



## **APPENDIX 4**

Matters of National Environmental  
Significance Report



GLENCORE

**SUPPLEMENTARY DGRS  
REPORT – ASSESSMENT OF  
MATTERS OF NATIONAL  
ENVIRONMENTAL  
SIGNIFICANCE, EPBC ACT**

Mount Owen Continued Operations  
Project

**FINAL**

October 2014

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ASSESSMENT OF MATTERS OF  
NATIONAL ENVIRONMENTAL  
SIGNIFICANCE, EPBC ACT**

Mount Owen Continued Operations Project

**FINAL**

**October 2014**

Prepared by  
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## APPENDICES

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# 1.0 Introduction

## 1.1 Background

Mt Owen Pty Limited (Mt Owen) (a subsidiary of Glencore Coal Pty Limited (Glencore)) proposes to extend its existing operations at the Mt Owen Complex within the Hunter Coalfields in the Upper Hunter Valley of New South Wales (NSW), approximately 20 kilometres north-west of Singleton and 24 kilometres south-east of Muswellbrook (refer to **Figure 1.1**).

The Mt Owen Continued Operations Project consists of continuation of existing operations as well as additional areas of disturbance associated with the proposed continued open cut mining and surface infrastructure.

The proposed activities resulting in additional disturbance (the Proposed Action) was referred to the then Department of Sustainability, Environment, Water, Population and Communities (DSEWPC, now the Department of the Environment (DoE)) on 16 August 2013 as a Proposed Action under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). The Proposed Action will provide for continued open cut mining and additional associated infrastructure, including:

- continuation of the North Pit in areas outside of the existing previously approved disturbance area;
- augmentation of the Mt Owen Rail Line through the construction of an additional rail line and northern turn-out, west of the existing Mt Owen Rail Line; and
- construction of a Main Northern Rail Line rail overpass and the construction of a new bridge across Bowmans Creek on Hebden Road.

The Proposed Action will allow for the continuation of the existing mining operations at Mt Owen (North Pit), enabling the extraction of approximately 74 million tonnes (Mt) of run-of-mine (ROM) coal to continue the current life of mine (LOM) from approximately 2018 to 2030, based on the optimal production schedule. The Proposed Action that is the subject of this report relates only to areas of additional disturbance. The Proposed Action does not include the approved activities under the existing development consents as part of continued operation of the existing Mt Owen Complex (including Mt Owen Mine, Ravensworth East Mine and Glendell Mine) and the use of associated mining infrastructure areas including the existing Mt Owen Rail Loop, the Mt Owen Coal Handling Preparation Plant (CHPP) and associated surface infrastructure. These activities are further described in **Section 3.1**.

In correspondence from the DoE dated 24 October 2013, the Minister's delegate determined that the Proposed Action (2013/6978) is a Controlled Action and requires assessment and the approval of the Minister for the Environment under the EPBC Act. It was acknowledged by the DoE that the Proposed Action was being assessed under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the DoE assessment will be through accreditation of the NSW Government process, (i.e. Accredited Assessment) with DoE liaising with the Department of Planning and Environment (DP&E) to ensure the assessment meets the requirements of the EPBC Act.

Specifically, the DoE have stated that *'the Action is likely to have a significant impact on the EPBC Act listed endangered spotted-tailed quoll, swift parrot and regent honeyeater. Significant impacts are also considered possible for a number of other species listed under the EPBC Act, [including but not limited to those listed in Appendix A]. The Action is also likely to have a significant impact on a water resource, as defined under the EPBC Act'*.



FIGURE 1.1  
Locality Plan

To ensure that sufficient information is provided to enable an appropriate level of assessment of relevant Matters of National Environmental Significance (MNES), the Director General of the DP&E issued Supplementary Director-General requirements (Supplementary DGRs) for the Environmental Impact Statement (EIS) for the Proposed Action, under section 78A(8A) of the EP&A Act (dated 8 November 2013).

Since the submission of the Project's referral to the DoE, Mt Owen has revised its mine plan within the Referral Area to enable optimisation of the resource recovery for the Proposed Action. This process has identified an opportunity for the extraction of an additional 4 Mt of ROM coal. To enable the extraction of this additional coal, the original Referral Area was required to be extended by approximately 21 ha. On 4 August 2014, Mt Owen submitted an application to vary the referral under Section 156A of the EPBC Act. This application for variation of the referral was approved by the DoE on 25 August 2014. The DoE also provided confirmation that the supplementary DGRs previously provided remained applicable to the revised Proposed Action. As outlined in Section 1.2 of the EIS, the EIS was previously submitted to DP&E in December 2013 for adequacy review. As part of this adequacy review DoE provided comments on the previous version of the MNES report and those comments have been addressed as appropriate in this report.

For the purposes of this report the following definitions apply:

- The Proposed Action: all activities associated with additional disturbance outside of areas previously approved for disturbance;
- The Referral Area: the area of proposed disturbance associated with the Proposed Action;
- The Project: All aspects of the Mt Owen Continued Operations Project including those aspects that do not constitute part of the Proposed Action; and
- The Project Area: The total area where all aspects of the Project will be undertaken.

## 1.2 Supplementary DGRs

This report provides a detailed response to the Supplementary DGRs and a copy of the Supplementary DGRs is provided in **Appendix 1**. **Table 1.1** presents each of the Supplementary DGRs and the section reference of this document where each is addressed.

This document seeks to provide an integrated assessment of relevant information from the EIS that relates to MNES only, without repeating the volumes of relevant material in other sections and appendices of the EIS. Therefore, it is important to review this report in conjunction with other parts of the EIS as described in each section of this report.

Table 1.1 – Supplementary DGRs

Requirement	Section Reference
<b>General Information</b>	
1. The background of the action, including:	
a. the title of the action	2.1
b. the full name and postal address of the designated proponent	2.2
c. a clear outline of the objective of the action	2.3
d. the location of the action	2.4
e. the background to the development of the action	2.5
f. how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action	2.6
g. the current status of the action, and	2.5
h. the consequences of not proceeding with the action	2.7
<b>Description of the controlled action</b>	
2. A description of the action, including:	
a. all the components of the action	3.1
b. the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts	3.2
c. how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts	3.2
d. the timing and duration of the works to be undertaken, and	3.1
e. to the extent reasonably practicable, a description of any feasible alternatives to the controlled action that have been identified through the assessment, and their likely impact, including:	3.3
i. if relevant, the alternative of taking no action	2.7
ii. a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action, and	3.3
iii. sufficient detail to clarify why any alternative is preferred to another	3.3
<b>Description of the existing environment</b>	
3. A description of the existing environment of the proposal location and the surrounding areas that may be affected by the action, including but not limited to:	4.0
a. surveys using accepted methodology for targeting listed threatened species, ecological communities and their respective habitat, including but not limited to OEH's Survey and assessment guidelines (2009), available at: <a href="http://www.environment.nsw.gov.au/threatenedspecies/surveymethodsfauna.htm">http://www.environment.nsw.gov.au/threatenedspecies/surveymethodsfauna.htm</a> and the Department of the Environment's species-specific survey guidelines for nationally threatened species, available at: <a href="http://www.environment.gov.au/cgi-bin/spravpublic/sprat.pl">http://www.environment.gov.au/cgi-bin/spravpublic/sprat.pl</a>	4.1.1
b. a description of the distribution and abundance of threatened species and ecological communities, as well as suitable habitat (including breeding, foraging, roosting habitat, habitat critical to the survival of threatened species) within the site and in surrounding areas that may be impacted by the proposal. Specifically, this must include but not be limited to the species in Appendix A (refer to <b>Appendix 1</b> ).	4.1.2

Table 1.1 – Supplementary DGRs (cont.)

Requirement	Section Reference
c. the regional distribution and abundance of suitable and potential habitat for threatened species and ecological communities surrounding the site	4.1.3
d. a description of the important water resources within the site and in surrounding areas, including detailed information addressing the department's Water Resources Terms of Reference, currently in preparation, and	4.2
e. a description of water related assets that are dependent on any important water resources, including an estimation of the water requirements of those assets (i.e. regional water use).	4.2.3
<b>Description of the relevant impacts of the controlled action</b>	
4. An assessment of all relevant impacts <sup>1</sup> with reference to the <i>EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance (2009)</i> , <i>Draft significant impact guidelines: Coal seam gas and large coal mining developments - impacts on water resources</i> and species specific guidelines as relevant (available at: <a href="http://www.environment.gov.au/epbc/guidelines-policies.html">www.environment.gov.au/epbc/guidelines-policies.html</a> ) that the controlled action has, will have, or is likely to have. Information must include:	5.0
a. a description of the relevant impacts of the action on matters of national environmental significance:	5.1.5
<ul style="list-style-type: none"> <li>listed species and communities (including, but not limited to, those listed in Appendix A (refer to <b>Appendix 1</b>), and</li> </ul>	Section 5.1.5
<ul style="list-style-type: none"> <li>water resources (...)</li> </ul>	5.2
b. a detailed assessment of the nature and extent of the likely short term and long term relevant impacts	5.1.1
c. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible	5.1.2
d. analyses of the significance of the relevant impacts, and	5.1.3
e. any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	5.1.4
5. Where there is a potential habitat for EPBC Act listed species (Appendix A (refer to <b>Appendix 1</b> )), surveys must be undertaken. These surveys must be timed appropriately and undertaken for a suitable period of time by a qualified person <sup>2</sup> . A subsequent description of the relevant impacts on such EPBC Act listed species should include, inter alia, direct, indirect, cumulative and facilitative impacts on the:	5.1.5
a. population of the species at the site	5.1.5
b. area of occupancy of the species	5.1.5
c. habitat critical to the survival of the species	5.1.5
d. breeding cycle of the population, and	5.1.5
e. availability or quality of habitat for the species	5.1.5

<sup>1</sup> The term “relevant impact” is defined in section 82 of the EPBC Act. Note that the actions has been found to be likely to have a significant impact on listed species and communities, under sections 18 and 18A of the EPBC Act, and water resources, under sections 24D and 24E of the Act.

