dragonfly
- Leafless Tongue-orchid
- Littlejohn's Tree Frog
- Prickly Bush-pea
- Stuttering Frog.

### 6.4.3 Performance Measures and Triggers

Performance measures for the EP Areas and broader UEP are outlined in Condition C1 of the Development Consent. Performance measures relevant to Coastal upland swamps are reproduced in **Table 15** and reflect the predicted negligible level of impact expected by the proposed bord and pillar mining methods.

**Table 15 Coastal Upland Swamp Performance Measures**

| Feature | Performance Measures | Performance Indicators |
|---|---|---|
| Coastal upland swamps identified in the figure in Appendix 5 of the Development Consent. | Negligible environmental consequences including negligible change to the structural integrity of the bedrock base or any controlling rockbar of the swamp. | Observed land subsidence above threshold level<br>Change in species abundance<br>Change in vegetation condition<br>Change in species composition<br>Water holding capacity of swamp |
| All coastal upland swamps (EPBC 2020/8702) | Vertical subsidence not to exceed 100 mm at any swamp | Vertical subsidence relative to pre-mining |
| Threatened species, threatened populations, or endangered ecological communities | Negligible environmental consequences | Change in species abundance<br>Change in swamp size. |

The performance triggers relevant to these performance measures are outlined in the TARPs as defined within **Appendix A** and **Appendix J**.

### 6.4.4 Management and Monitoring Measures

#### 6.4.4.1 Monitoring

The existing USMP was developed to monitor impacts associated with existing approved longwall mining in the Wongawilli Seam and includes baseline monitoring for the previously proposed longwall mining. The current monitoring program has focussed on the monitoring of the groundwater systems associated with the swamps and vegetation within the swamps. The level of current monitoring in swamps over and in the vicinity of longwall panels reflects the significantly higher potential for impacts to occur to swamps from the increased subsidence and groundwater impacts associated with longwall mining. This monitoring framework was developed in consultation with both Commonwealth and NSW agencies. The existing monitoring program and recent monitoring results are detailed in the Stage 1 and Stage 2 EP USMP (**Appendix J**).

The proposed monitoring program to be implemented for this EP builds on the existing groundwater and vegetation monitoring framework.

***Proposed Vegetation Monitoring***

Monitoring is undertaken according to a modified Before-After Control-Impact (BACI) design where data is collected before (baseline) and after impact at control and impact sites. Data collected during baseline monitoring is used for comparison to data collected during and after mining (the before-after component) and data collected at impact sites is compared to data collected at control sites (the control-impact component). The duration of post-mining monitoring is determined based on results of annual analysis of data as well as observed impacts to surface features and other monitoring (e.g., groundwater) but includes a minimum of one-year post-mining at sites where data from all monitoring programs shows negligible impacts.

The USMP for the swamps potentially impacted by the mining of PC21, PC07-08, PC22-PC25 and PC27-PC34 includes a combination of:

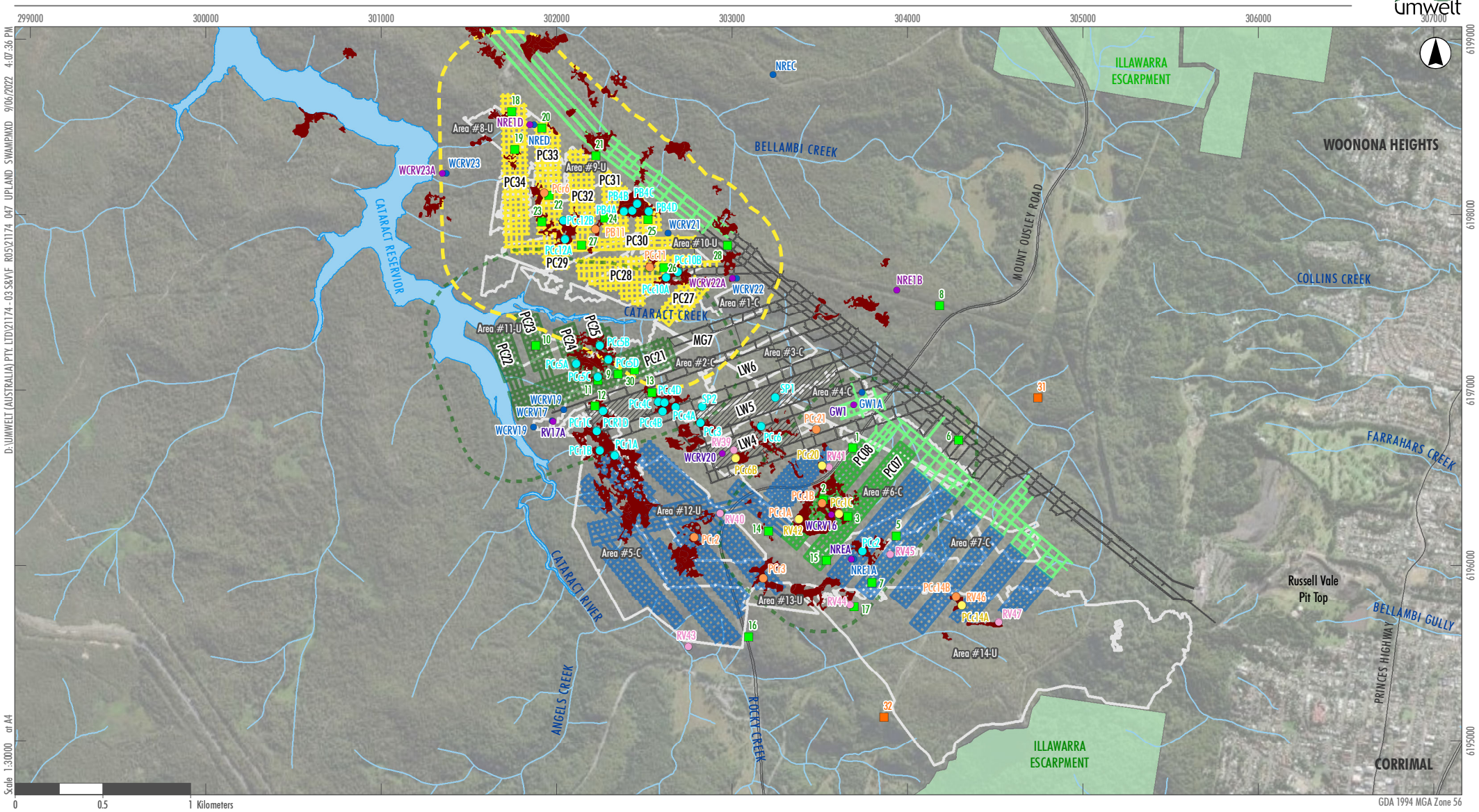
- Baseline LiDAR and aerial imagery analysis for swamp extent mapping.
- GNSS and LiDAR subsidence monitoring and analysis.
- BAM Data collection.
- Vegetation transect monitoring and observational monitoring in coastal upland swamps biannually during spring and autumn.
- Photopoint monitoring of coastal upland swamps.
- Soil moisture, groundwater levels, groundwater quality and swamp outflow.
- Giant Dragonfly (*Petalura gigantea*) targeted surveys and amphibian monitoring (Giant Burrowing Frog).

The key role for each of the proposed vegetation monitoring techniques is summarised in **Table 16.**

**Table 16 Vegetation Monitoring Techniques**

| Technique | Description |
|---|---|
| LiDAR analysis and Field Inspection | Provide baseline and periodic mapping of swamp extent and swamp sub-communities. |
| BAM Plots (Impact sites) | Provide baseline for any offsetting requirements in the unlikely event of observed impacts attributable to mining. For small swamps without permanent transects, BAM sites also provide quantitative data to assess vegetation changes that may be observed in photo points (e.g., dieback in specific plants, changes in extent of woody vegetation species). |
| Vegetation Transects | Quantitative data for statistical analysis of changes in total species richness (TSR) and Species Composition at impact sites relative to observed changes in control sites (including yet to be impacted sites (non-impact sites)). Trigger for further investigation (GW, moisture, veg transect). Baseline against which changes can be assessed. |
| Observational monitoring (impact sites) | Provide baseline condition assessment of swamp (when coupled with BAM Plot and transect) prior to any potential impacts. Trigger for further investigation (GW, moisture, veg transect). Enable visual assessment of vegetation condition to be assessed and detect any senescence/dieback. |
| Observational monitoring (non-impact sites) | Provide qualitative control for comparison to impact sites to assess whether any changes observed at impacts sites are also observed at control sites. |

A summary of the ecological monitoring program sites, methods and timing are provided in the **Appendix I**. A detailed summary of the proposed vegetation monitoring and data analysis to be undertaken is contained in the USMP. Key aspects of the USMP (including groundwater and subsidence monitoring) are shown in **Figure 20**.




## Legend

- Stage 2 Area PC27-34
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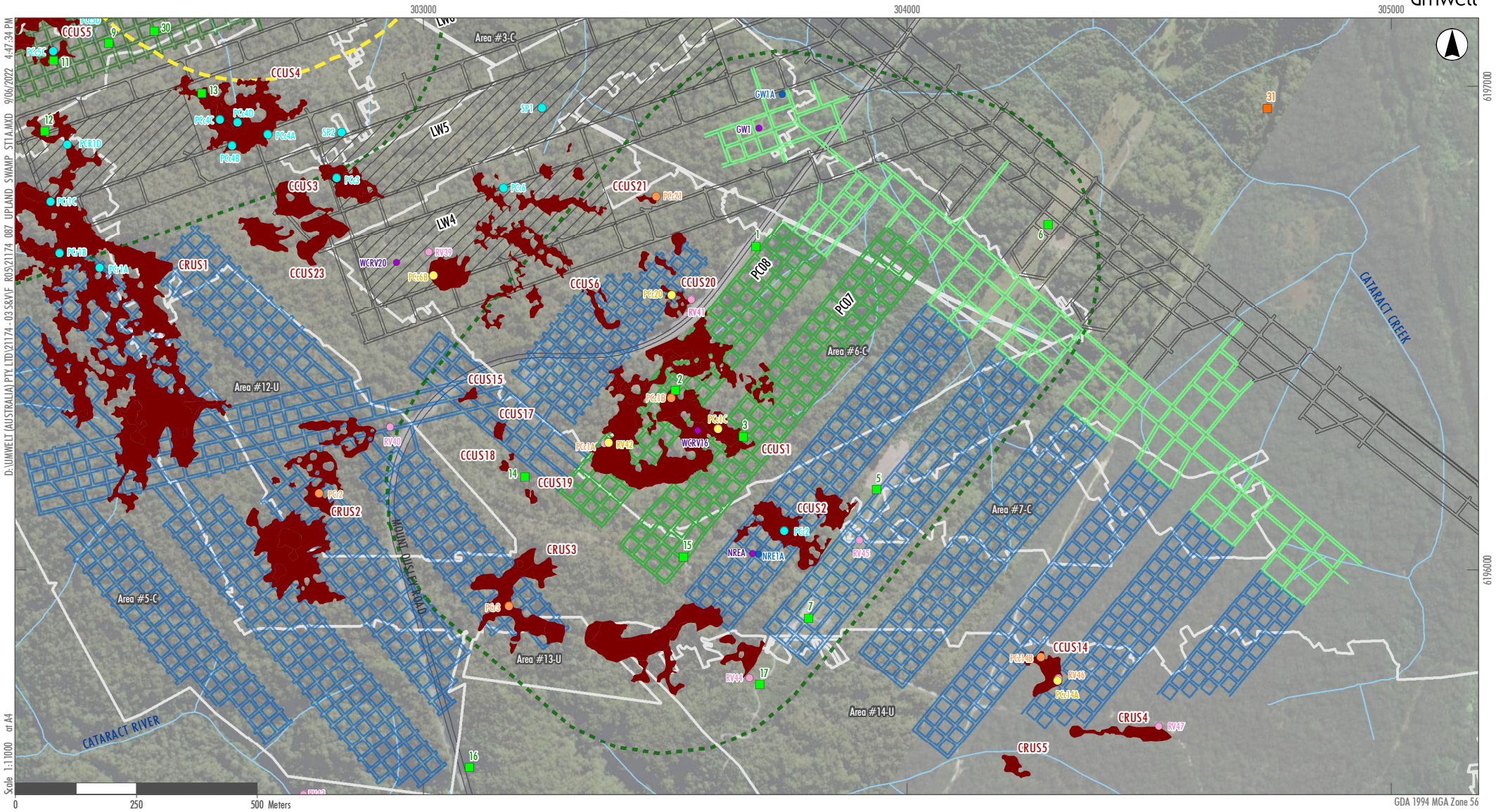
- State Conservation Area
- Upland Swamp
- Subsidence Monitoring GNSS Unit
- Conceptual Subsidence Monitoring GNSS Unit
- Groundwater Monitoring Site OSP
- Groundwater Monitoring Site VWP
- Proposed Monitoring Site OSP
- Proposed Swamp Monitoring Site SM
- Proposed Swamp Monitoring Site SM and PZ
- Swamp Monitoring Site SP
- Road

FIGURE 20

**Upland Swamp Monitoring Program (Including Groundwater and Subsidence Monitoring)**

Image Source: ESRI (2021) Data source: DFSI (2020)

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- Proposed Monitoring Site OSP
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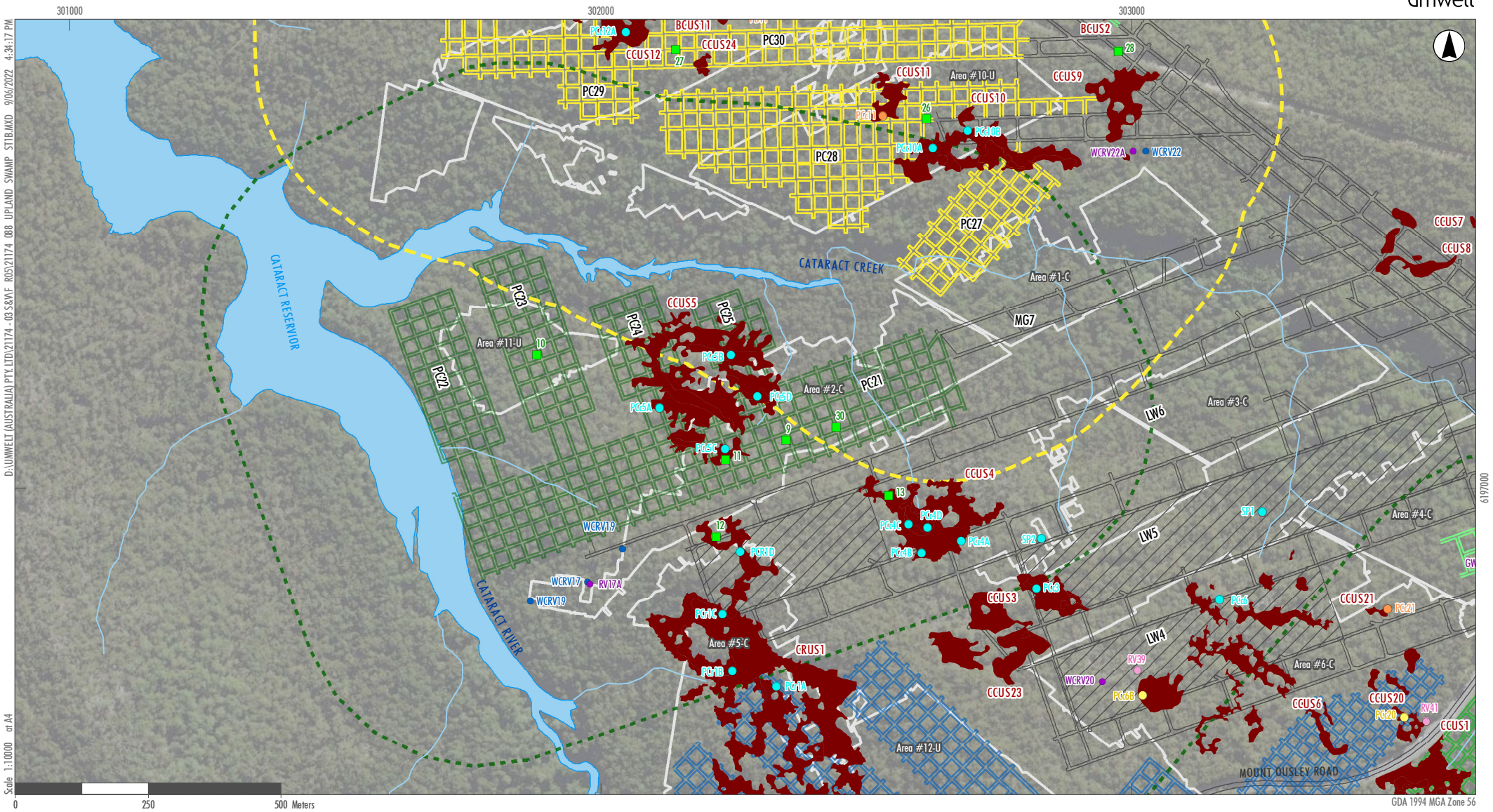
- Proposed Swamp Monitoring Site SM and PZ
- Swamp Monitoring Site SP
- Road

FIGURE 20A

Upland Swamp Monitoring Program
(Including Groundwater and Subsidence Monitoring)

Image Source: ESRI (2021) Data source: DFSI (2020)

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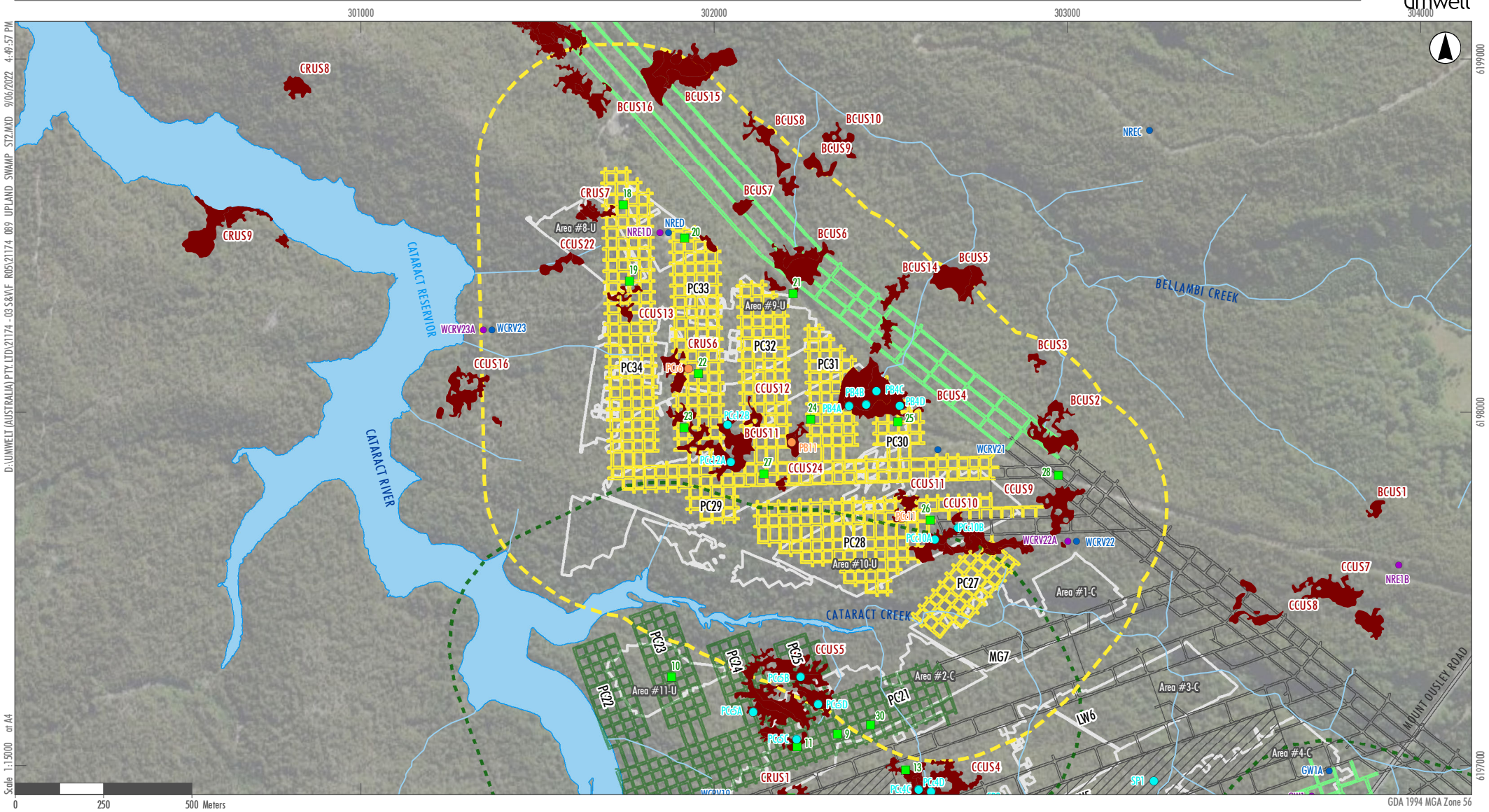
- Conceptual Subsidence Monitoring GNSS Unit
- Groundwater Monitoring Site OSP
- Groundwater Monitoring Site VWP
- Proposed Monitoring Site OSP
- Proposed Swamp Monitoring Site SM
- Proposed Swamp Monitoring Site SM and PZ
- Swamp Monitoring Site SP
- Drainage Line
- Road

FIGURE 20B

Upland Swamp Monitoring Program
(Including Groundwater and Subsidence Monitoring)

Image Source: ESRI (2021) Data source: DFSI (2020)

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GDA 1994 MGA Zone 56

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## Legend

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- Groundwater Monitoring Site VWP
- Proposed Monitoring Site OSP
- Proposed Swamp Monitoring Site SM
- Proposed Swamp Monitoring Site SM and PZ
- Swamp Monitoring Site SP
- Drainage Line
- Road

FIGURE 20C

# Upland Swamp Monitoring Program (Including Groundwater and Subsidence Monitoring)

Image Source: ESRI (2021) Data source: DFSI (2020)

### *Swamp Groundwater monitoring*

Groundwater monitoring within swamps currently includes the use of standpipe piezometers and soil moisture probes. The proposed swamp groundwater monitoring framework will utilise a range of monitoring techniques with their role in the monitoring program summarised in **Table 17**.

**Table 17 Swamp Groundwater Monitoring**

| Technique | Description |
|---|---|
| Shallow Swamp Piezometer | Existing piezometers indicate the swamps are often unsaturated and the occurrence of groundwater varies between and within the swamp clusters. Some swamps, particularly those in the middle of a large swamp cluster, show a good response to rainfall events. Monitoring will be conducted at all monitoring points with site specific water level triggers assigned for the more saturated monitoring locations to enable analysis of any changes in conditions during mining, to inform adaptive management practices. |
| Paired bores | Refers to bores near swamp monitoring sites that intersect the shallow weathered and deeper Triassic age sandstone units. Data from these bores and vibrating wire piezometers (VWPs) is used to assess potential changes in interactions between swamp aquifers and the deeper water table within underlying sandstone aquifer. Triggers have been assigned to the groundwater bores as presented in the Groundwater Management Plan (RVC EC PLN 006), which includes water level and vertical head profile triggers. |
| [Soil] Moisture Probes (Impact sites) | Assist in investigation of any observed changes to vegetation or water levels. Not used as triggers but potential for use as a trigger in subsequent EPs if able to be used to detect trend changes relative to other sites. Minimum of 6 months data pre-impact to enable calibration should investigation be required. |
| Water Quality Data – Swamp Piezometers | Assist in identifying any changes in groundwater quality within the swamp which may indicate an impact. This includes changes in environmental water tracers, including physiochemical properties and major ions that may indicate a change in recharge source. Additional sampling of environmental water isotopes can also be undertaken to inform targeted field investigations if considered warranted. |
| *Water Quality Data – Shallow sandstone bores* | Routine water quality analysis is undertaken within the shallow sandstone bores, including two monthly sampling of physiochemical properties and major ions. In conjunction with the swamp water quality data, this assists with identifying any changes in recharge sources/groundwater mixing. Additional sampling of environmental water isotopes can also be undertaken to inform targeted field investigations if considered warranted. |

The location of swamp groundwater monitoring sites is shown in **Figure 20.**

Only the swamp piezometers installed within CCUS1, CCUS5 and CCUS20 will be used for swamp groundwater performance indicator trigger monitoring. If changes in swamp water levels are observed which differ to those in non or less impacted monitoring sites, further investigation into the cause of such change may be required depending on the location and extent of change observed. The triggers for such investigations are detailed in **Appendix A** and the USMP (**Appendix J**). The monitoring of water levels, water quality and moisture within swamps will inform these investigations. Further soil moisture probes and shallow swamp piezometers can also be installed if required to provide further data regarding water and moisture levels within the swamps

where changes have been observed. This analysis can also be supported through the use of environmental water tracers, where appropriate, to assess the potential for any leakage from a swamp or humic soils to the underlying sandstone, and/or assess direct rain recharge to adjacent sandstone followed by lateral groundwater flow to beneath a swamp or shallow soils.

Swamp specific water balances can be developed based on the data collected if these are considered to be of benefit to the investigation of potential causes of any observed changes in swamp groundwater regimes.

The proposed swamp groundwater monitoring framework is described in detail in the USMP (**Appendix J**) and summarised in **Table 18, Table 19** and **Table 20**.

#### 6.4.4.2 Management

The subsidence TARPs are designed to identify circumstances where observations indicate that impact pathways and/or the magnitude of potential impacts may differ from those predicted. Departures from these predictions may indicate the *potential* for exceedances of biodiversity and water related performance criteria.

The subsidence TARP triggers have been designed to enable proactive mine planning decisions to be made to minimise the risk of subsidence related impacts on swamps. Should monitoring indicate actual or potentially higher than predicted levels of subsidence, the need for additional subsidence management measures will be considered. As the subsidence predictions are based on assumptions around the proposed bord and pillar layout being long term stable, incidences of pillar instability (e.g., pillar failure or pillars punching into the roof or floor) or strata failure within 250 metres of swamps have also been identified as Level 3 triggers. Adaptive measures that may be implemented include additional strata control measures, larger pillar sizes or changes in mine progression to avoid direct mining under the swamps. These decisions will be informed by a risk assessment having regard to the potential for subsidence predictions to be proceeded, observations of impacts from earlier mining of the panels and the location of the observed trigger exceedance. Additional and/or increased groundwater and vegetation monitoring may also be implemented to better inform adaptive management and contingency planning.

**Table 18 UEP upland swamp ecological monitoring requirements**

| Category | Rationale | Relevant swamps | Monitoring[1] | Timing and frequency |
|---|---|---|---|---|
| 1A | • Swamps with >2.0 ha within 350 m of the UEP.<br>• Partly or directly mined beneath by Wongawilli Seam bord and pillar 'second workings' or would be within subsidence zone for a conceptual Wongawilli Seam Pillar Failure scenario (approx. 50 m from panels).<br>• Pre-existing cumulative tensile strains from Bulli and Balgownie seam workings of >2 mm/m and <10 mm/m. | **Stage 1**<br>• CCUS5<br>• CRUS1<br>• CRUS3<br>**Stage 2**<br>• BCUS4<br>• CCUS5 | **Pre-mining**<br>• Swamp extent review and update.<br>• Baseline condition assessment.<br>• Detailed field assessment.<br>**During Mining**<br>• Detailed field assessment.<br>• Further monitoring only required if other TARP levels exceeding negligible impacts are triggered e.g., subsidence monitoring.<br>**Post-mining**<br>• Detailed field assessment.<br>• Further monitoring only required if other TARP levels exceeding negligible impacts are triggered e.g., subsidence monitoring. | **Pre-mining**<br>• Swamp extent review and update prior to any 'second workings' within 50 m of the swamp.<br>• Baseline condition assessment prior to any 'second workings' within 50 m of the swamp.<br>• A minimum of two spring and two autumn detailed field assessments to be undertaken prior to any 'second workings' within 50 m of the swamp.<br>**During Mining**<br>• Detailed field assessments undertaken in spring and autumn while 'second workings' are within 50 m of the swamp.<br>**Post-mining**<br>• A minimum of one spring and one autumn detailed field assessment to be undertaken once 'second workings' have progressed more than 50 m from the swamp. |

[1] Refer to the USMP for a detailed description of the monitoring methodology.