<sup>2</sup> Where available, species-specific survey guidelines can be obtained on the department's *Species Profile and Threats Database*: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>



Table 1.1 – Supplementary DGRs (cont.)

Requirement	Section Reference
If an endangered ecological community or threatened species listed at Appendix A (refer to <b>Appendix 1</b> ) is not believed to be present on the proposed site, detailed information must be included in the Environmental Impact Assessment to demonstrate that this community will not be impacted.	5.1.5
6. Under sections 24D and 24E of the EPBC Act, a water resource in relation to coal seam gas and large coal mining development has been determined a controlling provision in relation to this project. The documentation provided must include information addressing all relevant impacts on water resources and water related values. The information must be consistent with the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development's <i>Information Guidelines for Proposals Relating to the Development of Coal Seam Gas and Large Coal Mines where there is a Significant Impact on Water Resources</i> . The Guidelines are available at: <a href="http://www.environment.gov.au/coal-seam-gasmining/pubs/iesc-information-guidelines.pdf">http://www.environment.gov.au/coal-seam-gasmining/pubs/iesc-information-guidelines.pdf</a> . The information must include:	5.2, 5.4
<ul style="list-style-type: none"> <li>a detailed assessment of potential impacts (including cumulative impacts) on the quality and quantity of existing surface and ground water resources, including:</li> </ul>	5.2
<ul style="list-style-type: none"> <li>a. detailed modelling of potential groundwater impacts, including any potential impacts on alluvial aquifers</li> </ul>	5.3.2
<ul style="list-style-type: none"> <li>b. impacts on affected licensed water users and basic landholder rights</li> </ul>	5.3.1.7, 5.3.2.2
<ul style="list-style-type: none"> <li>c. impacts on riparian, ecological, geo-morphological and hydrological values of watercourses, including environmental flows, and</li> </ul>	3.2, 5.3.1.1, 5.3.1.5, 5.3.1.6, 5.3.2.5
<ul style="list-style-type: none"> <li>d. a flood assessment including identification of any necessary flood impact mitigation measures</li> </ul>	5.3.1.2
<ul style="list-style-type: none"> <li>a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume, salinity and frequency of any water discharges), water supply infrastructure and water storage structures</li> </ul>	5.5
<ul style="list-style-type: none"> <li>an assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives</li> </ul>	5.5.1, 5.3.1.1, 5.3.1.3, 5.3.1.7, 5.3.1.4, 5.3.2.1, 5.3.2.3, 5.3.2.4, 5.3.2.6
<ul style="list-style-type: none"> <li>assessment of impacts of salinity from mining operations, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to surface and groundwater sources</li> </ul>	5.5.2
<ul style="list-style-type: none"> <li>assessment of groundwater impacts against the minimal impact considerations in the <i>NSW Aquifer Interference Policy</i></li> </ul>	5.6.1
<ul style="list-style-type: none"> <li>identification of any licensing requirements or other approvals under the <i>Water Act 1912</i> and/or <i>Water Management Act 2000</i></li> </ul>	5.6.2, 8.0
<ul style="list-style-type: none"> <li>demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP)</li> </ul>	5.5, 5.6.2
<ul style="list-style-type: none"> <li>a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo</li> </ul>	5.6.2, 5.7.2.1, 5.7.3

**Table 1.1 – Supplementary DGRs (cont.)**

<b>Requirement</b>	<b>Section Reference</b>
<ul style="list-style-type: none"> <li>a detailed description of the proposed water management system (including sewage), water monitoring program and measures to mitigate surface and groundwater impacts, and</li> </ul>	<b>5.7</b>
<ul style="list-style-type: none"> <li>information on how the project will comply with the Hunter River Salinity Trading Scheme</li> </ul>	<b>5.2</b>
<b>Proposed safeguards and mitigation measures</b>	
7. A description of feasible mitigation measures, changes to the action or procedures, which have been proposed by the proponent or suggested in public submissions, and which are intended to prevent or minimise relevant impacts on matters of national environmental significance. Information must include:	<b>6.0</b>
a. a description of the mitigation measures that will be undertaken to prevent or minimise the relevant impacts of the action. These mitigation measures should be justified and based on best available practices	<b>6.1</b>
b. an assessment of the expected or predicted effectiveness of the mitigation measures including the effect on abundance and condition of species, suitable habitat and ecological communities	<b>6.2</b>
c. any statutory or policy basis for the mitigation measures	<b>6.3</b>
d. the cost of the mitigation measures	<b>6.4</b>
e. an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs (including any relevant thresholds for corrective actions) for the relevant impacts of the action. Include the person or agency responsible for implementing these programs and the effectiveness of all mitigation measures, including any provisions for independent environmental auditing	<b>6.5</b>
f. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program	<b>6.6</b>
g. identification of mitigation measures proposed to be undertaken by State governments, local governments or the proponent, and	<b>6.7</b>
h. any changes to the action which prevent or minimise relevant impacts on listed threatened species and communities	<b>6.8</b>
<b>Offsets</b>	
8. Where impacts cannot be avoided or mitigated, an offset package to compensate for any predicted or potential residual significant impacts on matters of national environmental significance. Offsets should demonstrate consistency with the Commonwealth EPBC Act Environmental Offsets Policy (October 2012, or subsequent versions), available at: <a href="http://www.environment.gov.au/epbc/publications/environmental-offsets-policy.html">www.environment.gov.au/epbc/publications/environmental-offsets-policy.html</a> . The department's information requirements in relation to EPBC Act offset proposals is provided at Appendix B (refer to <b>Appendix 1</b> ). Information must include:	<b>7.0</b>
a. the description of any offset package should include how the offset compensates for the residual impacts, when the offset will be delivered and how the offset will be managed	<b>7.1</b>
b. an assessment of the impact of the offsets on other matters of environmental, economic, or social significance and	<b>7.2</b>
c. analysis of cost, both financial and other, related to offsets.	<b>7.2</b>

Table 1.1 – Supplementary DGRs (cont.)

Requirement	Section Reference
<b>Other approvals and conditions</b>	
9. Any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action. Information must include:	<b>8.0</b>
a. details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including:	<b>8.1</b>
i. what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy, and	<b>8.1</b>
ii. how the scheme provides for the prevention, minimisation and management of any relevant impacts	<b>8.1</b>
b. a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the EPBC Act), including any conditions that apply to the action	<b>8.2</b>
c. a statement identifying any additional approval that is required, and	<b>8.2</b>
d. a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action	<b>8.3</b>
<b>Economic and social matters</b>	
10. A description of the short-term and long-term social and economic implications and/or impacts of the project.	<b>9.1</b>
<b>Environmental record of person proposing to take the action</b>	
11. Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:	<b>10.0</b>
a. the proponent, and	<b>10.0</b>
b. for an action for which a person has applied for a permit, the person making the application.	<b>10.0</b>
12. Details of the proponent's environmental policy and planning framework.	<b>10.1</b>
<b>Information Sources</b>	
13. For information given in an environment assessment, the draft must state:	<b>11.0</b>
a. the source of the information	<b>11.0</b>
b. how recent the information is	<b>11.0</b>
c. how the reliability of the information was tested, and	<b>11.0</b>
d. what uncertainties (if any) are in the information.	<b>11.0</b>
<b>Consultation</b>	
14. Any consultation about the action, including:	<b>12.0</b>
a. any consultation that has already taken place	<b>12.0</b>
b. proposed consultation about relevant impacts of the action, and	<b>12.0</b>
c. if there has been consultation about the proposed action - any documented response to, or result of, the consultation	<b>12.0</b>
15. Identification of affected parties, including a statement mentioning any communities that may be affected and a description of their views.	<b>12.1</b>

## 2.0 General Information

### 2.1 Title of the Action

#### 1. *The background of the action, including:*

##### *a) the title of the action*

The title of the Proposed Action is the Mt Owen Continued Operations Project.

### 2.2 Name and Address of the Designated Proponent

#### *b) the full name and postal address of the designated proponent*

The designated Proponent for the Proposed Action is Mt Owen Pty Limited (Mt Owen).