| Category | Rationale | Relevant swamps | Monitoring[1] | Timing and frequency |
|---|---|---|---|---|
| | • Swamps any size.<br>• Partly or directly mined beneath by Wongawilli Seam bord and pillar 'second workings' or would be within subsidence zone for a conceptual Wongawilli Seam Pillar Failure scenario (approx. 50 m from panels).<br>• Pre-existing cumulative tensile strains from Bulli and Balgownie seam workings of >10 mm/m. | **Stage 1**<br>• CCUS1<br>• CCUS6<br>• CCUS20 | | **Pre-mining**<br>• Swamp extent review and update prior to any 'second workings' within 350 m of the swamp.<br>• Baseline condition assessment prior to any 'second workings' within 350 m of the swamp.<br>• A minimum of two spring and two autumn detailed field assessments to be undertaken prior to any 'second workings' within 350 m of the swamp.<br>**During Mining**<br>• Detailed field assessments undertaken in spring and autumn while 'second workings' are within 350 m of the swamp.<br>**Post-mining**<br>• A minimum of one spring and one autumn detailed field assessment to be undertaken once 'second workings' have progressed further than 350 m from the swamp. |

| Category | Rationale | Relevant swamps | Monitoring[1] | Timing and frequency |
|---|---|---|---|---|
| 1B | • Swamps any size.<br>• Not directly mined under Wongawilli Seam bord and pillar 'second workings' or within subsidence zone for conceptual Wongawilli Seam Pillar Failure scenario (approx. 50 m from panels).<br>• Swamps located over areas of increased predicted drawdown >1m in the underlying sandstone aquifer. | **Stage 1**<br>• CCUS3<br>• CCUS21 | **Pre-mining**<br>• Swamp extent review and update.<br>• Baseline condition assessment.<br>• Detailed field assessment.<br>**During Mining**<br>• Detailed field assessment.<br>• Further monitoring required if other TARP levels exceeding negligible impacts are triggered e.g. subsidence monitoring.<br>**Post-mining**<br>• Detailed field assessment.<br>• Further monitoring required if other TARP levels exceeding negligible impacts are triggered e.g. subsidence monitoring. | **Pre-mining**<br>• Swamp extent review and update before any 'second workings' within 350 m of the swamp.<br>• Baseline condition assessment before any 'second workings' within 350 m of the swamp.<br>• A minimum of one spring and one autumn detailed field assessment before any 'second workings' within 350 m of the swamp.<br>**During Mining**<br>• Detailed field assessments undertaken in spring and autumn while 'second workings' are within 350 m of the swamp.<br>**Post-mining**<br>• A minimum of one spring and one autumn detailed field assessment for swamps that show negligible impacts once 'second workings have progressed more than 350 m from the swamp. |

| Category | Rationale | Relevant swamps | Monitoring[1] | Timing and frequency |
|---|---|---|---|---|
| 2 | • Swamps with >2.0 ha within 350 m of the UEP.<br>• Partly or directly mined beneath by Wongawilli Seam bord and pillar 'second workings' or would be within subsidence zone for a conceptual Wongawilli Seam Pillar Failure scenario (approx. 50 m from panels).<br>• Pre-existing cumulative tensile strains from Bulli and Balgownie seam workings of <2 mm/m. | No applicable swamps | **Pre-mining**<br>• Swamp extent review and update.<br>• Baseline condition assessment.<br>• Detailed field assessment.<br>**During Mining**<br>• Detailed field assessment. Further monitoring only required if other TARP levels exceeding negligible impacts are triggered e.g., subsidence monitoring.<br>**Post-mining**<br>• Detailed field assessment.<br>• Further monitoring only required if other TARP levels exceeding negligible impacts are triggered e.g., subsidence monitoring. | **Pre-mining**<br>• Swamp extent review and update before any 'second workings' within 50 m of the swamp.<br>• Baseline condition assessment before any 'second workings' within 50 m of the swamp.<br>• A minimum of one spring and one autumn detailed field assessment before any 'second workings' within 50 m of the swamp.<br>**During Mining**<br>• Detailed field assessments undertaken in spring and autumn while 'second workings' are within 50 m of the swamp.<br>**Post-mining**<br>• A minimum of one spring and one autumn detailed field assessment for swamps that show negligible impacts once 'second workings have progressed more than 50 m from the swamp. |

| Category | Rationale | Relevant swamps | Monitoring[1] | Timing and frequency |
|---|---|---|---|---|
| | • Swamps with <2.0 ha within 350 m of the UEP.<br>• Partly or directly mined beneath by Wongawilli Seam bord and pillar 'second workings' or would be within subsidence zone for a conceptual Wongawilli Seam Pillar Failure scenario (approx. 50 m from panels).<br>• Pre-existing cumulative tensile strains from Bulli and Balgownie seam workings between 5 mm/m and 10 mm/m. | **Stage 1**<br>• CCUS2 | | |

| Category | Rationale | Relevant swamps | Monitoring[1] | Timing and frequency |
|---|---|---|---|---|
| 3 | • Swamps with <2.0 ha within 350 m of the UEP.<br>• Partly or directly mined beneath by Wongawilli Seam bord and pillar 'second workings' or would be within subsidence zone for conceptual Wongawilli Seam Pillar Failure scenario (approx. 50 m from panels).<br>• Pre-existing cumulative tensile strains from Bulli and Balgownie seam workings of <5 mm/m. | **Stage 1**<br>• CCUS10<br>• CCUS15<br>• CCUS17<br>• CCUS18<br>• CCUS19<br>• CCUS23<br>**Stage 2**<br>• BCUS6<br>• BCUS7<br>• BCUS11<br>• BCUS14<br>• CCUS9<br>• CCUS10<br>• CCUS11<br>• CCUS12<br>• CCUS13<br>• CCUS22<br>• CCUS24<br>• CRUS6<br>• CRUS7 | **Pre-mining**<br>• Swamp extent review and update.<br>• Baseline condition assessment.<br>• Detailed field assessment.<br>**During Mining**<br>• Basic field assessment.<br>• Further monitoring only required if other TARP levels exceeding negligible impacts are triggered e.g., subsidence monitoring.<br>**Post-mining**<br>• Basic field assessment.<br>• Further monitoring only required if other TARP levels exceeding negligible impacts are triggered e.g., subsidence monitoring. | **Pre-mining**<br>• Swamp extent review and update prior to any 'second workings' within 50 m of the swamp.<br>• Baseline condition assessment prior to any 'second workings' within 50 m of the swamp.<br>• A minimum of one spring and one autumn detailed field assessments to be undertaken prior to any 'second workings' within 50 m of the swamp.<br>**During Mining**<br>• Basic field assessments to be undertaken while 'second workings' are within 50 m of the swamp.<br>**Post-mining**<br>• A minimum of one spring and autumn survey post mining for swamps that show negligible impacts, to be undertaken once 'second workings' have progressed further than 50 m from the swamp. |

| Category | Rationale | Relevant swamps | Monitoring[1] | Timing and frequency |
|---|---|---|---|---|
| | • Swamps any size.<br>• Not directly mined under by Wongawilli Seam bord and pillar 'second workings' or within subsidence zone for conceptual Wongawilli Seam Pillar Failure scenario (approx. 50 m from panels).<br>• Located within 350 m of Wongawilli Seam bord and pillar 'second workings'.<br>• Pre-existing cumulative tensile strains from Bulli and Balgownie seam workings of >2 mm/m. | **Stage 1**<br>• CCUS4<br>**Stage 2**<br>• BCUS2<br>• BCUS3<br>• BCUS5<br>• CCUS4<br>• CCUS16 | | **Pre-mining**<br>• Swamp extent review and update prior to any 'second workings' within 350 m of the swamp.<br>• Baseline condition assessment prior to any 'second workings' within 350 m of the swamp.<br>• A minimum of one spring and one autumn detailed field assessments to be undertaken prior to any 'second workings' within 350 m of the swamp.<br>**During Mining**<br>• Basic field assessments to be undertaken while 'second workings' are within 350 m of the swamp.<br>**Post-mining**<br>• A minimum of one spring and autumn survey post mining for swamps that show negligible impacts, to be undertaken once 'second workings' have progressed further than 350 m from the swamp. |

| Category | Rationale | Relevant swamps | Monitoring[1] | Timing and frequency |
|---|---|---|---|---|
| 4 | • Swamps any size.<br>• Not directly mined under by Wongawilli Seam bord and pillar 'second workings' or within subsidence zone for conceptual Wongawilli Seam Pillar Failure scenario (approx. 50 m from panels).<br>• Located within 350 m of Wongawilli Seam bord and pillar 'second workings'.<br>• Pre-existing cumulative tensile strains from Bulli and Balgownie seam workings of <2 mm/m. | **Stage 2**<br>• BCUS8<br>• BCUS9<br>• BCUS15<br>• BCUS16 | **Pre-mining**<br>• Swamp extent review and update.<br>• Baseline condition assessment.<br>**During Mining**<br>• Further monitoring only required if other TARP levels exceeding negligible impacts are triggered e.g., subsidence monitoring.<br>**Post-mining**<br>• Further monitoring only required if other TARP levels exceeding negligible impacts are triggered e.g., subsidence monitoring. | **Pre-mining**<br>• Swamp extent review and update prior to any 'second workings' occurring within 350 m of the swamp.<br>• Baseline condition assessment prior to any 'second workings' occurring within 350 m of the swamp. |
| | • Swamps are not within 350 m of Wongawilli Seam bord and pillar 'second workings'. | • CCUS7<br>• CCUS8 | | |

| Category | Rationale | Relevant swamps | Monitoring[1] | Timing and frequency |
|---|---|---|---|---|
| Control | • Swamps are not located within 350 m of active or completed Wongawilli Seam bord and pillar 'second workings'.<br>• Swamps represent suitable comparison swamps for impact swamps. | • ACUS<br>• BCUS12<br>• BCUS13<br>• S15A(1)<br>• S22<br>• S33<br>• WACUS<br>• WCUS<br>• CRUS2[2] | **Pre-mining**<br>• Detailed field assessment.<br>**During Mining**<br>• Detailed field assessment.<br>• Further monitoring only required if other TARP levels exceeding negligible impacts are triggered at impact sites e.g., subsidence monitoring.<br>**Post-mining**<br>• Detailed field assessment.<br>• Further monitoring only required if other TARP levels exceeding negligible impacts are triggered at impact sites e.g., subsidence monitoring. | **Pre-mining**<br>• A minimum of one spring and one autumn detailed field assessment coinciding with monitoring period for impact swamp prior to any 'second workings' within relevant distances (as defined above) from impact swamps.<br>**During Mining**<br>• Spring and autumn detailed field assessments during 'second workings' within relevant distances (as defined above) of impact swamps.<br>**Post-mining**<br>• A minimum of one spring and one autumn detailed field assessment post mining for swamps that show negligible impacts. |

[2] Available as a reference swamp for bord and pillar second workings only up until mining is within 350 m of swamp extent. If used as a reference swamp, monitoring would be as per category 2 swamps.

**Table 19 Giant Burrowing Frog monitoring and methodology**

| Impact monitoring sites | Control monitoring sites | Timing | Methodology |
|---|---|---|---|
| **Stage 1**<br>• CCUS1<br>• CCUS4<br>• CCUS5<br>• CRUS1<br>**Stage 2**<br>• BCUS4<br>• CCUS10 | • BCUS12<br>• BCUS13<br>• WACUS<br>• WCUS | **Pre-mining**<br>• A minimum of one year prior to any 'second workings' occurring within 350 m of the swamp.<br>**During Mining**<br>• Surveys to be undertaken while 'second workings' are within 350 m of the swamp.<br>**Post-mining**<br>• A minimum of one year post mining for swamps that show negligible impacts. | Giant Dragonfly exuviae monitoring: Monitoring is conducted during the breeding season (summer) by searching all ground layer, sedgeland and shrub vegetation within suitable Giant Dragonfly habitat, along a linear transect of fixed length at each site. Each site is surveyed twice in summer. |

**Table 20 Water monitoring requirements and locations**

| Monitoring Requirement | Monitoring Location | Timing/ Frequency | | | Parameters | Purpose |
|---|---|---|---|---|---|---|
| | | Prior to Mining | During Mining* | Post Mining | | |
| Monitoring of swamp soil moisture and shallow water | Swamp sites with soil moisture probes and piezometers:<br>**Moisture probes and piezometers:**<br>PB4 (A/B/D) near swamp BCUS4<br>PCc10 (A/B) at CCUS10<br>PCc12 (A/B) at CCUS12<br>PCc4 (B/C/D) at CCUS4<br>PCc5 (A/B/D) at CCUS5<br>PCr1 (A/B/C) at CRUS1 | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped once every two months<br>2 monthly – field analysis<br>Quarterly – discrete analysis<br>Annual – full metals suite analysis | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped monthly during mining<br>2 monthly – field analysis<br>Quarterly – discrete analysis<br>Annual – full metals suite analysis | Daily – water level monitoring with logger set at minimum 12 hourly interval and downloaded and dipped for an agreed period (minimum 1 year) after the completion of the underground mining | Field analysis*<br>Discrete# | Verify predicted swamp water level/moisture response and water quality changes to existing operations and inform future model iterations and updates.<br>Verify predicted swamp water level/moisture response to mine closure. |

| Monitoring Requirement | Monitoring Location | Timing/ Frequency | | | Parameters | Purpose |
|---|---|---|---|---|---|---|
| | | Prior to Mining | During Mining* | Post Mining | | |
| | PCc1 (A/C) at CCUS1<br>PCc14A at CCUS14<br>PCc20 at CCUS20<br>PCc6B at CCUS6<br>**Piezometers only:**<br>PB4C near swamp BCUS4<br>PCc2 at CCUS2<br>PCc3 at CCUS3<br>PCc4A at CCUS4<br>PCc5C at CCUS5<br>PCc6 near CCUS6<br>PCr1D at CRUS1 | | | 2 monthly – field analysis<br>Quarterly – discrete analysis | | |
| | Shallow piezometers near swamp locations, including:<br>SP1 near CCUS6<br>SP2 near CCUS3 and CCUS4 | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped 2 monthly (once every two months)<br>2 monthly – field analysis<br>Quarterly – discrete analysis | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped monthly during mining<br>2 monthly – field analysis<br>Quarterly – discrete analysis | Daily – water level monitoring with logger set at minimum 12 hourly interval and downloaded and dipped for an agreed period (minimum 1 year) after completion of the underground mining<br>2 monthly – field analysis | Field analysis*<br>Discrete# | Identify if current dry conditions may change with the cessation of longwall mining and recovery, and changes in climatic conditions. |

| Monitoring Requirement | Monitoring Location | Timing/ Frequency | | | Parameters | Purpose |
|---|---|---|---|---|---|---|
| | | Prior to Mining | During Mining* | Post Mining | | |
| | | | | Quarterly – discrete analysis | | |
| | Installation of additional swamp soil moisture probes and water piezometers at identified swamp locations:<br>PCc1 A/BC at CCUS1<br>PCc6 B at CCUS6<br>PCc14 at CCUS14<br>PCc20 at CCUS20<br>PCc21 at CCUS21<br>PCr2 at CRUS2<br>PCr6 near CRUS6 | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped<br>2 monthly – field analysis of piezometers<br>Quarterly – discrete analysis of piezometers | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped monthly in swamps being actively undermined.<br>2 monthly – field analysis of piezometers<br>Quarterly – discrete analysis of piezometers<br>Annual – full metals suite analysis | Daily – water level monitoring with logger set at minimum 12 hourly interval and downloaded and dipped for an agreed period (minimum 1 year) after the swamp is undermined.<br>2 monthly – field analysis of piezometers<br>Annual – discrete analysis of piezometers | Field analysis*<br>Discrete#<br>Full metals suite^ | Verify predicted swamp water level/moisture response to existing operations and inform future model iterations and updates.<br>Verify predicted swamp water level/moisture response to mine closure. |

| Monitoring Requirement | Monitoring Location | Timing/ Frequency | | | Parameters | Purpose |
|---|---|---|---|---|---|---|
| | | Prior to Mining | During Mining* | Post Mining | | |
| Monitoring of groundwater levels and head gradients near swamps | Swamp monitoring paired open standpipes and VWPs at existing locations<br>NRE1A_R and NREA near CCUS2<br>RV16 within CCUS1<br>RV20 near CCUS6<br>RV19 near CRUS1<br>RV21 near BCUS4 | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped (for open standpipes)<br>2 monthly – field analysis for open standpipes<br>Quarterly – discrete analysis for open standpipes<br>Annual – full metals suite analysis | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped (for open standpipes) monthly in areas being actively undermined<br>2 monthly – field analysis for open standpipes<br>Quarterly – discrete analysis for open standpipes<br>Annual – full metals suite analysis | Daily – water level monitoring with logger set at 12 hourly interval and downloaded and dipped (for open standpipes) two monthly for an agreed period (minimum 1 year) after the area is undermined<br>Quarterly – field analysis for open standpipes for an agreed period (minimum 1 year) after mining is completed<br>Annual – discrete analysis for open standpipes for an agreed period (minimum 1 year) after mining is completed | Field analysis*<br>Discrete#<br>Full metals suite^ | Verify predicted groundwater level and swamp water level/moisture response to existing operations and inform future model iterations and updates. Assess head gradients and recharge/discharge processes in relation to the swamps.<br>Verify predicted groundwater level and swamp water level/moisture response to mine closure. Assess head gradient changes and recharge/discharge processes in relation to the swamps post closure |

| Monitoring Requirement | Monitoring Location | Timing/ Frequency | | | Parameters | Purpose |
|---|---|---|---|---|---|---|
| | | Prior to Mining | During Mining* | Post Mining | | |
| | Installation of additional paired monitoring points near swamps:<br>RV39 near CCUS6<br>RV40 near CRUS2<br>RV41 near CCUS20<br>RV42 near CCUS1<br>RV44 near CRUS3<br>RV46 near CCUS14 | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped (for open standpipes) two monthly<br>2 monthly – field analysis for open standpipes<br>2 monthly – discrete analysis for open standpipes within first 12 months of installation, reducing to quarterly frequency<br>Annual – full metals suite analysis | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped (for open standpipes) monthly in areas being actively undermined<br>2 monthly – field analysis for open standpipes<br>2 monthly – discrete analysis for open standpipes within first 12 months of installation, reducing to quarterly frequency | Daily – water level monitoring with logger set at 6 hourly interval and downloaded and dipped (for open standpipes) 2 monthly for an agreed period (minimum 1 year after the area is undermined)<br>2 monthly – field analysis for open standpipes for an agreed period (minimum 1 year) after mining is completed<br>Annual – discrete analysis for open standpipes for an agreed period (minimum 1 year) after mining is completed | Field analysis*<br>Discrete# | Verify predicted groundwater level and swamp water level/moisture response to existing operations and inform future model iterations and updates. Assess head gradients and recharge/discharge processes in relation to the swamps.<br>Verify predicted groundwater level and swamp water level/moisture response to mine closure. Assess head gradient changes and recharge/discharge processes in relation to the swamps post closure |

* During Mining means the period of approximately 3 months prior to the individual swamp being mined under and the period during which mining is occurring directly below the swamp or within 50 m (horizontal distance) of the swamp.

**** Field analysis:*** *includes field analysis of pH, EC, DO, ORP and temp*

***# Discrete:*** *includes field analysis of pH, EC, DO, ORP and temp. As well as laboratory analysis of TDS, TSS, major ions (Na, K, Ca, Mg, Cl, SO4), F, $HCO_3$, $CaCO_3$, $NO_3$, Total N, Total P, Total alkalinity, filtered DOC and dissolved metals Al, P, Cu, Pb, Zn, Ni, Sb, Fe, Mn, Mo As, Li and Ba.*

***^ Full metals suite****: includes field analysis of pH, EC, DO, ORP and temp. As well as discrete laboratory analysis suite* ***plus*** *laboratory analysis of additional dissolved metals B, Cd, Co, Hg, Se and Ag*

## 6.5 Land Management Plan

### 6.5.1 Overview

The surface land overlying the proposed extraction area for this EP lies wholly within crown land, declared as a 'Special Area' controlled by WaterNSW. Managing the ecological integrity of the Special Areas is a key consideration of WaterNSW. The surface topography comprises of undulating land and dense bush and upland swamps (addressed within the USMP, refer to **Section 6.4**). All streams and drainage are directed towards Cataract Dam, via Cataract Creek, Cataract River and their tributaries (addressed within the Water Management Plan). Surface elevations range from 31 m to 390 m AHD.

One major natural feature within proximity to the EP Area is the Illawarra Escarpment which is located approximately 1.2 km east of the nearest panel of proposed workings covered by this EP and LMP. As the escarpment is located over 1 km from the nearest proposed workings, it will not experience any mining related impacts and it is not discussed further within this LMP.

The nearest cliff to the EP Area is 'Brokers Nose' on the Illawarra Escarpment, more than 1.3 km from PC07. No impacts from the planned mining are expected at Brokers Nose. Road cuttings for Mount Ousley Road located on the northern side of the Cataract Creek are outside the EP Area and more than 500 m from PC07. No perceptible impacts to these features are expected from the planned mining (refer to the Built Features Management Plan (BFMP)).

There are no definitions for cliffs and steep slopes included in the Development Consent conditions. Sandstone formations and steep slopes have been assessed within the Subsidence Assessments (SCT, 2021; SCT, 2022) in the context of previous standards applied to RVC and the definitions found in contemporary mining approval conditions for other NSW sites with significant cliffs and areas of steeper ground.

There are numerous cliff formations located within the approved broader UEP Area, most of which are less than 5 m high. There are no cliffs or minor cliffs in the EP Area. No waterfalls or gorges are found within the EP Area and are therefore not discussed further within this LMP.

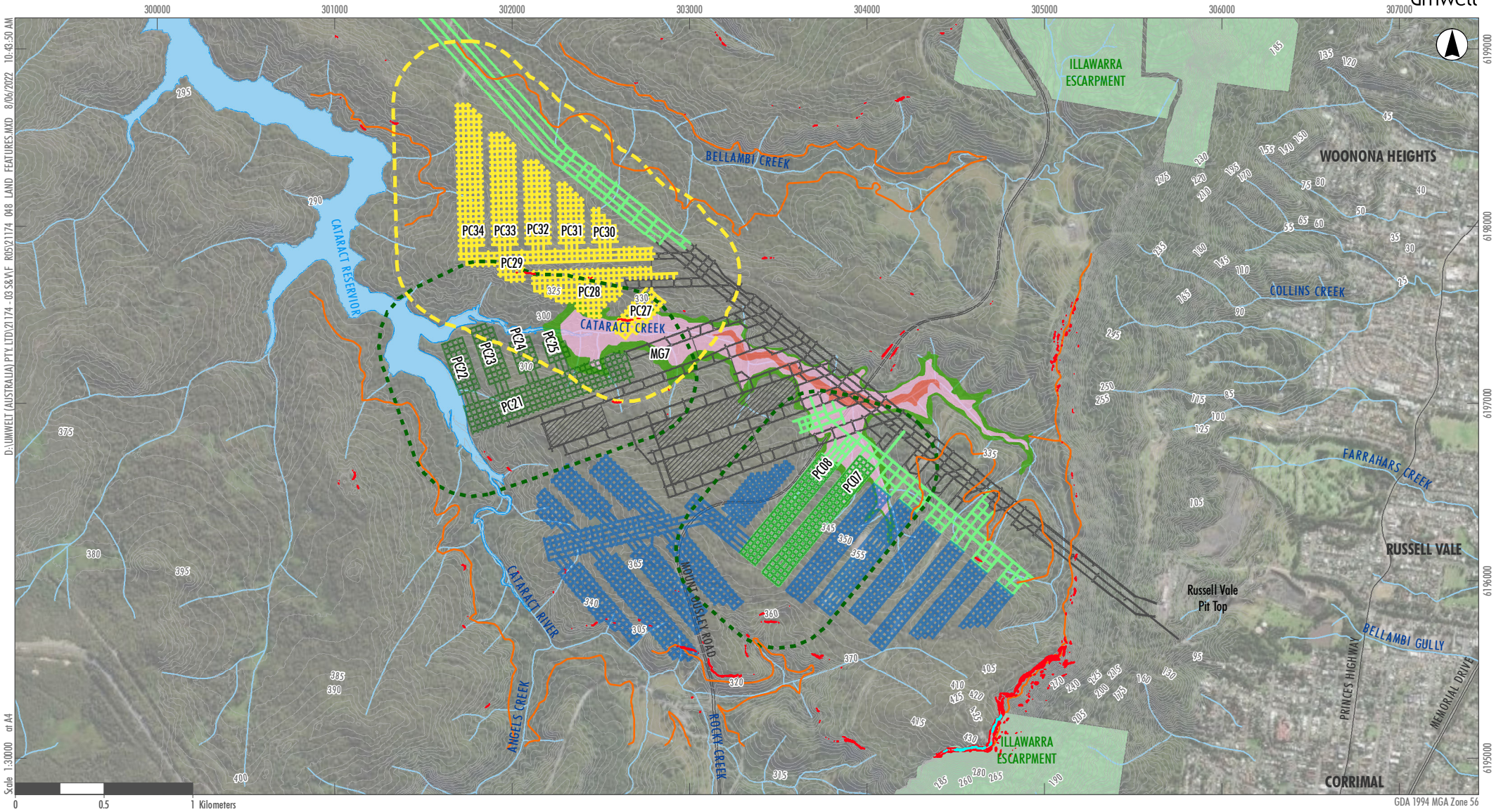
The land features identified within the vicinity of the EP Area, which are subject to the LMP, include:

- steep slopes
- rocky outcrops.

The location of the natural features within the EP Area is described below in **Table 21** and shown in **Figure 21**.

**Table 21 Natural Features Description and EP Area Location**

| Natural Feature | Description (SCT, 2021, 2022) | General Location of land features in Relation to EP Area (SC, 2021, 2022) |
|---|---|---|
| Cliffs/minor cliffs | Sandstone formations or rock faces greater than 10 m high. | There are no cliffs or minor cliffs in the EP Areas. |
| Steep slopes | Extended slopes, that are not sandstone formations, with an average slope of greater than 1 in 1. | There are no significant areas above the EP Areas considered to be steep slopes. |
| Rocky outcrops | Largely sandstone outcrops. Refer to section 5.1.3 of **Appendix D**. | Rocky outcrops (Bald Hill Claystone) can be found on the northern ends of PC07 and PC08 and the eastern end of PC21 and PC25.<br>Rocky Outcrops (bald Hill Claystone and Gosford Formation) can be found on the southern ends of PC27 and PC28. |
| Gorges | A narrow valley between hills or mountains, typically with steep rocky walls and a stream running through it. | There are no gorges in the EP Areas. |




Legend

- Stage 2 Area PC27-34
- Stage 1 Areas PC07-08 and PC21-25
- EP2 Layout PC27-34
- EP1 Layout PC07-08 and PC21-25
- Future Wongawilli Seam Workings (not subject to this EP)
- Existing Wongawilli Seam Workings
- Wongawilli Seam First Workings (Approved under MP09_0013)
- Contour (5m)
- Road
- Hawkesbury Sandstone Outcrop
- Cliffs (rock faces > 10 m high)
- Steep slopes (extended slopes > 1V:1H)
- Bald Hill Claystone Outcrop
- Bulgo Sandstone Outcrop
- Gosford Formation Outcrop
- State Conservation Area

FIGURE 21

Land Features

Image Source: ESRI (2021) Data source: DFSI (2020)

### 6.5.2 Potential Impacts

The mine design is not considered to have any potential to perceptibly impact on natural surface features including cliffs, steep slopes and rock faces. As outlined within the Subsidence Assessment (SCT, 2021; SCT, 2022), subsidence movements are expected to be generally imperceptible and insignificant for all practical purposes.

The Illawarra Escarpment, in particular the section of Hawkesbury Sandstone outcrop at Brokers Nose, is not expected to be impacted by the proposed mining. It should be recognised that there is always potential for cliff falls to occur naturally as part of the ongoing erosion processes, but the proposed mining is not expected to increase this potential.

### 6.5.3 Performance Measures and Triggers

Performance measures relevant to land features within the EP Area are outlined in **Table 22.**

**Table 22 Land Features Performance Measures**

| Feature - Land | Performance Measure | Performance Indicator |
|---|---|---|
| Cliffs, steep slopes and rock face features | Negligible environmental consequence (including subsidence induced rock falls, displacement or dislodgement of boulders or slabs, or fracturing) | Rock falls<br>Fracturing of rock slabs<br>Instability of steep slopes |

The performance triggers relevant to this performance measure are outlined in TARP as defined within **Appendix A.**

### 6.5.4 Management and Monitoring Measures

The subsidence monitoring program will be conducted during the secondary extraction PC21, and PC07, PC08, PC22 to PC25 and PC24 to PC34. The program will be implemented to monitor the development of possible subsidence related environmental impacts. The Subsidence Monitoring Program is described in further detail in **Section 6.1.** A summary of the monitoring program for land features relevant to this EP is provided in **Table 23**.