The postal address for Mt Owen is:

PO Box 320  
Singleton NSW 2330

### 2.3 Objective of the Action

#### *c) a clear outline of the objective of the action*

As discussed in **Section 1.0**, the Proposed Action is the additional disturbance associated with the continuation of Mt Owen and Ravensworth East mining operations to provide for continued open cut mining and additional associated infrastructure. The Proposed Action will allow for the continuation of the existing mining operations, enabling the extraction of approximately 74 Mt of ROM coal from the North Pit Continuation. As noted in **Section 1.0**, the Proposed Action relates only to areas of additional disturbance and not those activities already approved.

The key objectives of the Proposed Action include:

- the continued operation of the Mt Owen and Ravensworth East Mines with a focus on:
  - maximising resource recovery from within the existing Glencore mining tenements; and
  - optimising the use of existing infrastructure;
- maintaining the economic life of the Mt Owen Mine and providing ongoing employment for the existing workforce;
- further development of the existing environmental mitigation and management strategies, expanding the existing commitments to mitigate and manage the predicted impacts associated with the Proposed Action;
- maximising the use of previously disturbed areas and existing mining infrastructure, thereby minimising the overall disturbance as far as practicable;

- avoiding disturbance of existing Biodiversity Offset Areas and the Ravensworth State Forest;
- providing suitable offsets for the biodiversity impacts resulting from the Proposed Action;
- continuing to actively engage and consult with the surrounding community; and
- establishing a final landform that is safe and stable which ensures sustainable post mining land use options which serves as a component of the Biodiversity Offset Strategy for the Proposed Action.

## 2.4 Location of the Proposed Action

### *d) the location of the action*

The Proposed Action will form part of the Mt Owen Complex which is located within the Hunter Coalfields in the Upper Hunter Valley of NSW, an area historically characterised by coal mining which includes a number of existing mining operations, both within the Mt Owen Complex and the broader Ravensworth Area. The site of the Proposed Action is approximately 20 kilometres north-west of Singleton and 24 kilometres south-east of Muswellbrook (refer to **Figure 1.1**).

With respect to the specific location of the Proposed Action, this is illustrated in **Figure 2.1** (Referral Area), and a schedule of lands impacted by the Proposed Action is provided below in **Table 2.1**.

**Table 2.1 – Schedule of Lands**

Lot	DP
1	137381
1	137382
1	151176
1	159786
1	745486
1	804150
1	865784
1	940619
10	38725
100	752462
102	752462
11	38725
11	6830
11	825904
112	850054
12	38725
12	825904
121	752462
1221	709371
13	38725
13	6830



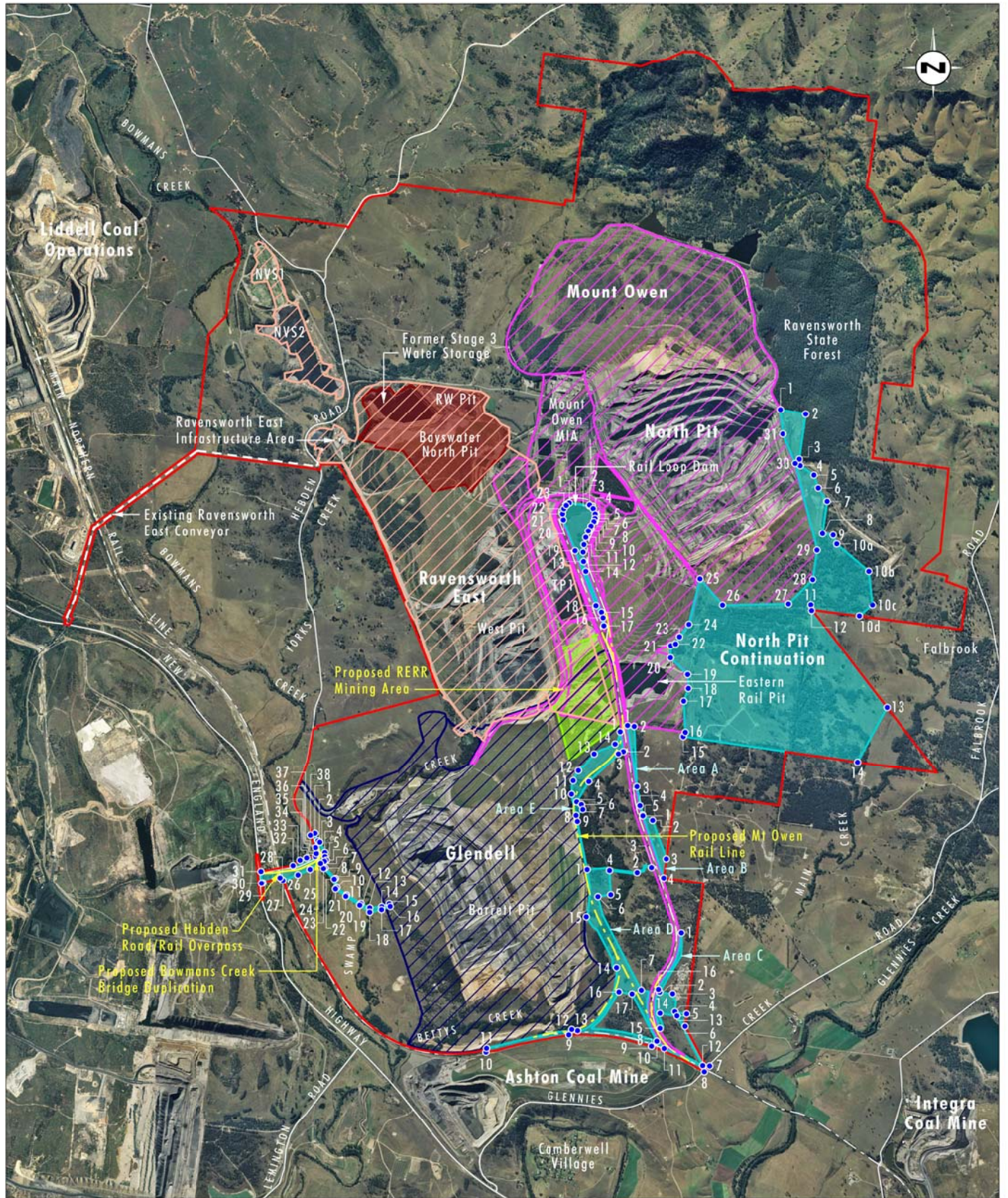


Image Source: Mount Owen (2012-2013)  
Data Source: Mount Owen (2014)

0 1 2 3 km  
1:60 000

#### Legend

- Mount Owen Complex
- Referral Area
- Mount Owen Operational Area
- Glendell Operational Area
- Ravensworth East Operational Area
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Referral Area Location
- Proposed RERR Mining Area
- Bayswater North Pit

FIGURE 2.1

Project Overview  
Mount Owen Continued Operations Project



**Table 2.1 – Schedule of Lands (cont.)**

<b>Lot</b>	<b>DP</b>
13	825904
14	38725
14	825904
15	38725
16	38725
17	6830
19	38725
2	38725
2	6842
2	804150
20	38725
21	38725
21	6830
2A	6842
3	195598
3	38725
3	662944
4	38725
4	859544
5	1077004
5	38725
5	859544
6	1077004
6	38725
6	859544
60	752462
7	38725
7	859544
71	625171
8	1077004
8	38725
8	6830
8	859544
9	38725
922	844642
923	844642
924	862883
925	862883

Section 1.3.1 of the EIS provides further detail regarding the location of the Proposed Action and surrounding land.

## 2.5 Background to the Development and Current Status of the Proposed Action

### *e) the background to the development of the action*

The Mt Owen Mine has been operating since 1993 during which time it has provided substantial economic benefits to the local, State and national economies. .

Subject to market conditions, Mt Owen expects that mining will be completed within the currently approved area of the North Pit and the Ravensworth East Mine by 2018 and 2021 respectively. In order to continue these mining operations, Mt Owen has undertaken extensive exploration of its mining tenements and has identified additional mineable coal to the south of the currently approved North Pit mining limit.

Mt Owen is seeking approval for the Proposed Action to extract the additional mineable coal through continued open cut mining methods. The Proposed Action proposes to continue the existing mining operations within the North Pit to the south beyond the current approved North Pit mining limit (refer to **Figure 2.2**).

The Proposed Action seeks to maintain the current approved North Pit extraction rate of 10 Mtpa of ROM coal, extracting an additional 74 Mt of ROM coal over the life of the mine. The extraction of these additional mineable coal tonnes would continue the North Pit life to approximately 2030, extending the substantial employment and economic benefits provided to the existing workforce and suppliers. The current recoverable coal tonnes from the North Pit are 24 Mt ROM and if approved, the Proposed Action would increase this recovery to a total of approximately 98 Mt ROM coal.