**Table 23 Summary of Land Features Subsidence Monitoring**

| Timing | Monitoring Component | Parameter | Timing/Frequency |
|---|---|---|---|
| Pre-mining | Visual inspection of rock face features, steep slopes and land in general. | Observations (e.g., baseline photography, existing rockfalls, cliff instabilities, surface cracking). | Prior to the commencement of second workings |
| | Subsidence monitoring | As per subsidence monitoring program<br>• LiDAR | Prior to the commencement of second workings |
| During mining | Visual inspection of rock face features, steep slopes and land in general. | Visual observation checklist (e.g. photography, existing rockfalls, cliff instabilities, surface cracking). | Fortnightly |
| | Subsidence monitoring | As per subsidence monitoring program<br>• LiDAR | As per subsidence monitoring program |

| Timing | Monitoring Component | Parameter | Timing/Frequency |
|---|---|---|---|
| Post mining | Visual inspection of rock face features, steep slopes and land in general. | Visual observation checklist (e.g. photography, existing rockfalls, cliff instabilities, surface cracking). | Within one month of the completion of second workings |
| | Subsidence monitoring | As per subsidence monitoring program<br>• LiDAR | Prior to the commencement of second workings |

In the unlikely event that impacts occur, potential management measures that will be considered to mitigate/remediate environmental consequences are detailed in **Appendix K.**

## 6.6 Heritage Management Plan

### 6.6.1 Overview

Aboriginal cultural heritage sites in the vicinity of the EP Area are presented in **Figure 22**. The Heritage Management Plan (**Appendix L**) indicated 15 sites of relevance to the Stage 1 and Stage 2 EP areas. These sites are:

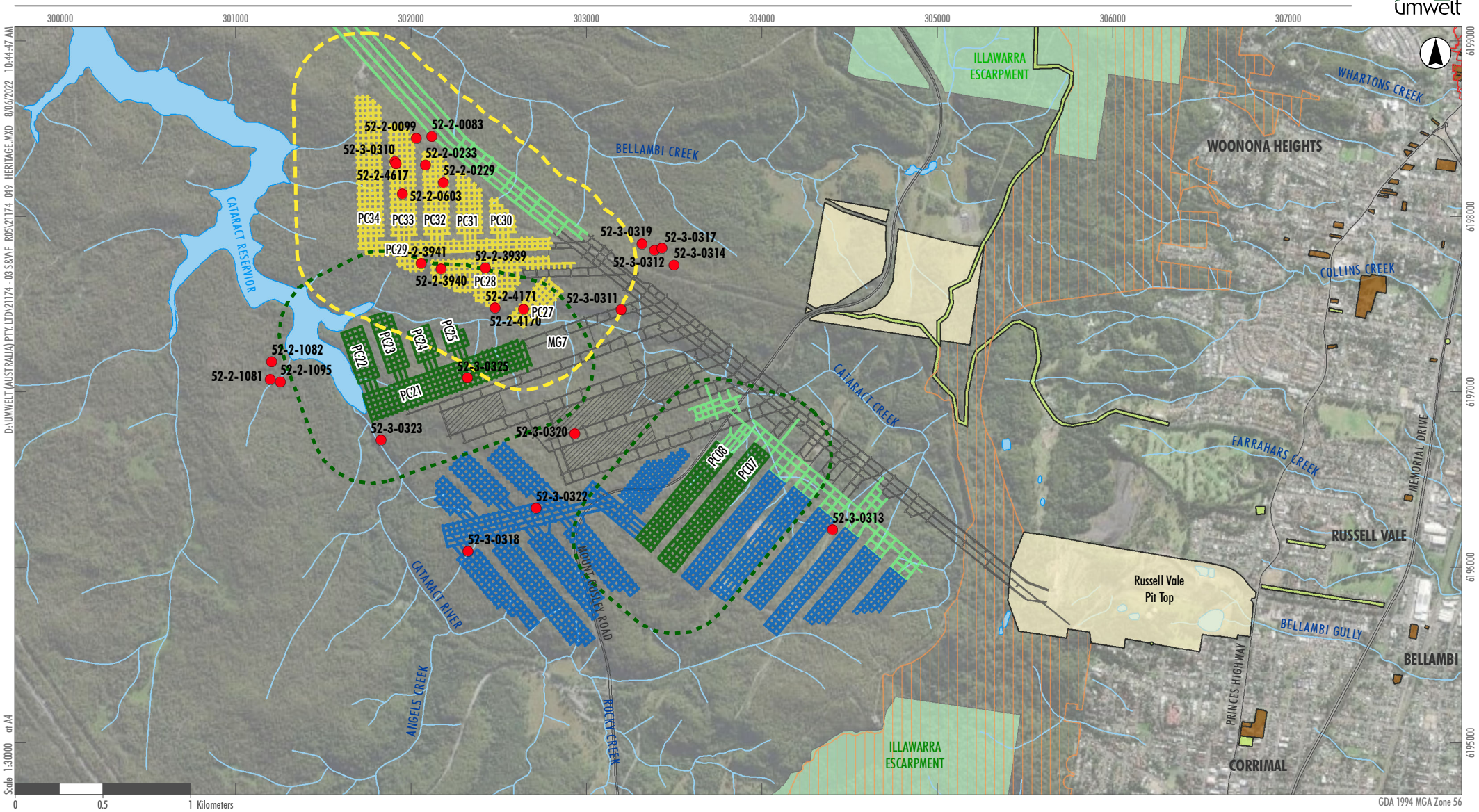
- Wonga East 1 (AHIMS 52-2-3939) – Shelter with deposit and artefacts
- Wonga East 2 (AHIMS 52-2-3940) – Shelter with deposit and artefacts
- Wonga East 3 (AHIMS 52-2-3941) – Shelter with deposit and artefacts
- Wonga East 4 (AHIMS 52-2-4170) – Shelter with deposit and artefacts
- Wonga East 5 (AHIMS 52-2-4171) – Shelter with stone arrangement
- Bulli Mine Shaft Site 7 (AHIMS 52-2-0083) – Shelter with deposit and artefacts
- Bulli Mine Shaft Site 8 (AHIMS 52-2-0099) – Axe grinding grooves
- Bulli Mine Shaft 12 (AHIMS 52-2-0229) – Bulli Mine Shaft 12 is grinding groove site
- Bulli Mine Shaft 13 (AHIMS 52-2-0233) – Bulli Mine Shaft 36 is shelter with deposit
- Bulli Mine Shaft Site 18 (AHIMS 52-2-0310) – Shelter with deposit, art and grinding grooves
- Bulli Mine Shaft Site 19 (AHIMS 52-2-0603) – Shelter with art and artefacts
- Bulli Mine Shaft Site 20 (AHIMS 52-2-0311) – Shelter with deposit
- Bulli Mine Shaft Site 26 (AHIMS 52-3-0323) – Shelter with deposit and artefacts
- Bulli Mine Shaft Site 27 (AHIMS 52-3-0325) – Shelter with art, deposit and artefacts
- Bulli Mine Shaft 36 (AHMIS 52-2-4617) – Shelter with deposit and artefacts.

The scientific and cultural significance of the sites within the EP Area are presented in **Table 24.**

**Table 24 Scientific and cultural significance of cultural heritage sites**

| Site Name | Scientific Significance | Cultural Significance |
|---|---|---|
| Wonga East 1 | Moderate | High |
| Wonga East 2 | Moderate | High |
| Wonga East 3 | Moderate | High |
| Wonga East 4 | Moderate | High |
| Wonga East 5 | Low | High |
| Bulli Mine Shaft 7 | Moderate | High |
| Bulli Mine Shaft 8 | Low | High |
| Bulli Mine Shaft 12 | Low | High |
| Bulli Mine Shaft 13 | Low | High |
| Bulli Mine Shaft 18 | High | High |
| Bulli Mine Shaft 19 | Low | High |
| Bulli Mine Shaft 20 | Moderate | High |
| Bulli Mine Shaft 26 | Moderate | High |
| Bulli Mine Shaft 27 | Moderate | High |
| Bulli Mine Sfaft 36 | Moderate | High |

The EP Area is located adjacent to the curtilage of Cataract Dam as defined by the Dam high water line. Cataract Dam is a State listed heritage item. Cataract Dam includes a range of ancillary structures which form components of the overall site, including a set of handsome sandstone masonry residential cottages for operational staff (which appear to date from the construction of the dam). They are representative of their age and type (Heritage NSW, 2019).




Legend

- Stage 2 Area PC27-34
- Stage 1 Areas PC07-08 and PC21-25
- EP2 Layout PC27-34
- EP1 Layout PC07-08 and PC21-25
- Future Wongawilli Seam Workings (not subject to this EP)
- Existing Wongawilli Seam Workings
- Wongawilli Seam First Workings (Approved under MP09_0013)
- State Conservation Area
- Road
- Conservation Area - General
- Conservation Area - Landscape
- Item - General
- Item - Archaeological
- Item - Landscape
- AHIMS Registered Cultural Heritage Site

FIGURE 22

Heritage Features

Image Source: ESRI (2021) Data source: DFSI (2020)

### 6.6.2 Potential Impacts

Changes to shelter conditions attributed to subsidence impacts can include small movement along joints, tension cracking of strata, cliff collapse or block fall and increased water seepage of shelter sandstone surfaces. While subsidence impacts do not always have direct heritage values impacts, i.e., impacts to art panels, they can cause a change in shelter conditions that lead to heritage values impact, such as altering water seepage patterns that adversely affects art panels. Thus, the heritage values at a given Aboriginal shelter site, such as the presence or absence of art panels, will influence the risk of a heritage values impact due to subsidence impacts.

A subsidence impact assessment of sites relevant to the Stage 1 and Stage 2 EP areas was undertaken and the results are summarised in **Table 25**. Generally, risk to cultural heritage sites was assessed as "very low", while risk to Bulli Mine Shaft 27 was "low".

**Table 25 Risk to Heritage Sites from Stage 1 and Stage 2 Second Workings Subsidence**

| Site Name | Risk of Impact | Risk Description |
|---|---|---|
| Wonga East 1 | Low | There is a low chance of subsidence effects occurring which may result in impacts to heritage values. |
| Wonga East 2 | Very Low | There is a very low chance of subsidence effects occurring which may result in impacts to heritage values. |
| Wonga East 3 | Low | There is a low chance of subsidence effects occurring which may result in impacts to heritage values. |
| Wonga East 4 | Low | There is a low chance of subsidence effects occurring which may result in impacts to heritage values. |
| Wonga East 5 | Low | There is a low chance of subsidence effects occurring which may result in impacts to heritage values. |
| Bulli Mine Shaft 7 | Negligible | The chance of subsidence effects occurring which may result in impacts to heritage values is negligible. |
| Bulli Mine Shaft 8 | Negligible | The chance of subsidence effects occurring which may result in impacts to heritage values is negligible. |
| Bulli Mine Shaft 12 | Very Low | There is a very low chance of subsidence effects occurring which may result in impacts to heritage values. |
| Bulli Mine Shaft 13 | Very Low | There is a very low chance of subsidence effects occurring which may result in impacts to heritage values. |
| Bulli Mine Shaft 18 | Low | There is a low chance of subsidence effects occurring which may result in impacts to heritage values. |
| Bulli Mine Shaft 19 | Low | There is a low chance of subsidence effects occurring which may result in impacts to heritage values. |

| Site Name | Risk of Impact | Risk Description |
|---|---|---|
| Bulli Mine Shaft 36 | Low | There is a low chance of subsidence effects occurring which may result in impacts to heritage values. |
| Bulli Mine Shaft 20 | Negligible | The chance of subsidence effects occurring which may result in impacts to heritage values is negligible. |
| Bulli Mine Shaft 26 | Very Low | There is a very low chance of subsidence effects occurring which may result in impacts to heritage values. |
| Bulli Mine Shaft 27 | Low | There is a low chance of subsidence effects occurring which may result in impacts to heritage values. |

**Cataract Dam**

The EP Area is located over 9 kilometres from the dam wall and associated structures and there is no impact predicted to these structures. However, the heritage listing of the sites defines the curtilage of Cataract Dam as including all land within the Dam high water line. The western extent of PC21 and PC22 are located adjacent to the full supply level (FSL) but not below it. The EP Area extends into the curtilage area. Vertical subsidence impacts below the Reservoir FSL are predicted to be less than 100 mm and the performance measure for vertical subsidence has been set at 300 mm under the Development Consent. This level of subsidence impact, which would be restricted to the edge of the FSL area immediately adjacent to the EP Area, will have no observable impacts on the Reservoir and would not have any impact on the heritage values of the Cataract Dam.

**South Bulli Colliery**

South Bulli Colliery sits approximately 1.1 km east of PC07-PC08. The site of the South Bulli Colliery comprises buildings, structures and landscape features relating to mining operations from the mid nineteenth to late twentieth centuries. The South Bulli Colliery is discussed in detail in the HMP (refer to **Appendix L**). Given its distance from the EP Area, the South Bulli Colliery will not be affected by the second workings in this EP and is excluded from further discussion in this EP.

### 6.6.3 Performance Measures and Triggers

Performance measures relevant to heritage features within the EP Area are outlined in **Table 26**.

**Table 26 Heritage Features Performance Measures**

| Feature | Performance Measures | Performance Indicator |
|---|---|---|
| **Heritage Sites** | | |
| Aboriginal heritage sites identified in the figure in Appendix 6 of the DA. | Negligible subsidence impacts and environmental consequences<br>Negligible loss of heritage value | Visible evidence of subsidence impacts (cracking, cliff falls, feature realignment, increased water seepage)<br>Change in heritage value |
| Historic heritage sites listed in the figure Appendix 7 of the DA. | Negligible subsidence impacts and environmental consequences<br>Negligible loss of heritage value | Change in Condition<br>Change in heritage value |

| Feature | Performance Measures | Performance Indicator |
|---|---|---|
| **Heritage Sites** | | |
| Other Aboriginal and historic heritage sites. | Negligible subsidence impacts and environmental consequences<br>Negligible loss of heritage value | Change in Condition<br>Change in heritage value |

The performance triggers relevant to these performance measures are outlined in TARP as defined within **Appendix A** and **Appendix L**. It is noted that the TARPs cover all sites within broader UEP Area, however post mining inspections will only be undertaken in relation to those sites present within the EP Area.

### 6.6.4 Management and Monitoring Measures

Monitoring of Aboriginal heritage sites will be undertaken prior to, during and after mining operations of grinding groove and rock shelter sites in areas of predicted subsidence. This program includes all sites that are within the Stage 1 and Stage 2 EP Areas. Regular (6 monthly) monitoring of these sites during the period when subsidence impacts are occurring will provide evidence that impacts are or are not occurring as a direct result of mining.

Increased monitoring frequency in the event that observed subsidence impacts are higher than anticipated (i.e., greater than 100 mm) will also be undertaken as part of the Subsidence TARP process, refer to **Appendix A**.

Post mining (12 months after 'second workings' mining has finished within 350 m of the site) will be undertaken to assess any changes from baseline conditions. Any observed changes in site condition relative to baseline condition at any stage during the monitoring program, will be compared against observed subsidence impacts to ascertain any link between observed changes and mining. This monitoring framework will ensure that the risk assessment is accurate and if there are unexpected impacts to sites, these can be managed and, in the unlikely event of impact to a site, addressed.

The management of non-Aboriginal or Historical heritage will be undertaken in accordance with the 2012 Conservation Management Plan conservation policy (WCL Conservation Management Plan - Biosis Pty Ltd 2012). The 2012 CMP sets out a strategy for managing the place to best maintain its cultural significance whilst ensuring high operational standards.

TARPs outlining heritage management and monitoring measures can be found within **Appendix A**. If any impacts to Aboriginal cultural heritage sites are identified, WCL will engage a qualified archaeologist to develop additional management and mitigation measures (in accordance with the TARP).

## 6.7 Built Features Management Plan

### 6.7.1 Overview

Mount Ousley Road (recently renamed the Princes Motorway) is a major four-lane highway passing through the EP Area. Mount Ousley Road is flanked by embankments and road cuttings. The cuttings are up to 10 m high and are formed within Hawkesbury Sandstone.