The Mt Owen Mine was the subject of an EPBC referral in 2004 and deemed to not be a controlled action and the remainder of the current operations associated with the Mt Owen and Ravensworth East Mines were approved under the *Environmental Planning and Assessment Act 1979 NSW* (EP&A Act) prior to the commencement of the EPBC Act. The existing Glendell Mine development consent (80/952) was first approved in 1983 with a subsequent modification in 1997. In 2007 the Glendell Mine development consent (80/952) was subject to a modification which was considered to not have any impact on any of the matters of national environmental significance prescribed by the EPBC Act at that time and therefore was not the subject of an EPBC referral. The Proposed Action does not relate to any works which are currently authorised by existing approvals nor any modifications to these approvals.

## 2.6 Relationship with other Actions

### *f) how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action*

Coal was first mined in the Upper Hunter in the Rixs Creek area near Singleton in the 1860s (Rappoport 2006:24). Coal mining and electricity generation have become major industries in the Singleton area since the 1950s with the first wave of collieries built to meet export demand at Liddell, Foybrook and Liddell State. Since the mid-twentieth century, coal mining operations 'expanded from the Cessnock/Maitland area to the triangle bounded by Singleton, Muswellbrook and Denman, using highly mechanised, open cut surface mining techniques in which all overburden is stripped from the surface' (Rappoport 2006:24).



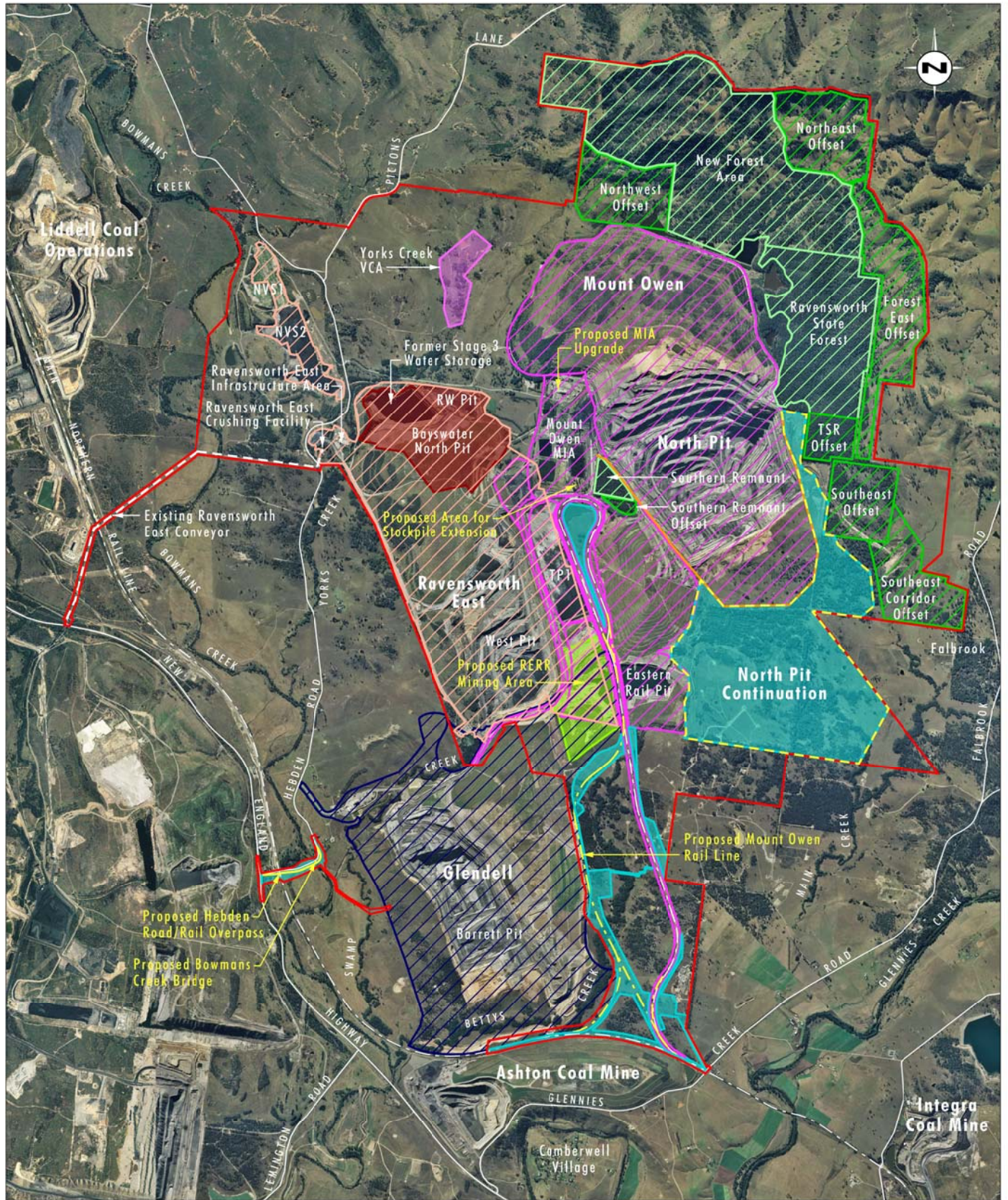


Image Source: Mount Owen (2012-2013)  
Data Source: Mount Owen (2014)

0 1 2 3 km  
1:60 000

### Legend

- |  |   |
|--|---|
| <span style="border: 1px solid red; display: inline-block; width: 20px; height: 10px;"></span> Project Area  | <span style="background-color: #f08080; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Yorks Creek VCA                   |
| <span style="background-color: #90ee90; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Approved North Pit Mining Extent   | <span style="background-color: #800000; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Bayswater North Pit               |
| <span style="background-color: #008000; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Proposed North Pit Continuation    | <span style="background-color: #ff00ff; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Mount Owen Operational Area       |
| <span style="background-color: #0000ff; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Proposed Rail Upgrade Works        | <span style="background-color: #0000ff; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Glendell Operational Area         |
| <span style="background-color: #0000ff; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Proposed Hedden Road Upgrade Works | <span style="background-color: #ff00ff; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Ravensworth East Operational Area |
| <span style="background-color: #0000ff; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Referral Area                      | <span style="background-color: #008000; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Existing Biodiversity Offset Area |
| <span style="background-color: #0000ff; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Proposed RRR Mining Area           | <span style="background-color: #008000; border: 1px solid black; display: inline-block; width: 20px; height: 10px;"></span> Ravensworth State Forest          |

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20141009 10.03

FIGURE 2.2

Proposed Mount Owen  
Continued Operations Project



There are a number of established mining operations located within 10 kilometres of the Project Area including:

- Glendell Mine to the south-west;
- Liddell Coal Operations to the north-west;
- Ravensworth Operations to the south-west;
- Integra Mine to the south-east (currently on care and maintenance); and
- Ashton Mine to the south.

Other land uses within the surrounding area include mining operations, grazing and rural residential holdings, the Hebden and Wild Quarries (7.8 and 7.1 kilometres respectively from the Proposed Action) and the Bayswater and Liddell Power Stations (13 and 11.6 kilometres respectively from the Proposed Action) (refer to **Figure 2.3**).

With respect to how the Proposed Action relates to other actions, Integra Mine, which is an operational underground mine, was an integral consideration during the mine planning process. The proposed depth of mining within the North Pit Continuation is restricted by lease holdings related to the Integra Underground Mining operations. Based on the current conceptual mine plans, the North Pit Continuation will result in mining over a portion of the current approved Integra underground workings (refer to **Figure 2.4**). The vertical separation between the North Pit Continuation pit floor and the Integra underground workings will be a minimum of approximately 250 metres (refer to **Figure 2.5**), which is considered adequate to enable the management of safety and operational issues. Mt Owen has commenced and will maintain consultation with Integra Underground management throughout the approvals and operational phases. It is proposed to manage any interaction through the development and implementation of a *Blast Management Plan* which worked successfully during the mining of the Eastern Rail Pit in 2005 and 2006 where there was an earlier interaction between the mines.

There will be continued subsidence maintenance and management relating to Integra Operations interaction with the existing rail line, which will continue to be undertaken in accordance with the existing Memorandum of Understanding between Mount Owen and Integra. Maintenance of gas ventilation fans and gas drainage infrastructure will also continue, and associated management protocols updated, as consultation with Integra management progresses.

In addition, the current Mt Owen environmental impact assessment has been considered in a cumulative context with surrounding mines.

Further, Mt Owen's offset planning has considered synergies with another current Proposed Action relating to Glencore's Liddell Coal Mine Extension, located approximately 7 kilometres from the Referral Area. In particular, consideration has been given in relation to the spotted-tailed quoll, with the proposed Mt Owen offset designed to add value to the offset proposed for the Liddell Coal Mine Extension (refer to **Section 7.1**). In addition, the current Mt Owen rehabilitation offset strategy builds upon the rehabilitation offset strategy established for Glencore's Ravensworth Operations Project (refer to **Section 7.1**).

***g) the current status of the action, and***

Refer to **Section 2.5** above.

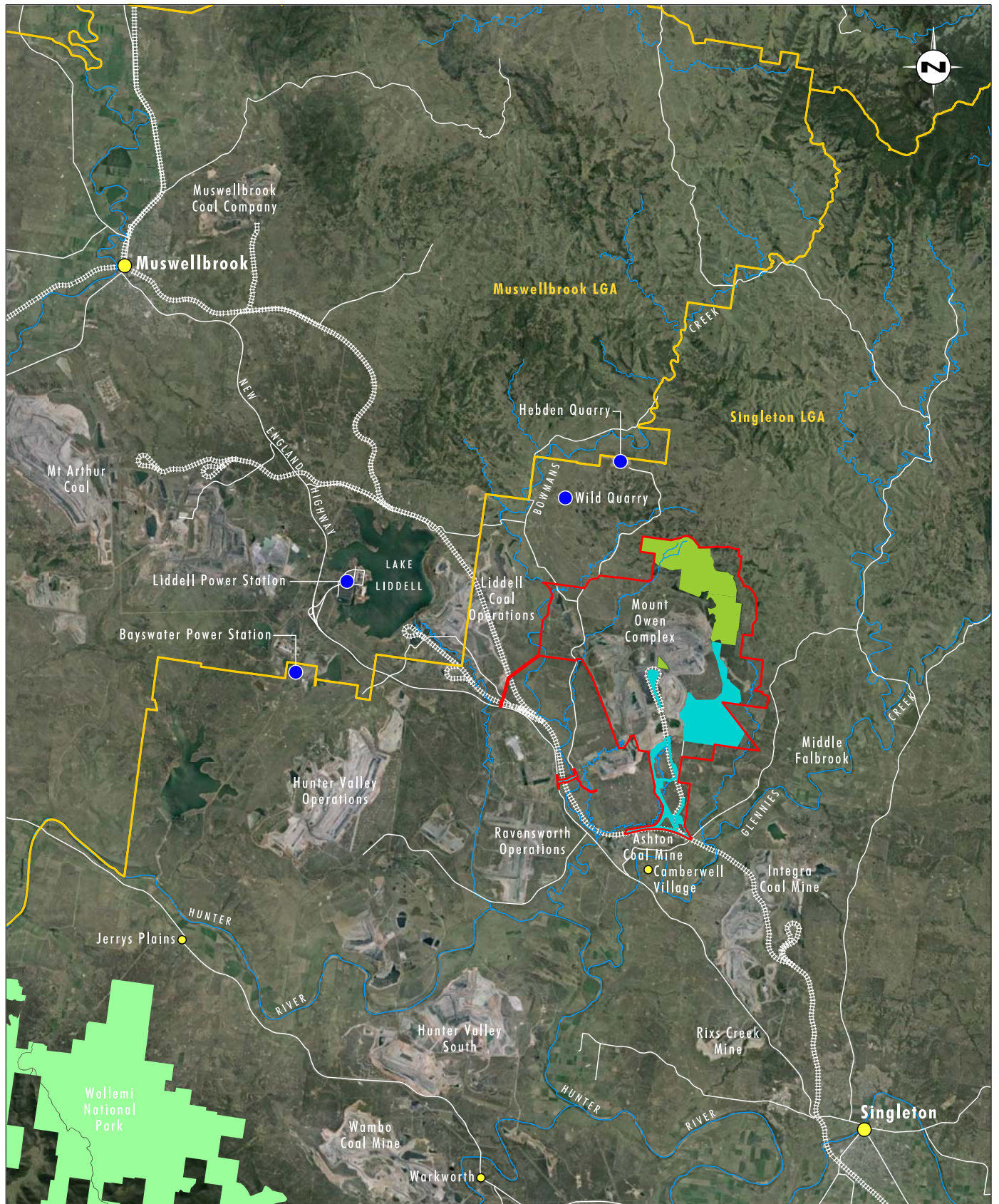


Image Source: Google Earth (2013)  
 Data Source: Mount Owen (2013), OEH (2013),  
 Forest Corporation of NSW (2013)

#### Legend

- ▬ Project Area
- ▬ Local Government Area Boundary
- ▬ Referral Area
- ▬ National Park
- ▬ State Forest
- Towns/Villages
- ▬ Road
- ▬ Railway

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FIGURE 2.3

Upper Hunter  
 Valley Context



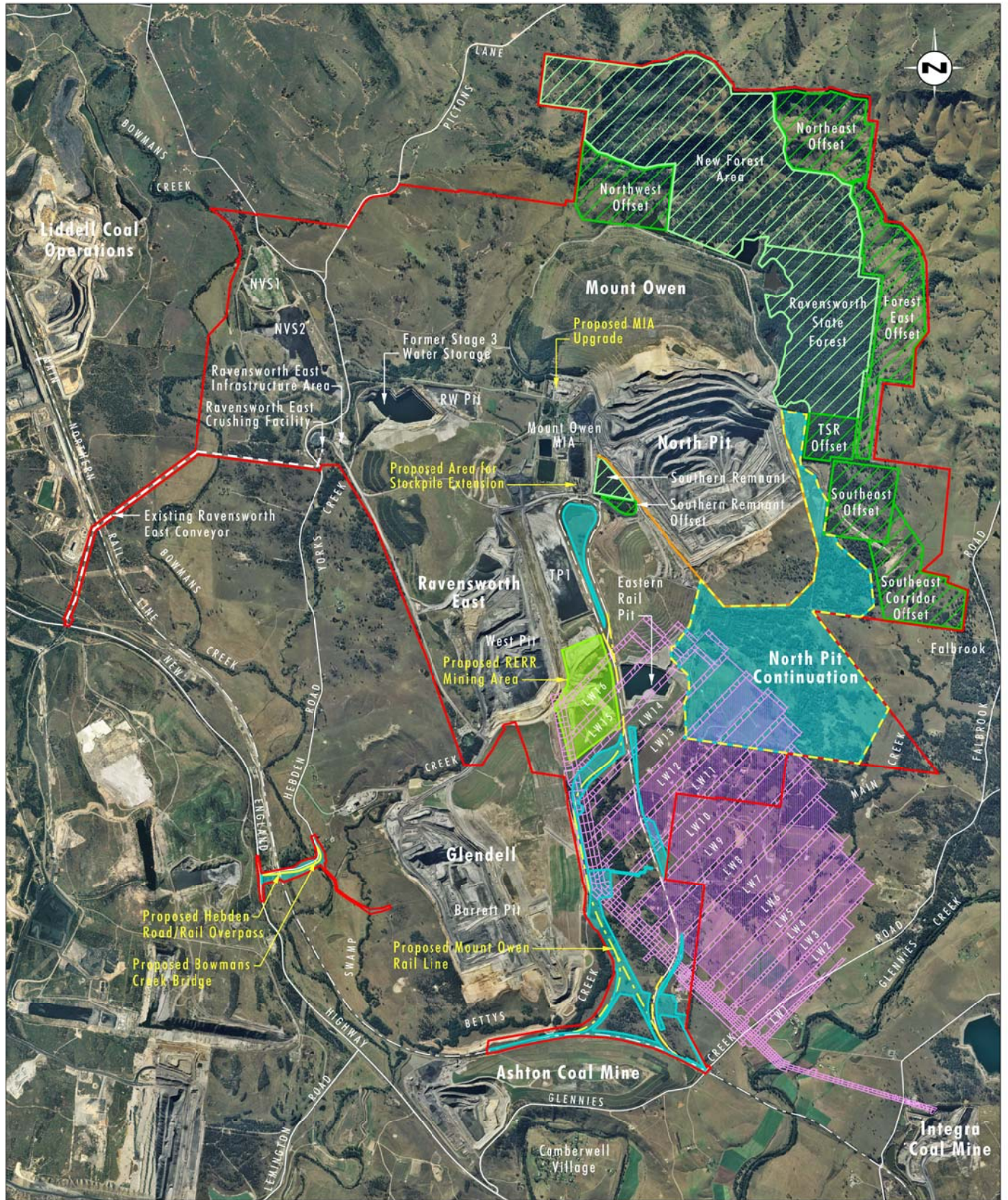


Image Source: Mount Owen (2012-2013)  
Data Source: Mount Owen (2014)