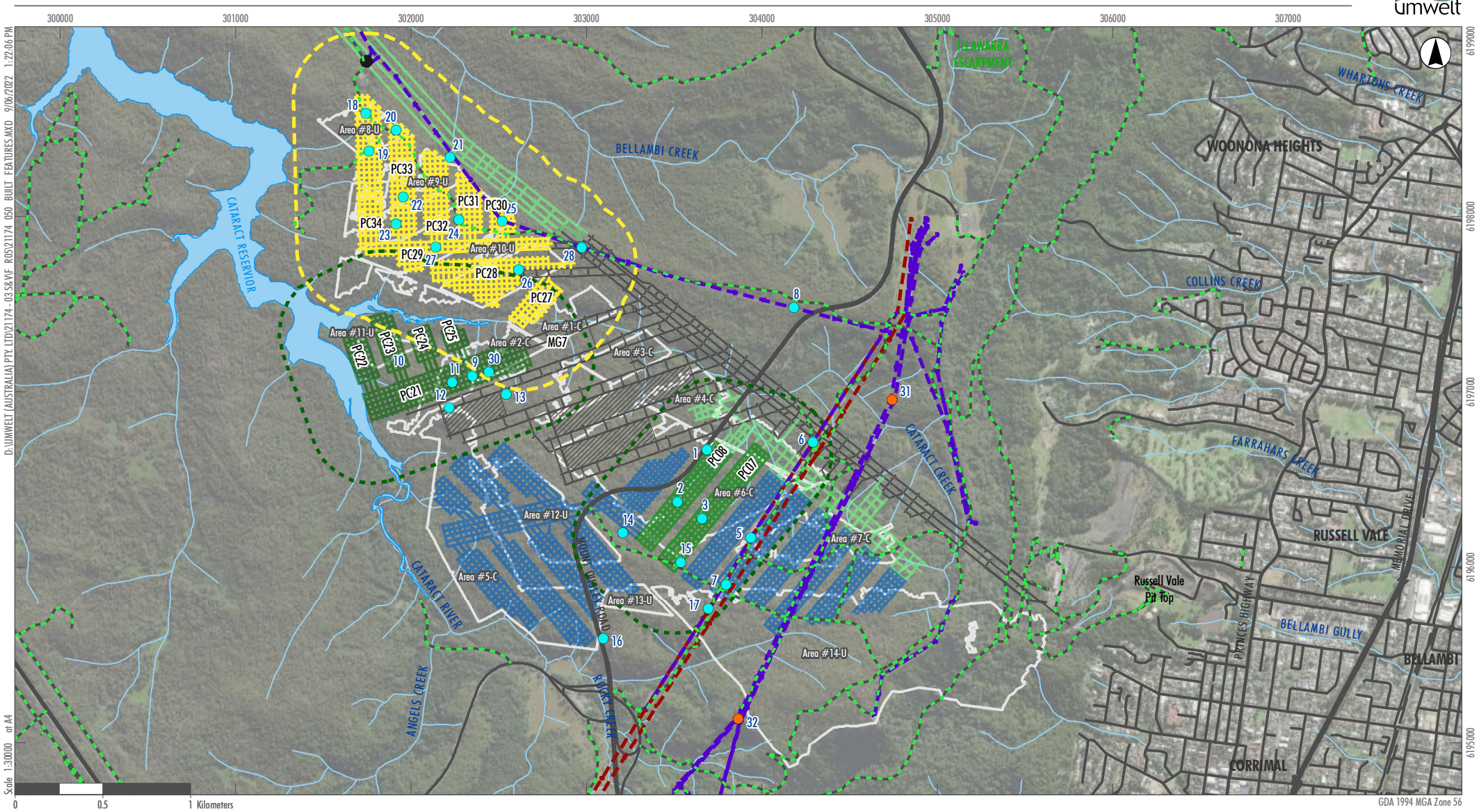
The interchange with Picton Road is located within the vicinity of the EP Area and consists of a concrete bridge passing over Mount Ousley Road and several drainage culverts. Mount Ousley

Road and Picton Road are managed by TfNSW. Picton Road is located entirely outside of the EP Area.

There are four powerlines in the vicinity of the Stage 1 EP Area and one abandoned WCL owned powerline in the vicinity of the Stage 2 EP Area. TransGrid operates 330 kV while Endeavour Energy operates 132 kV and 33 kV lines.

There are four permanent survey stations in the vicinity of the proposed Stage 1 EP Area. Permanent marks (PM 173135, PM 173136) and state survey mark (SS165830), are positioned along the Mt Ousley Road easement from north to south. State Survey mark SS 14867 is located approximately 200 m to the east of PC07. Three additional marks (PM 173728, PM 173137 and SS 16583) are located along the edge of Mt Ousley Road and within 1km of the planned mining in Stage 2 panels PC27-PC34 are to be included in the process to management subsidence impacts to these public utilities.

There are numerous fire trails and unsealed access tracks in the Stage 1 and Stage 2 EP Areas. These unsealed tracks are managed under the PSMP (refer to **Section 6.8**). Built Features in the Extraction Plan area are presented in **Figure 23**. The Built Features Management Plan (BFMP) can be found in **Appendix E**.




Legend

- Stage 2 Area PC27-34
- Stage 1 Areas PC07-08 and PC21-25
- EP2 Layout PC27-34
- EP1 Layout PC07-08 and PC21-25
- Future Wongawilli Seam Workings (not subject to this EP)
- Existing Wongawilli Seam Workings
- Wongawilli Seam First Workings (Approved under MP09_0013)
- Bulli Seam Goaf Areas -
  - C - Confirmed as collapsed/subsided
  - U - Unconfirmed as collapsed/subsided
- Unsealed Access Roads and Fire Trails
- Unsealed Access Roads and Fire Trails
- 33kV Powerline
- 132kV and 330kV Powerline
- Substation
- Road
- Subsidence Monitoring GNSS Unit
- Conceptual Subsidence Monitoring GNSS Unit

FIGURE 23

**Built Features**

Image Source: ESRI (2021) Data source: DFSI (2020)

### 6.7.2 Potential Impacts

Second workings in Stage 1 panels PC21-25, do not have any overlying-built features (i.e., Mt Ousley Road, high voltage transmission lines). The EP approval for Stage 1 secondary workings requires PC21 to demonstrate that subsidence movements are within predicted levels and impacts are expected to be less than subsidence impact performances measures of MP09_0013 before mining in PC22-PC25 and PC07 - PC08 can commence.

Low-level subsidence below the straight section of Mount Ousley Road to the south of the Cataract Creek crossing is expected, but the magnitude of this movement is expected to be less than a few tens of millimetres and much less than the movements that were observed during the period of mining Longwalls 4 and 5. Impacts are expected to be barely perceptible. Near real-time monitoring of the closure across Cataract Creek is planned to manage these movements.

The four electricity transmission lines located between Mount Ousley Road, and the Illawarra Escarpment are located to the east more than 150 m from the approved mining in PC07 and PC08. There is no potential for subsidence movements from either the mains headings or the planned mining of PC07, PC08 and PC21-PC25 to impact the structural integrity or operation of the towers. Nevertheless, near real time three-dimensional monitoring of the towers is planned. In September 2021, a risk assessment was conducted between WCL and the Technical Committee, and outcomes of this risk assessment formed the basis of the mitigation and management measures outlined in the BFMP (**Appendix E**).

Small movements may affect some permanent survey marks. Potential subsidence hazards associated with mining the remainder of the approved panels is planned to be addressed in future EPs and is not considered in this document.

### 6.7.3 Performance Measures and Triggers

Performance measures relevant to built features within the EP Area are outlined in **Table 27.**

**Table 27 Built Features Performance Measures**

| Feature | Performance Measures | Performance Indicator |
|---|---|---|
| **Key Public Infrastructure** | | |
| M1 Princes Motorway (formerly known as Mount Ousley Road) | Always safe and serviceable.<br>Damage that does not affect safety or serviceability must be fully repairable and must be fully repaired. | **M1/Mt Ousley Road:**<br>No vertical subsidence or horizontal ground movements that result in unacceptable ride quality.<br>No slot closure at Cataract Creek leading to unacceptable ride quality.<br>No tension crack development leading to unacceptable ride quality and weakening of pavement due to water ingress.<br>No actual mining related damage to TfNSW infrastructure<br><br>**Picton Interchange Bridge/Structures:**<br>Bridge Engineer – No actual mining related damage to bridge. |

| Feature | Performance Measures | Performance Indicator |
|---|---|---|
| | | **Culverts:**<br>Negligible visible distortion or damage to culverts<br><br>**Slopes:**<br>Negligible observed changes in cuttings<br>Strains ≤0.5 mm/m in pavement at Cataract Creek. |
| *TransGrid 330 kV HV line Transmission towers* | Always safe and serviceable.<br>Damage that does not affect safety or serviceability must be fully repairable and must be fully repaired. | - No observable surface deformations<br>- No actual mining related damage to TransGrid infrastructure<br>o Separation between tower legs<br>o Tilt<br>• Above predicted maximum vertical subsidence |
| *Endeavour Energy 132kV towers and 33kV pylons* | Always safe and serviceable.<br>Damage that does not affect safety or serviceability must be fully repairable and must be fully repaired. | - No observable surface deformations<br>- No actual mining related damage to Endeavour Energy infrastructure<br>o Separation between tower legs<br>• Above predicted maximum vertical subsidence |
| **Other Infrastructure** | | |
| Access roads and fire trails | Always safe.<br>Serviceability should be maintained wherever practicable.<br>Loss of serviceability must be fully compensated.<br>Damage must be fully repairable and must be fully repaired or else replaced or fully compensated. | No cracking greater than 10mm and no noticeable instability or traffic (foot/vehicular) impedance |
| Permanent survey marks | Always safe.<br>Serviceability should be maintained wherever practicable.<br>Loss of serviceability must be fully compensated.<br>Damage must be fully repairable and must be fully repaired or else replaced or fully compensated. | General movement of survey markers |

The performance triggers relevant to built features are outlined in TARPs as defined within **Appendix A**.

### 6.7.4 Management and Monitoring Measures

Monitoring of subsidence effects will be undertaken in accordance with the BFMP (see **Section 6** of **Appendix E**) and the Subsidence Monitoring Program (see **Section 6.1** of this document and **Appendix M**). Management and monitoring for major built features are presented in the sections below.

The key hazards to M1 Princes Highway/Mount Ousley Road are expected to be from subsidence related to PC07-08. The key hazard is predicted to be ground closure at the existing Mount Ousley Road crossing across Cataract Creek. This closure will be monitored by:

- near real-time monitoring of GNSS stations (GNSS1, 2, 8, 14 and 16)
- quarterly closure measurements across Cataract Creek at four locations, referred to as CCC1-CCC4
- continuous monitoring of pavement compression slot closure as installed in pavement slot at the crossing point on the low point of Mount Ousley Road where it crosses Cataract Creek via the 'crack meter'
- periodic inspections of the geometry of the Cataract Creek culvert (triggered by movements in the GNSS units) via the installed 3D prisms
- periodic surveys of the cracks at the ridge top to the south of Cataract Creek via existing crack survey lines (SXC1 – SXC2, SXC3 – SXC4 and QCN – QCS) if triggered by movements in the GNSS units or crackmeters.

The key hazard for 330 kV TransGrid HV electricity transmission towers and lines is differential movement of the legs of the transmission towers. Monitoring of 330 and 132kV electricity transmission towers to be undertaken during secondary extraction of panels PC07 and PC08 includes:

1) quarterly surveyed measurements to determine tilt of the towers or differential movement of individual legs via a prism to be installed on each of the legs of affected towers.
2) absolute vertical subsidence movement of the tower measured by near real-time GNSS monitoring (tolerance level of +/- <20 mm in 3D)
3) quarterly lidar (+/- 200 mm).

The key hazard for the Endeavour Energy 132kV high voltage (HV) transmission lines and towers is recognised to be differential movements of the legs of the electricity transmission towers. The key hazard for the 33KV lines and pylons is recognized to be the vertical subsidence movement of the pylons.

Monitoring of electricity transmission pylons to be undertaken during secondary extraction of panels PC07 and PC08 includes:

1) quarterly surveyed measurements to determine via a prism to be installed on each tower of the 132 kV and 33kV lines.

2) absolute vertical subsidence movement of the pylon measured by near real-time GNSS monitoring (tolerance level of +/- <20 mm in 3D)

3) quarterly lidar (+/- 200 mm).

There is potential for the permanent survey marks to move as a result of subsidence. The strategy to manage subsidence impacts is to notify the asset owner via the NSW Spatial Services Permanent Survey Mark removal application process. The movement of the affected permanent survey marks is monitored by near real time kinematic positioning survey every six months during secondary workings. This monitoring will continue until the mine workings has been completed and the subsidence, if any, has ceased.

At the completion of second workings WCL will complete a NSW Spatial Services *End of Project Applicant Compliance Statement* for submission to NSW Spatial Services.

In the unlikely event that subsidence impacts do become apparent on any of the listed fire trails or access roads as listed in the WaterNSW special areas access consent (F2020/3092) minor remedial work may be required. Details on such minor remedial repairs as required to be undertaken by WCL in consultation with WaterNSW as soon as possible to maintain them in a working safe and serviceable condition for the listed fire trails and access roads are detailed in the WCL EP Public Safety Management Plan (RVC EC PLN 009).