0 1 2 3 km  
1:60 000

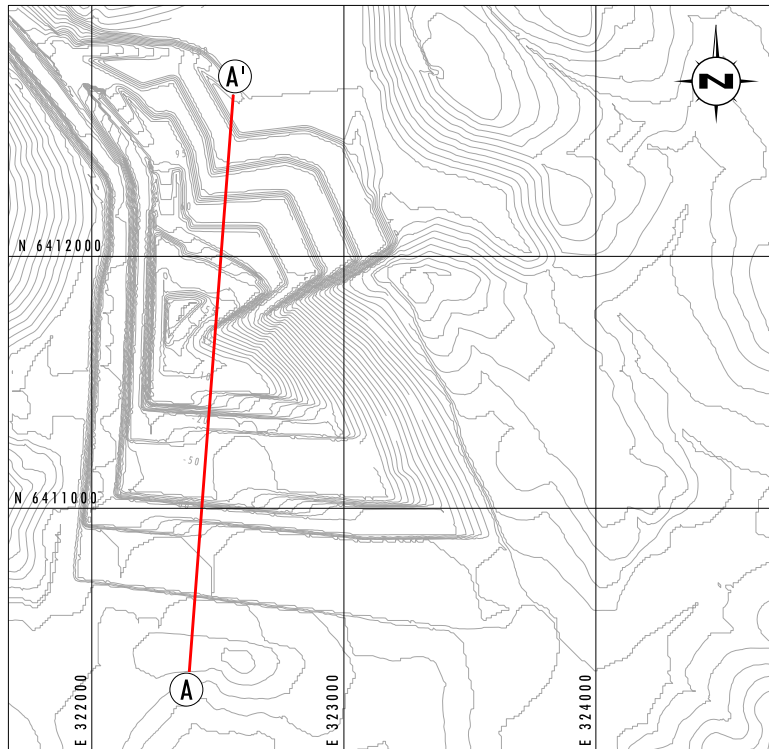
### Legend

- Project Area
- Approved North Pit Mining Extent
- Proposed North Pit Continuation
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Referral Area
- Proposed RERR Mining Area
- Existing Biodiversity Offset Area
- Ravensworth State Forest
- Integra Coal Mine Plan
- Mined Area

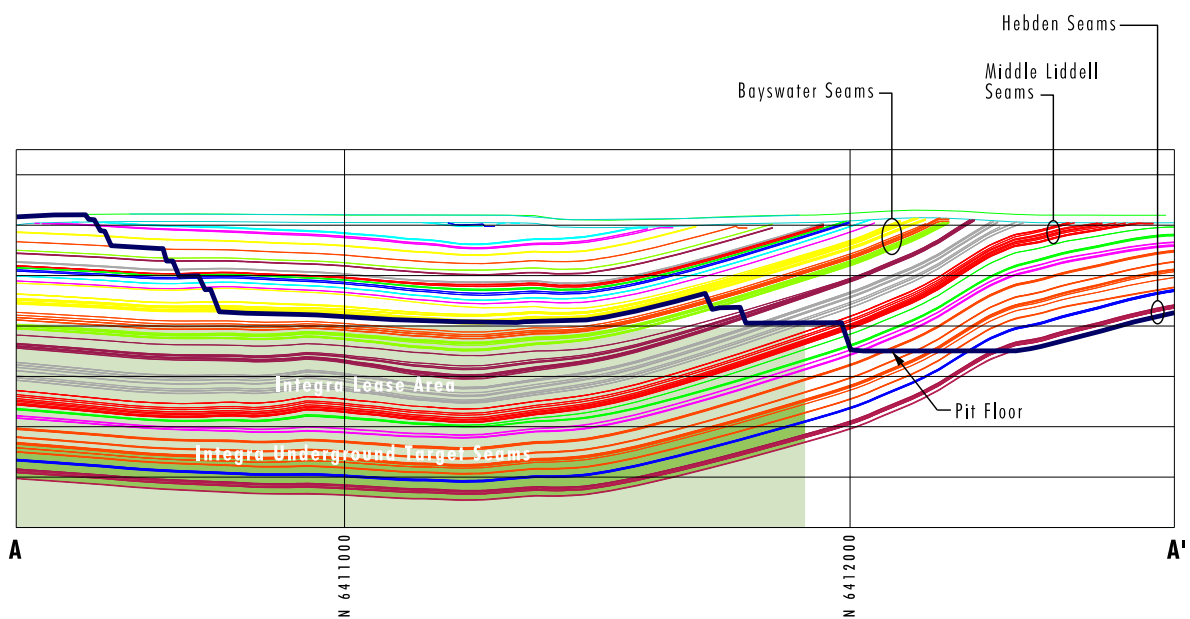
FIGURE 2.4

Proposed Project Area and  
Integra Underground Mine

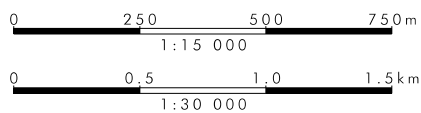




**Plan View**  
SCALE 1:30 000



**Section View of Pit Floor**  
SCALE 1:15 000



**FIGURE 2.5**  
**Vertical Separation**  
**North Pit and Integra**  
**Underground Mine**

## 2.7 Consequences of not Proceeding with the Proposed Action

### *h) the consequences of not proceeding with the action*

Section 2.5 of the EIS presents alternatives for the Proposed Action including the alternative of not proceeding. In summary, if the Proposed Action was not to proceed, Mt Owen Mine would cease operations in approximately 2018. At that time, there would be approximately 74 Mt ROM coal that would not be recovered. Moreover, it would be difficult for Glencore or other mining companies to ever access the resource in the future, once Mt Owen operations ceased and the mine was fully rehabilitated. Whilst rehabilitation and closure works would continue for some years following the cessation of mining, such operations would be at a much lower intensity than the current mining operations and there would be a significant reduction in employee numbers. The employment opportunities for approximately 660 employees (North Pit) and up to 260 (Ravensworth East) would be lost as would the significant flow on effect to the local, regional and state economy.

An economic assessment was completed for the Project and identified that the gross mining revenue is the primary benefit for the Project. The gross mining revenue is calculated from the anticipated production schedule (amount of coal anticipated to be extracted). As outlined above, there are some mining activities that are part of the Project that will be undertaken in areas that have previously been approved for mining and accordingly do not result in additional disturbance nor are part of the Proposed Action. Mining in these areas would extract approximately 18 Mt of ROM coal from a total of approximately 92 Mt. Thus, the Proposed Action contributes approximately 80% of the primary benefit (gross mining revenue) for the economic assessment. Similarly, the cost benefit analysis includes a number of impacts (for example air quality, noise, biodiversity) for the Project. The economic cost of all predicted impacts (including those associated with aspects of the Project that are not part of the Proposed Action) have been considered in the cost benefit analysis.

The results of the economic assessment for the Project are provided below.

The Project is anticipated to have the following positive economic benefits that would not be realised if the Project did not proceed:

- deliver a net benefit of around \$758 million over its life and generates a benefit cost ratio of approximately 1.30;
- generate royalties of an estimated \$258 million in NPV terms to the NSW Government;
- generate a net benefit to the Singleton community of around \$306 million (in NPV (net present value terms) over the life of the Project;
- the Hunter Region's Gross Regional Product (GRP) is projected to increase by just under \$1.3 billion in NPV terms, over the life of the Project;
- increase the NSW gross State product (GSP) (including the Hunter) by approximately \$1.9 billion (NPV terms);
- capital expenditure of approximately \$152.9 million; and
- directly and indirectly employ a peak of almost 1,200 full time equivalent (FTE) workers. Of this, about 1,091 are estimated to be employed in the Hunter region.

Refer to Section 5.18 and Appendix 15 of the EIS for further detail.

## 3.0 Description of the Controlled Action

### 3.1 Components of the Action

#### 2. A description of the action, including:

##### a) all the components of the action

The Proposed Action will provide for continued open cut mining and additional associated infrastructure and includes:

- continuation of the North Pit to the south of the existing previously approved disturbance area;
- augmentation of the Mt Owen Rail Line through the construction of an additional rail line and northern turn-out west of the existing Mt Owen Rail Line; and
- construction of a Main Northern Rail Line rail overpass and the construction of a new bridge across Bowmans Creek on Hebden Road (refer to **Figure 2.2**).

The following sections provide a summary of the Proposed Action, including the aspects of currently approved and existing operations that are not part of the Proposed Action.

#### Current Approved Operations (Not part of the Proposed Action)

The Mt Owen Complex including all existing mining operations is approximately 5,857 hectares, of which approximately 2,572 hectares is either disturbed land (as a result of existing approved mining activities) or land in the process of being rehabilitated.

The existing open cut mining operations at the Mt Owen Complex consist of truck and excavators supported by ancillary equipment. The Mt Owen Mine has an approved production rate of 10 Mtpa ROM coal, the Ravensworth East Mine has an approved production rate of 4 Mtpa ROM coal, and Glendell Mine has an approved production rate of 4.5 Mtpa ROM coal. The Mt Owen Complex has an approved total processing capacity at the Mount Owen CHPP of 17 Mtpa of ROM coal. All ROM coal mined from the North Pit, Ravensworth East and Glendell operations is processed at the Mt Owen CHPP and transported to the Port of Newcastle, or occasionally to domestic markets, via the existing Mount Owen Rail Line and the Main Northern Rail Line. ROM coal is also transported to the Bayswater and Liddell power stations via the Ravensworth East and M-series conveyor on an 'as required' basis. Tailings management is currently undertaken in accordance with the existing Mt Owen development consent (DA 14-1-2004) at tailings emplacement areas across the Mt Owen Complex, with an additional approved tailings facility, the West Pit, to be utilised upon cessation of mining that area.