## 6.8 Public Safety Management Plan

### 6.8.1 Overview

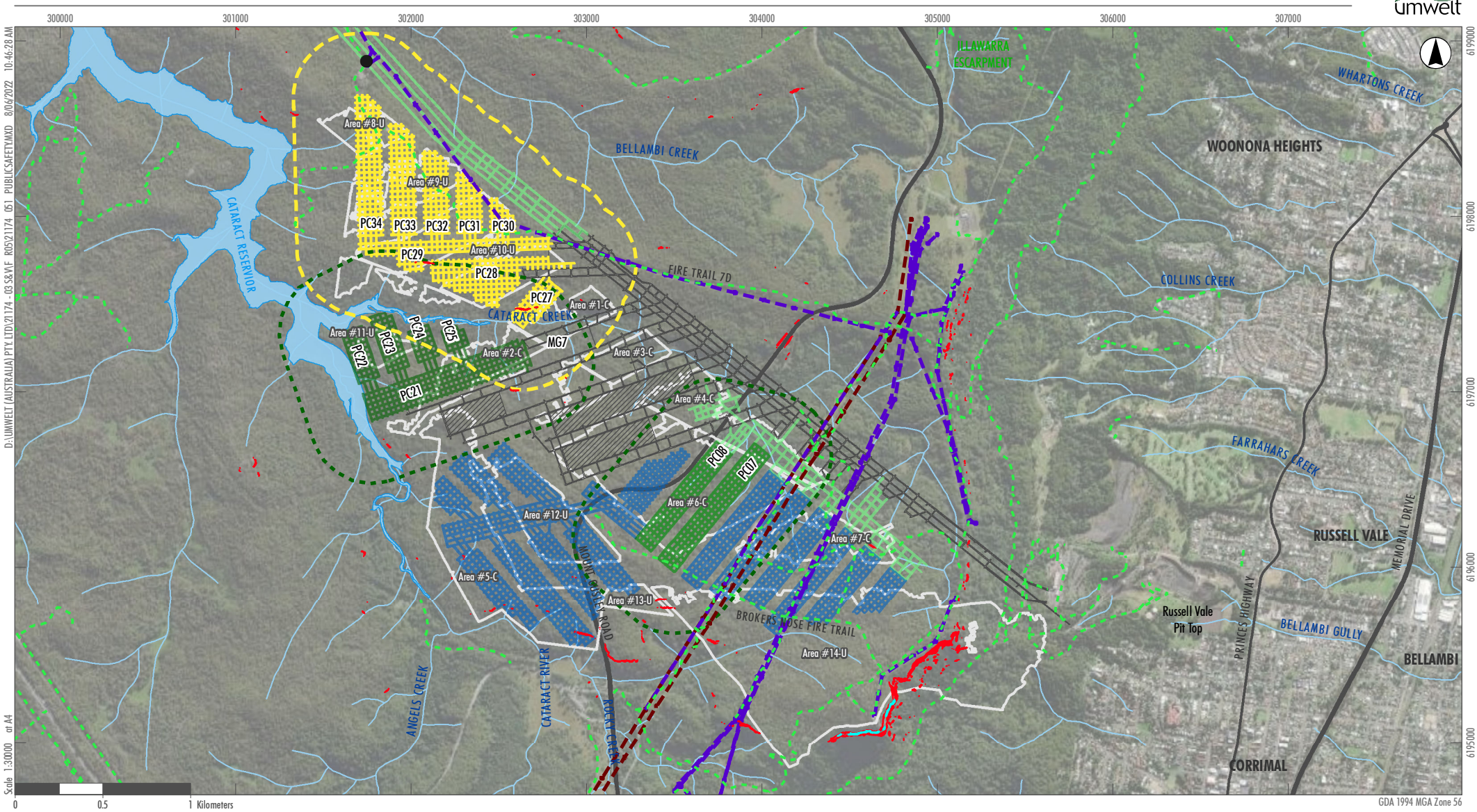
Known surface features (natural and built) within the EP Area that have the potential to affect public safety include steep slopes and are managed within the LMP. Hazards associated with the following built surface features are possible, however are expected to be minor and manageable with the appropriate risk control measures (refer to section 4 of the BFMP):

- Mount Ousley Road
- Picton Road Interchange
- high voltage electricity transmission lines east of Mount Ousley Road
- mine infrastructure (exploration boreholes, electricity lines, and ventilation shafts)
- other roads/trails (dirt roads and fire trails)
- decommissioned, WCL owned powerline.

Locations of these surface features are shown in **Figure 24**.

These features and any associated public safety impacts and monitoring requirements are addressed within the BFMP (refer to **Section 6.7**). There are no known public amenities, agricultural lands, industrial/commercial establishments, or residential properties within the EP Area. The EP Area is not in a Mine Subsidence District.

The full Public Safety Management Plan (PSMP) can be found in **Appendix F.**




Legend

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- Unsealed Access Roads and Fire Trails
- 33kV Powerline
- 132kV and 330kV Powerline
- Substation
- Cliffs (rock faces > 10 m high)
- Steep slopes (extended slopes > 1V:1H)
- Road

FIGURE 24

**Public Safety Features**

Image Source: ESRI (2021) Data source: DFSI (2020)

### 6.8.2 Potential Impacts

The Subsidence Assessments (SCT 2021; SCT 2022) determined that the mine design will not perceptibly impact on public safety. The only noted potential risk to public safety associated with the planned mining, is expected to be from potential impacts during secondary extraction of panels PC07 and PC08 to Mount Ousley Road and the electricity transmission lines (refer to **Section 6.7.4**).

While not predicted to occur, subsidence impacts also have potential to result in road deformations to fire trails and other access roads. Subsidence impacts also have potential to destabilise steep slopes which may present a risk to people below these areas.

The portion of the EP Area to the west of Mount Ousley Road is within the Metropolitan Special Area. The general public is not permitted to enter the Metropolitan Special Area (unless authorised by the WaterNSW). Signage installed at the entries to the WaterNSW special areas clearly stipulate that public access is restricted.

### 6.8.3 Performance Measures and Triggers

Performance measures relevant to public safety within the EP Area are outlined in **Table 28**.

**Table 28 Public Safety Performance Measures**

| Feature | Performance Measures | Performance Indicator | Monitoring |
|---|---|---|---|
| **Public Safety** | | | |
| Public Safety | Negligible Additional Risk | • no impacts affecting the trafficability of fire trails and access tracks<br>• Management of risks associated with steep slopes<br>• No impacts on public roads that would affect the safety of motorists | Visual Inspection<br>Monitoring related to Mt Ousley Road and non-WCL owned Transmission Lines |

The performance triggers relevant to this performance measure are outlined in the TARPs as defined within **Appendix A**.

### 6.8.4 Management and Monitoring Measures

Steep slopes within the vicinity of the EP Area will be managed in accordance with **Section 6.5.4.**

The unsealed access roads and trails within the EP Area are not likely to experience cracking as a result of mining. The monitoring regime for these unsealed roads is outlined in the TARPs (see **Appendix A**). Visual inspections of unsealed roads will be undertaken fortnightly during the second workings extraction and monthly for a period of six months after mining. If cracks larger than 10 mm are identified, WCL will notify DPE, WaterNSW and any other relevant agencies and prepare a remediation plan within one week.

# 7. IMPLEMENTATION

## 7.1 Compliance Register

In accordance with the EMS, compliance with all approvals, plans and procedures will be the responsibility of all Colliery personnel (staff and contractors) employed on or in association with WCL. Compliance will be promoted through direct consultation and with the direction of the Mine Manager.

A Compliance Register is maintained and available on the Wollongong Coal server to monitor compliance against Development Consent. Non-compliances are to be reported, with any necessary corrective actions implemented as per the Contingency Plan process set out in **Section 5.6.**

A review of WCL's compliance with all conditions of the Development Consent, mining leases and relevant approvals and licences will be undertaken prior to (and included within) each Annual Review. Relevant approvals and licenses are discussed in **Section 1.4**. The Annual Review will be made publicly available on Wollongong Coals website.

## 7.2 Reporting Framework

### 7.2.1 Incident Reporting

**Section 5.2** sets out the thresholds for the reporting of Incidents and non-compliances as required under the Development Consent. As it is unlikely that any observed changes in the environment that may constitute material harm or an exceedance of a performance trigger will be readily attributable to mining, a *Potential* Incident Notification process will be adopted for Level 3 TARP exceedances with subsequent notification of the proposed approach to investigating the cause of the exceedance provided to relevant stakeholders. This process is described further in **Section 7.2.3**.

In accordance with Condition F9 of the Development Consent, WCL will notify DPE and any other relevant agencies of any incident immediately after it becomes aware of an 'incident' that has been caused by development approved under the Development Consent.

The notification must identify the development (including the development application number and name) as well as:

- any condition which has been or may have been in breach
- a short description of the incident and / or non-compliance
- the location (including coordinates), date, and time of the incident or non-compliance.

As per Condition 26 of EPBC 2020/8702, WCL would notify DAWE in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification would be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification would specify:

- any condition which has been or may have been in breach
- a short description of the incident and/or non-compliance

- the location (including co-ordinates), date, and time of the incident and/or non-compliance. In the event the exact information cannot be provided, the best information available would be provided.

As per Condition 27 of EPBC 2020/8702, WCL must provide to DAWE the details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying:

- any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;
- the potential impacts of the incident or non-compliance; and
- the method and timing of any remedial action that will be undertaken by the approval holder.

Incident responses relevant to this EP Area will be completed in accordance with the TARPs in the key component plans (**Appendix E** to **Appendix L**).

Note: Condition E1 also includes specific notification requirements in relation to exceedances of criteria set out in Part B of the Development Consent. These notification requirements are not relevant to subsidence related impacts.

### 7.2.2 Six Monthly Reporting

WCL will prepare a subsidence impact report every six months. This report will be provided within 20 business days after the completion of a six month anniversary of the commencement of mining covered by this EP. Six monthly reporting will continue for 12 months after the completion or the temporary cessation of mining covered by this EP.

Six monthly reporting of all impacts and environmental monitoring results including:

- an assessment of compliance with all relevant performance measures
- a comprehensive summary of all qualitative and quantitative environmental monitoring results including subsidence monitoring data
- status of any ongoing investigations of Level 3 TARPs
- status of any Contingency measures or adaptive management measures implemented in response to TARPs, incidents or non-compliances.

WCL will make copies of the reports available on the website and will be reported to the CCC.

### 7.2.3 Impact Reporting

In the unlikely event of a TARP Level 3 exceedance or event that triggers an Incident Notification or *Potential* Incident Notification associated with subsidence related impacts, a bi-monthly (or lesser frequency if agreed by RR and DPE) report to relevant agencies, landholder or infrastructure operator will be provided which includes:

- a full description and photo of the impact
- preliminary characterisation of the impact in accordance with the relevant TARP (if applicable)
- current status of investigation into cause of the impact (if ongoing)

- current status and effectiveness of any mitigation or adaptive management or contingency measures implemented in response to the impact.

### 7.2.4 Annual Review

In accordance with Condition F11 of the Development Consent, WCL will prepare and submit an Annual Review by the end of September each year. A summary of subsidence effects monitoring results will also be included. The Annual Review will:

- describe the development (including any rehabilitation) that was carried out in the previous calendar year and the development that is proposed to be carried out over the current calendar year;
- include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the:
  - relevant statutory requirements, limits or performance measures/criteria;
  - requirements of any plan or program required under this consent;
  - monitoring results of previous years; and
  - relevant predictions in the document/s listed in condition A2(c) and the updated subsidence prediction contained in **Appendix D**;
- identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid recurrence;
- evaluate and report on:
  - the effectiveness of the noise and air quality management systems; and
  - compliance with the performance measures, criteria and operating conditions of this consent;
- identify any trends in the monitoring data over the life of the development;
- identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and
- describe what measures will be implemented over the next calendar year to improve the environmental performance of the development.

Copies of the Annual Review will be uploaded to the WCL website, submitted to DPE, Wollongong City Council, Wollondilly Shire Council and made available to the CCC and any interested person upon request.

### 7.2.5 Annual Compliance Reporting

In accordance with Conditions 15 and 25 under Part B of the EPBC approval 2020-8702, WCL will prepare and submit an Annual Compliance Report by the end of each 12 month period following the date of commencement of the action under the approval.

The approval holder must:

a) publish each compliance report on the website within 60 business days following the end of the 12-month period for which that compliance report is prepared;

b) notify the DAWE by email that each compliance report has been published on the website and provide the weblink for the compliance report within five business days of the date of publication of each compliance report;

c) keep all compliance reports publicly available on the website until this approval expires;

d) exclude or redact sensitive ecological data from compliance reports published on the website; and

e) where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the DAWE within 5 business days of publication on the website.

## 7.3 Auditing

In accordance with Condition F13 of the Development Consent an Independent Environmental Audit will be undertaken by a suitably qualified auditor and include experts in any field specified by the Secretary within 12 months of the approval and every three years after that.

This audit must:

- be prepared in accordance with the *Independent Audit Post Approval Requirements* (DPIE 2020 or as updated)
- be led and conducted by a suitably qualified, experienced and independent auditor whose appointment has been endorsed by the Planning Secretary
- be conducted by a suitably qualified, experienced and independent team of experts (including any expert in field/s specified by the Planning Secretary) whose appointment has been endorsed by the Planning Secretary
- include consultation with the relevant agencies and the CCC
- assess the environmental performance of the development and whether it is complying with the relevant requirements in the approval water licences and mining leases for the development (including any assessment, strategy, plan or program required under these approvals)
- review the adequacy of any approved strategy, plan or program required under the abovementioned approvals
- recommend appropriate measures or actions to improve the environmental performance of the development, and/or any assessment strategy, plan or program required under these approvals
- be conducted and reported to the satisfaction of the Planning Secretary.

In accordance with Condition F14 of the development Consent, WCL would submit a copy of the audit report, along with responses to any recommendations contained within the report to the Planning Secretary. The audit and response to recommendations would be submitted within three months of the completion of the audit unless otherwise agreed by the Planning Secretary.

## 7.4 Review of Extraction Plan and Key Component Management Plans

Review of this EP and the key component management plans will be undertaken in accordance with Condition F7 of the Development Consent. This condition requires that strategies, plans and programs be reviewed within three months of:

a) the submission of an incident report under condition F9;

b) the submission of an Annual Review under condition F11;

c) the submission of an Independent Environmental Audit under condition F13; or

d) the approval of any modification of the conditions of this consent (unless the conditions require otherwise).

If necessary, to either improve the environmental performance of the development, cater for a modification, or comply with a direction, the strategies, plans and programs required under this consent will be revised by WCL, to the satisfaction of DPE. Where revisions are required, the revised document will be submitted to DPE for approval within 6 weeks of the review.

As outlined in Condition 5 of the EPBC approval, WCL will also provide DAWE with the final version of the EP and key component management plans within 10 business days of their approval by DPE.

As per Condition 6 of the EPBC approval, WCL must notify the DAWE, in writing, within two business days of proposing to the NSW Planning Secretary any changes to a version of the Plan/s, explaining what changes are requested and any implications for protected matters if the proposed changes are made. If the NSW Planning Secretary approves a revised version of the Plan/s, the approval holder must provide DPE with the approved revised Plan/s within 10 business days of its approval by the NSW Planning Secretary, explaining what changes have been made and any implications for protected matters.

In accordance with Condition 23 of the EPBC approval, WCL must:

- publish each plan on the website within 20 business days of the date the plan is approved by the NSW Planning Secretary, unless otherwise agreed to in writing by the Minister; and
- keep plans published on the website until the end date of this approval.

## 7.5 Rehabilitation Management Plan

WCL currently implement a Mining Operations Plan (MOP) which details the progressive rehabilitation of the disturbance caused by mining at RVC. As per the amendment to the Mining Regulation 2021, a rehabilitation management plan (RMP) will be prepared and implemented for site, including covering the Stage 1 and 2 EP Areas. The intention of the RMP is to replace the MOP. Appropriate revisions to the RMP will be undertaken in accordance with the Development Consent and relevant guidelines to incorporate any remediation of subsidence impacts identified as being required under this EP.

## 7.6 Key Responsibilities

The overall responsibility for the implementation of this EP resides with the Mine Manager who shall be the EP authorising officer. Responsibilities for the implementation and maintenance of the EP are outlined within **Table 29** below.