Each of these mines, i.e. Ravensworth East, Glendell and Mt Owen, has existing development consents and any activities approved under these existing consents are not part of the Proposed Action. No changes are proposed to the approved Glendell mining operations (refer to **Figure 2.1** for approved operational areas, these are not included as part of the Proposed Action). However, to improve compliance efficiencies and management of the Mt Owen Complex operations, should the Proposed Action be approved, Mt Owen seeks a single new development consent under the EP&A Act for the existing Mt Owen and Ravensworth East mines, but excluding the Glendell Mine (as identified in **Figure 2.1**).

The use of existing facilities and associated improvement works within the Mine Infrastructure Area (MIA) will not result in any additional surface disturbance beyond that approved as part of the existing mining operations.

The Proposed Action will not involve any changes to the existing approved mining techniques.

### Proposed Action

Mt Owen proposes to continue mining operations within the existing North Pit beyond the current approved mining limit in a southerly direction, as illustrated on **Figure 2.2**. It is proposed that the current approved mining limit would be extended by an additional surface disturbance footprint of approximately 381 hectares, with a total disturbance of approximately 485 hectares including the proposed rail and road upgrade works as identified in **Figure 2.2** as the Referral Area.

The key features of the Project are shown in **Table 3.1** and on **Figure 2.2**.

**Table 3.1 – Overview of the Proposed Project**

Key Feature	Proposed Operations	Result in Additional Disturbance
<b>Mine Life</b>	<ul style="list-style-type: none"> <li>Consent will be sought for 21 years (from date of Project Approval) to provide for mining until approximately 2030 and contingency for other activities such as rehabilitation and capping of tailings emplacement areas.</li> </ul>	NA
<b>Limits on Extraction</b>	No change in approved extraction rates. <ul style="list-style-type: none"> <li>North Pit – up to 10 Mtpa ROM.</li> <li>Ravensworth East – up to 4 Mtpa ROM.</li> </ul>	NA
<b>Mine Extent</b>	<ul style="list-style-type: none"> <li>Continuation of the North Pit footprint to the south of current approved North Pit mining limit.</li> <li>Mining within the approved BNP, followed sequentially by mining within the RERR Mining Area within the Ravensworth East Mine.</li> <li>Mining depths to approximately 300 m (North Pit).</li> <li>Total additional mineable coal tonnes of approximately 92 Mt ROM (comprising 74 Mt ROM (North Pit Continuation), 12 Mt ROM (BNP) and 6 Mt ROM (RERR) Mining Area).</li> </ul>	Yes
<b>Operating Hours</b>	<ul style="list-style-type: none"> <li>No change proposed - 24 hours per day, 7 days per week.</li> </ul>	NA



**Table 3.1 – Overview of the Proposed Project (cont.)**

<b>Key Feature</b>	<b>Proposed Operations</b>	<b>Result in Additional Disturbance</b>
<b>Workforce Numbers</b>	<ul style="list-style-type: none"> <li>No significant change to workforce numbers is required. Current workforce required to operate North Pit and CHPP fluctuates and peaks at about 660 and the Ravensworth East development consent allows for a workforce of up to 260 to operate Ravensworth East operations.</li> <li>Addition of approximately 330 personnel for construction phase for proposed infrastructure works (approximately 18 months).</li> </ul>	NA
<b>Mining Methods</b>	<ul style="list-style-type: none"> <li>No change to mining methods proposed.</li> </ul>	NA
<b>Mount Owen CHPP and MIA</b>	<ul style="list-style-type: none"> <li>No change to existing approved CHPP capacity of 17 Mtpa ROM.</li> <li>product stockpile extension;</li> <li>CHPP improvements (including operational efficiencies) to increase processing capacity and tailings management;</li> <li>MIA extensions and improvements;</li> </ul>	No
<b>Existing Mine Infrastructure</b>	<ul style="list-style-type: none"> <li>Continued utilisation of all existing mining infrastructure, including the existing crushing plant for the crushing of overburden.</li> </ul>	No
<b>Infrastructure Construction Activities</b>	<ul style="list-style-type: none"> <li>Infrastructure upgrades including: <ul style="list-style-type: none"> <li>provision for a northern rail line turn-out and additional Mount Owen rail line; Hebden Road overpass over Main Northern Rail Line; and</li> <li>New Hebden Road bridge crossing over Bowmans Creek.</li> </ul> </li> </ul>	Yes

**Table 3.1 – Overview of the Proposed Project (cont.)**

Key Feature	Proposed Operations	Result in Additional Disturbance
<b>Tailings and Coarse Emplacement</b>	<ul style="list-style-type: none"> <li>Continued use of the Ravensworth East voids for tailings emplacement and co-disposal of coarse reject and overburden within the North Pit Continuation, the West Pit / BNP and the RERR Mining Area as mining progresses.</li> <li>Tailings cells may be constructed and filled within the North Pit Continuation area as required to allow time for consolidation and drying of tailings in the West Pit and the RERR Mining Area.</li> <li>Allowance for the receipt of tailings from other mines.</li> </ul>	<p>No</p> <p>No</p> <p>Yes for North Pit</p>
<b>Coal Transportation</b>	<ul style="list-style-type: none"> <li>No change to current export coal transportation with the exception of the use of the proposed additional rail line.</li> <li>No change to capacity of 17 Mtpa ROM coal.</li> <li>Use of existing rail line for Glencore train park up.</li> <li>Transportation of up to 2 Mtpa ROM coal and crushed gravel on an as required basis via the existing overland conveyor to Liddell Coal Operations and the RCT in addition to maintaining the current approval to transport ROM coal to Bayswater and Liddell power stations.</li> </ul>	No

A substantial proportion of the approved Mt Owen and Ravensworth East mines have already been disturbed and are either continuing active operations or subject to ongoing rehabilitation and/or maintenance. The Proposed Action has been designed to maximise the efficient use of existing infrastructure and minimise the overall surface disturbance area, as far as practicable. The activities which form the Proposed Action include those aspects that result in additional surface disturbance to that associated with the current approved disturbance areas of the existing approved operations as shown in **Figure 2.1**.

## Proposed Action

The Proposed Action includes those elements of the Project which would result in additional disturbance, being:

- continuation of the North Pit in a southerly direction outside of the existing previously approved disturbance area, involving an additional area of approximately 381 hectares;
- augmentation of the Mt Owen Rail Line, involving an additional area of approximately 91 hectares; and

- construction of the Main Northern Rail Line rail overpass and the construction of a new bridge across Bowmans Creek on Hebden Road, involving an additional area of approximately 13 hectares.

As outlined previously, Mt Owen will continue to utilise the existing approved Mt Owen Rail Line which currently services the Mt Owen Complex and this will not result in additional disturbance. In addition, Mt Owen are provisioning for the upgrade of the Mt Owen Rail Line by constructing an additional rail line and northern turn-out west of the existing Mt Owen Rail Line (refer to **Figure 2.2**) which will allow Glencore trains the ability to turn around and return to Glencore owned mines to the west, thereby reducing unnecessary traffic flow on the Main Northern Rail Line. The existing rail line will also be used as a siding for parking of Glencore Rail trains when not in service.

The Main Northern Rail Line runs parallel to the New England Highway near the intersection of Hebden Road and the New England Highway. There is an existing rail level crossing at the location where Hebden Road crosses this rail line. Approximately 400 metres to the east of the rail level crossing, a single lane bridge crossing over Bowmans Creek further constrains existing traffic movements with northbound traffic given right-of-way over the bridge. It is considered that the construction of the proposed rail overpass and new bridge across Bowmans Creek would result in improved safety for all users of Hebden Road.

Further details of the Proposed Action are provided in Section 2.3 of the EIS.

## 3.2 Works/Structures and Impacts

### *b) the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts*

**Figure 2.1** illustrates the location of works to be undertaken and structures to be built as part of the Proposed Action.

The locations of the works are delineated by the coordinates in **Table 3.2** to **Table 3.5** below.