**Table 29 Roles and Responsibilities**

| Role | Responsibilities |
|---|---|
| Mine Operations Manager | • Ensure personnel and equipment are provided to enable this Extraction Plan to be implemented effectively.<br>• Endorse the Extraction Plan and provide any amendments to DPE for authorisation.<br>• Address any identified non-compliances, assess improvement ideas submitted and implement if considered appropriate.<br>• Arrange for the implementation of any agreed actions, responses or remedial measures. |
| Group Environment Manager (or delegate) | • Provide regular updates to WCL on the results of the monitoring and review contained within this Extraction Plan.<br>• Arrange information forums for key stakeholders as required.<br>• Prepare any report in accordance with this Extraction Plan.<br>• Maintain records required by this Extraction Plan.<br>• Organise and participate in assessment meetings called to review mining impacts.<br>• Within 24 hours, respond to any queries or complaints made by members of the public in relation to aspects of this Extraction Plan.<br>• Organise reviews of this Extraction Plan.<br>• Publish all plans on the WCL website. |
| Survey Manager | • Collate survey data and present in an acceptable form.<br>• Bring to the attention of the Group Environment Manager any findings indicating an immediate response may be warranted.<br>• Bring to the attention of the Group Environment Manager any non-compliances identified by the Survey Manager. |
| Technical Experts | • Conduct the tasks assigned to them in a competent and timely manner to the satisfaction of the Group Environment Manager. |
| Persons Performing Inspections | • Formally bring to the attention of the Environment department any non-compliances identified with the Plan.<br>• Conduct inspections in a safe manner. |

## 7.7 Record Keeping and Control

The Group Environment Manager is responsible for maintaining environmental management documents so that they are current at the point of use and consistent with respect to site operations. Types of records include:

- monitoring, inspection and compliance reports/records;
- correspondence with public authorities;
- induction and training records;
- reports on environmental incidents, other environmental non-compliances, complaints and follow-up action;
- community engagement information;
- incident and non-compliance investigations; and
- minutes of environmental management system review meetings and evidence of any action taken.

All environmental management documents are subject to ongoing review and continual improvement. This includes times of change to scheduled activities or to legislative or licensing requirements. Only the Environmental Manger, or delegate, has the authority to change any of the environmental management documentation.

This EP will be developed, approved, implemented and maintained in accordance with the Document Control Procedure (WCL SYS PRO 001).

## 7.8 Training

Staff training will consist of three levels of applicable to different types of staff:

- Level 1 – High level training on environmental legislative requirements (management staff)
- Level 2 – Operational level training (project managers, supervisors, surface personnel, control room operators)
- Level 3 – Basic awareness of environmental management (underground staff, all personnel).

Targeted training will be provided as required for all workers relevant to their activities to provide them with the knowledge, skills and awareness to minimize environmental impacts where they are undertaking an activity with a high risk of potential environmental impact in accordance with **Condition A28** of the Development Consent

The Group Environment Manager or delegate and Mine Training Manager will review the training program and monitor its implementation.

## 7.9 Inductions

All personnel, including contractors, sub-contractors and staff, are required to attend a compulsory site induction that includes an environmental component prior to commencement on site.

The environmental component will include an overview of:

- Relevant details of this Management Plan, including purpose and objectives;
- Key environmental issues;
- Conditions of environmental licences, permits and approvals;
- Mitigation measures for environmental issues; and
- Incident response and reporting requirements.

A record of all environmental training and inductions will be maintained and kept on site. The Group Environment Manager may authorise amendments to the induction where required to address project modifications, legislative changes or amendments to this Management Plan or related documentation.

The Group Environment Manager will review and endorse the induction program and monitor its implementation.

## 7.10 Complaints Handling

Complaints will be managed through established WCL procedures as detailed in the EMS. Any complaints received via telephone or email will have the following information recorded in the WCL complaints register:

- date and time of complaint;
- method by which the complaint was made;
- personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
- nature of complaint;
- the action(s) taken by the Colliery in relation to the complaint, including any follow-up contact with the complainant; and
- if no action was taken by the Colliery and the reason why no action was taken.

As required by Condition F17 of the Development Consent, a copy of a complaints register (updated on a monthly basis) will be made available on the WCL website. A summary of complaints will be available to regulatory authorities on request and provided in the Annual Review.

## 7.11 Dispute Resolution

Condition C2 of the Development Consent states that:

*Measurement and monitoring of compliance with performance measures and performance indicators in this consent is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans and monitoring programs. In the event of a dispute over the appropriateness of proposed methods, the Planning Secretary will be the final arbiter.*

Condition C8 of the Development Consent states:

*Any dispute between the Applicant and the owner of any built feature over the interpretation, application or implementation of the performance measures in Table 7 is to be settled by the Secretary, following consultation with RR. Any decision by the Secretary shall be final and not subject to further dispute resolution under this consent.*

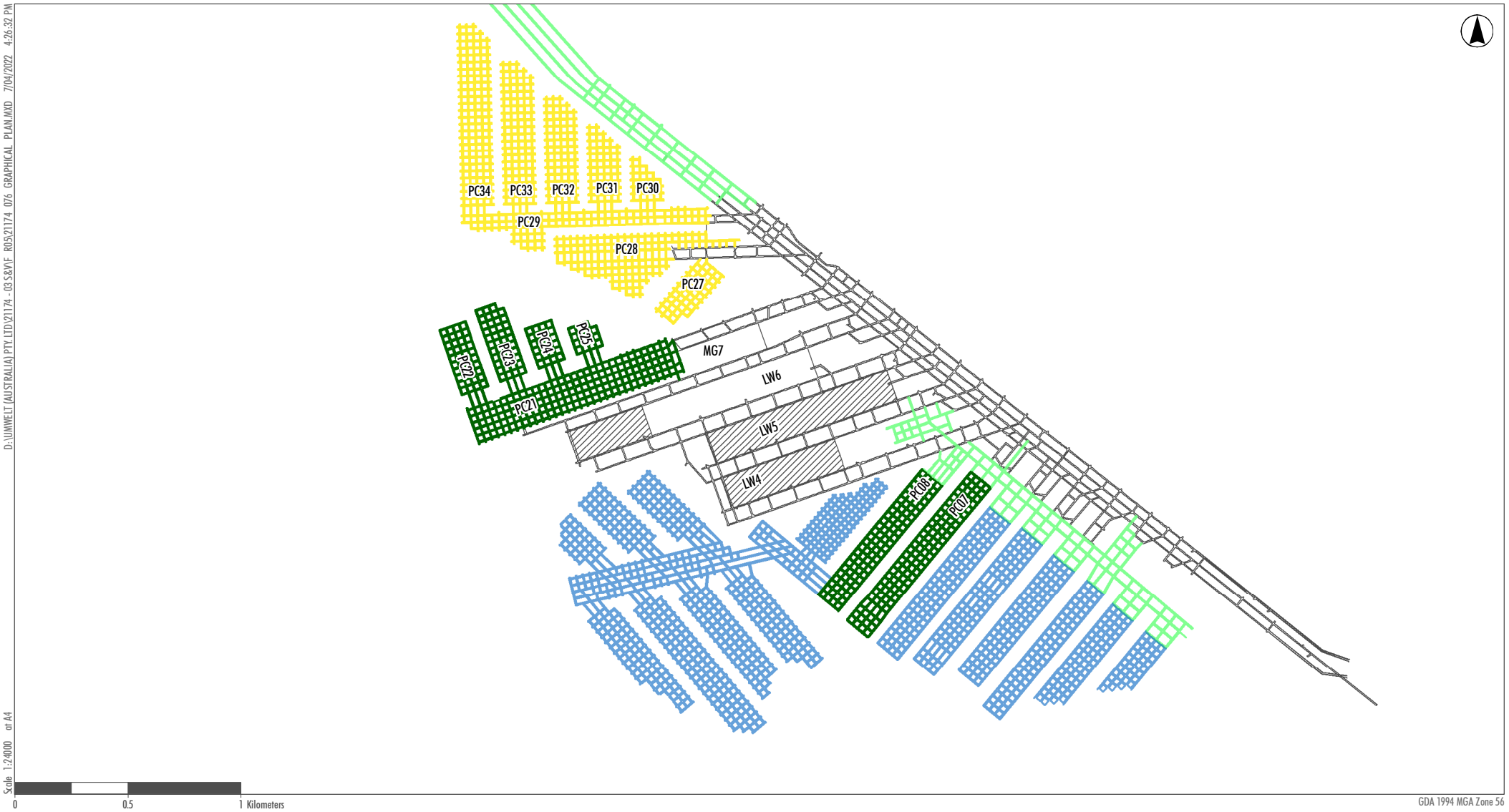
Disputes will be managed through established WCL procedures as detailed in Section 4.8 of the EMS, as per below.

*The Secretary will be the final arbiter for any dispute over the appropriateness of proposed measurements and monitoring of compliance of performance measures and performance indicators in the Development Consent, in accordance with condition C2.*

*Any dispute between WCL and the owner of any built feature over the interpretation, application or implementation of the subsidence impact performance measures is to be settled by the Secretary, following consultation with the Resources Regulator. Any decision by the Secretary is final and not subject to further dispute resolution under the consent, in accordance with condition C8.*

# 8. GRAPHICAL PLAN

The Graphical plan relevant to the Stage 1 and 2 EP Areas outlining the mining plan as approved and for the preparation of this revised EP is detailed on **Figure 25**.

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Legend

- EP2 Layout PC27-34
- EP1 Layout PC07-08 and PC21-25
- Future Wongawilli Seam Workings (not subject to this EP)
- Existing Wongawilli Seam Workings
- Wongawilli Seam First Workings (Approved under MP09_0013)

FIGURE 25

Graphical Plan

# 9. ABBREVIATIONS AND DEFINITIONS

Abbreviations and definitions of terms used in this document are presented in **Table 30** and **Table 31** respectively.

**Table 30 Abbreviations**

| Term | Description |
|---|---|
| AHIMS | Aboriginal Heritage Information Management System |
| BCD | Biodiversity Conservation Division |
| BFMP | Built Features Management Plan |
| BMP | Biodiversity Management Plan |
| CCC | Community Consultative Committee |
| CCL | Consolidated Coal Lease |
| DPE | Department of Planning and Environment |
| DPIE | Department of Planning, Industry & Environment |
| DSC | DSC Dams Safety Committee |
| EA | Environmental Assessment |
| EEC | Endangered Ecological Community |
| EMS | Environmental Management System |
| EP&A | Environmental Planning and Assessment 1979 (NSW) |
| EPA | Environment Protection Authority |
| EP | Extraction Plan |
| EP Area | Current mine plan and associated subsidence boundaries. |
| EPBC | Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) |
| GWMP | Groundwater Monitoring Program |
| HMP | Heritage Management Plan |
| LW | Longwall |
| LMP | Land Management Plan |
| ML | Megalitre |
| NSW | New South Wales |
| OEH | Office of Environmental & Heritage |
| PC | Place Change |
| PSMP | Public Safety Management Plan |
| ROM | Run of Mine |
| RR | Resource Regulator |
| RVC | Russell Vale Colliery |
| RVE | Russell Vale East |
| SMP | Subsidence Monitoring Program |

| Term | Description |
|---|---|
| TARP | Trigger Action Response Plan |
| TfNSW RMS | Transport for NSW Roads and Maritime Service |
| UEP | Underground Expansion Project |
| USMP | Upland Swamp Monitoring Plan |
| WNSW | Water NSW |
| WCC | Wollongong City Council |
| WCL | Wollongong Coal Limited |
| WMP | Water Management Plan |

**Table 31 Definitions**

| Term | Definition |
|---|---|
| Approved mine plan | The mine plan for Years 1-5 shown in Appendix 2 of the Development Consent. |
| Annual review | The review required by condition F11 of the Development Consent. |
| Bord and pillar mining method | Mining method comprising of a series of self-supporting roadways (or bords) within the coal seam leaving a grid of pillars of unmined coal which are designed to be stable in the long term. |
| Built Features | Includes any building or work erected or constructed on land and includes dwellings and infrastructure such as any formed road, street, path, walk, or driveway; any pipeline, water, sewer, telephone, gas or other service main. |
| Environmental Consequences | The environmental consequences of subsidence impacts, including damage to built features; loss of surface water flows to the subsurface; adverse water quality impacts; development of iron bacterial mats; cliff falls; rock falls; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. |
| First Workings | Development of main headings, gate roads, related cut throughs and other workings for mine access and ventilation. |
| Heritage Item | An Aboriginal object, an Aboriginal place, or a place, building, work, relic, moveable object, tree or precinct of heritage significance, that is listed under any of the following:<br>• the State Heritage Register under the Heritage Act 1977;<br>• -state agency heritage and conservation register under section 170 of the Heritage Act 1977;<br>• a Local Environmental Plan under the EP&A Act;<br>• the World Heritage List;<br>• the National Heritage List or Commonwealth Heritage List under the EPBC Act; or<br>• anything identified as a heritage item under the conditions of this consent. |
| Incident | An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance. |

| Term | Definition |
| --- | --- |
| Material Harm | Is harm to the environment that:<br>• involves actual or potential harm to the health or safety of human beings or to the environment that is not trivial, or<br>• results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000 (such loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment)<br>This definition excludes "harm" that is authorised under either this consent or any other statutory consent'. |
| Minor | Not very large, important or serious. |
| Mitigation | Activities associated with reducing the impacts of the development. |
| Negligible | Small and unimportant, such as to be not worth considering. |
| Non-compliance | An occurrence, set of circumstances or development that is a breach of this consent. |
| Second workings | Extraction of coal from bord and pillar workings. |
| Subsidence | The totality of subsidence effects, subsidence impacts and environmental. |
| Subsidence effects | consequences of subsidence impacts. |
| Subsidence impacts | Deformation of the ground mass due to mining, including all mining induced. |

# 10. REFERENCES

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SCT Operations 2022. RVC: Subsidence Assessment for PC27-34.

Umwelt 2019. Russell Vale Revised Underground Expansion Project: Revised preferred project report and response to second PAC review, Umwelt Environmental and Social Consultants.

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# APPENDIX A: MASTER TRIGGER ACTION RESPONSE PLANS

# APPENDIX B: CONSULTATION

# APPENDIX C: RISK ASSESSMENT

# APPENDIX D: SUBSIDENCE ASSESSMENT

# APPENDIX E: BUILT FEATURES MANAGEMENT PLAN

# APPENDIX F: PUBLIC SAFETY MANAGEMENT PLAN

# APPENDIX G: WATER MANAGEMENT PLAN

# APPENDIX H: GROUNDWATER MANAGEMENT PLAN

# APPENDIX I: BIODIVERSITY MANAGEMENT PLAN

# APPENDIX J: UPLAND SWAMP MONITORING PLAN

# APPENDIX K: LAND MANAGEMENT PLAN

# APPENDIX L: HERITAGE MANAGEMENT PLAN

# APPENDIX M: SUBSIDENCE MONITORING PROGRAM