**Table 3.2 – North Pit**

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	-32	23	44.6	151	07	01.4
2	-32	23	46.4	151	07	12.1
3	-32	24	02.5	151	07	09.1
4	-32	24	04.8	151	07	09.5
5	-32	24	08.3	151	07	15.2
6	-32	24	12.9	151	07	16.9
7	-32	24	17.8	151	07	20.5
8	-32	24	29.4	151	07	18.4
9	-32	24	30.0	151	07	22.8
10a	-32	24	33.2	151	07	24.3
10b	-32	24	43.2	151	07	37.6
10c	-32	24	55.3	151	07	38.9
10d	-32	24	59.1	151	07	33.3
11	-32	24	54.8	151	07	12.9
12	-32	24	56.9	151	07	13.2

**Table 3.2 – North Pit (cont.)**

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
13	-32	25	32.1	151	07	44.3
14	-32	25	51.6	151	07	31.4
15	-32	25	41.3	151	06	18.0
16	-32	25	39.8	151	06	18.9
17	-32	25	28.6	151	06	18.4
18	-32	25	24.0	151	06	20.5
19	-32	25	19.1	151	06	20.3
20	-32	25	12.9	151	06	13.2
21	-32	25	08.6	151	06	13.4
22	-32	25	08.0	151	06	15.4
23	-32	25	05.5	151	06	17.1
24	-32	25	01.1	151	06	21.2
25	-32	24	44.8	151	06	26.2
26	-32	24	54.4	151	06	35.5
27	-32	24	54.4	151	07	03.4
28	-32	24	45.8	151	07	13.9
29	-32	24	35.3	151	07	15.9
30	-32	24	04.0	151	07	07.3
31	-32	23	53.4	151	07	02.3

**Table 3.3 – Rail Loop**

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	-32	24	16.7	151	05	31.6
2	-32	24	17.9	151	05	40.1
3	-32	24	17.5	151	05	40.1
4	-32	24	18.9	151	05	41.6
5	-32	24	20.9	151	05	42.4
6	-32	24	22.4	151	05	42.3
7	-32	24	23.5	151	05	41.8
8	-32	24	25.1	151	05	40.5
9	-32	24	26.9	151	05	39.4
10	-32	24	29.2	151	05	38.2
11	-32	24	31.8	151	05	37.4
12	-32	24	34.5	151	05	37.0
13	-32	24	37.9	151	05	37.1
14	-32	24	41.5	151	05	38.0
15	-32	24	56.1	151	05	44.3
16	-32	24	58.2	151	05	44.9
17	-32	25	01.0	151	05	45.2
18	-32	24	53.7	151	05	42.0
19	-32	24	34.0	151	05	33.6

**Table 3.3 – Rail Loop (cont.)**

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
20	-32	24	22.7	151	05	28.9
21	-32	24	20.6	151	05	28.6
22	-32	24	18.7	151	05	29.2
23	-32	24	17.5	151	05	30.3

**Table 3.4 – Hebden Road**

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	-32	26	13.6	151	03	41.5
2	-32	26	16.3	151	03	42.8
3	-32	26	16.8	151	03	43.5
4	-32	26	20.5	151	03	45.6
5	-32	26	21.9	151	03	45.6
6	-32	26	23.2	151	03	46.1
7	-32	26	23.6	151	03	45.3
8	-32	26	26.0	151	03	45.5
9	-32	26	29.8	151	03	49.8
10	-32	26	33.3	151	03	50.3
11	-32	26	36.0	151	03	54.4
12	-32	26	39.2	151	04	00.3
13	-32	26	40.8	151	04	04.1
14	-32	26	40.4	151	04	09.2
15	-32	26	39.4	151	04	12.3
16	-32	26	40.4	151	04	12.7
17	-32	26	41.5	151	04	09.0
18	-32	26	42.3	151	04	04.0
19	-32	26	39.8	151	03	59.9
20	-32	26	36.5	151	03	54.0
21	-32	26	33.8	151	03	49.8
22	-32	26	30.1	151	03	49.3
23	-32	26	26.2	151	03	44.9
24	-32	26	24.4	151	03	43.7
25	-32	26	26.5	151	03	39.1
26	-32	26	28.4	151	03	33.9
27	-32	26	30.3	151	03	27.5
28	-32	26	29.3	151	03	26.4
29	-32	26	31.0	151	03	19.1
30	-32	26	31.2	151	03	18.5
31	-32	26	26.9	151	03	18.3
32	-32	26	25.0	151	03	31.9
33	-32	26	23.1	151	03	34.9
34	-32	26	22.3	151	03	37.7

**Table 3.4 – Hebden Road (cont.)**

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
35	-32	26	21.8	151	03	41.4
36	-32	26	20.8	151	03	42.0
37	-32	26	18.7	151	03	41.7
38	-32	26	14.2	151	03	39.5

**Table 3.5 – Rail Spur**

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
<b>Rail Spur Portion A</b>						
1	-32	25	36.9	151	05	54.5
2	-32	25	37.3	151	05	57.3
3	-32	25	58.9	151	05	58.0
4	-32	26	09.1	151	06	00.1
5	-32	26	05.8	151	05	59.1
<b>Rail Spur Portion B</b>						
1	-32	26	09.4	151	06	00.2
2	-32	26	11.1	151	06	04.3
3	-32	26	25.0	151	06	09.9
4	-32	26	31.8	151	06	08.6
<b>Rail Spur Portion C</b>						
1	-32	26	51.7	151	06	15.7
2	-32	27	12.7	151	06	06.0
3	-32	27	13.4	151	06	11.6
4	-32	27	19.9	151	06	12.4
5	-32	27	20.8	151	06	17.3
6	-32	27	25.2	151	06	16.6
7	-32	27	39.6	151	06	26.6
8	-32	27	41.6	151	06	24.3
9	-32	27	32.1	151	06	02.2
10	-32	27	30.4	151	06	04.4
11	-32	27	33.1	151	06	07.5
12	-32	27	39.4	151	06	23.7
13	-32	27	21.4	151	06	13.2
14	-32	27	20.4	151	06	06.0
15	-32	27	25.8	151	06	05.9
16	-32	27	11.7	151	06	05.5
<b>Rail Spur Portion D</b>						
1	-32	26	28.3	151	05	36.3
2	-32	26	29.7	151	05	57.4
3	-32	26	28.0	151	06	03.5
4	-32	26	28.7	151	05	45.8
5	-32	26	37.7	151	05	46.1

**Table 3.5 – Rail Spur (cont.)**

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
<b>Rail Spur Portion D (cont.)</b>						
6	-32	26	38.3	151	05	40.7
7	-32	27	11.9	151	05	58.3
8	-32	27	32.1	151	06	02.2
9	-32	27	27.6	151	05	27.3
10	-32	27	33.2	151	04	52.1
11	-32	27	31.8	151	04	52.4
12	-32	27	25.6	151	05	28.6
13	-32	27	26.1	151	05	31.1
14	-32	27	03.7	151	05	48.0
15	-32	26	45.4	151	05	35.6
16	-32	27	12.4	151	05	48.8
17	-32	27	13.2	151	05	54.3
<b>Rail Spur Portion E</b>						
1	-32	25	39.2	151	05	51.3
2	-32	25	46.3	151	05	52.5
3	-32	25	47.1	151	05	50.4
4	-32	25	56.8	151	05	37.7
5	-32	26	04.0	151	05	32.4
6	-32	26	05.0	151	05	34.4
7	-32	26	06.8	151	05	35.0
8	-32	26	08.9	151	05	32.1
9	-32	26	11.1	151	05	32.6
10	-32	26	01.2	151	05	30.3
11	-32	25	56.4	151	05	31.1
12	-32	25	52.8	151	05	33.4
13	-32	25	46.9	151	05	40.2
14	-32	25	43.5	151	05	49.0

Relevant impacts to MNES as a result of work and structures as part of the Proposed Action include ecological impacts (refer to **Section 5.1**) and water resources impacts (refer to **Section 5.3**).

***c) how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts***

The North Pit is currently operating as a multi-seam truck and excavator operation, with an approved ROM extraction rate of 10 Mtpa, mining to depths of approximately 300 metres. The sequence of mining involves the clearing of vegetation and topsoil followed by drilling and blasting of overburden and then the excavation and haulage of overburden to emplacement areas and ROM coal to the Mt Owen CHPP for processing. Product coal is then loaded onto trains using the rail loading facility. The proposed North Pit Continuation is designed such that works will be undertaken using similar mining techniques. The design parameters considered for the works are provided below in **Section 3.3**.

The Proposed Action will require a construction phase of approximately 12 to 18 months. Within the additional Referral Area, construction activities will include:

- additional rail line and northern turn-out;
- Hebden Road upgrade works including Main Northern Rail Line overpass and new Bowmans Creek Bridge; and
- associated other ancillary works.

The relevant impacts of the Proposed Action include clearing of vegetation, loss of surface water catchment during mining, impacts on hard rock groundwater aquifers, and the potential for water quality impacts due to erosion and sedimentation.

A summary of the timing and work parameters for construction are provided below with further details provided throughout Section 5.0 of the EIS (Environmental and Social Assessment).

It is anticipated that construction of the Hebden Road upgrade works would start within one year of the commencement of mining beyond the currently approved mining limit. Construction of the Hebden Road upgrade works and the proposed Rail Line will occur during standard construction hours of 7.00 am to 6.00 pm, Monday to Friday and 8.00 am to 1.00 pm on Saturday. However, limited activities such as track work involving the Main Northern Rail Line will be required to be undertaken during outage windows (periods of no or highly restricted rail activity on the Main Northern Rail Line) where construction activities may need to be continuous over a 24 hour period or more. Works will be undertaken in accordance with the clearing requirements of the current approved *Landscape Management Plan* for the operation (amended as required), the management measures set out in **Table 6.2** and **Table 6.4** of this report, and in accordance with *Managing Urban Stormwater – Soils and Construction* (Landcom 2001).

**d) the timing and duration of the works to be undertaken, and**

Mining is expected to take 12-15 years (dependent on market conditions). The Proposed Action will commence when mining progresses beyond the currently approved pit limit, and considering necessary site preparation, this is expected to occur in approximately 2016. There will be a number of years post mining for rehabilitation activities.

Refer also to **Section 3.1** of this report.

### 3.3 Alternatives

**e) to the extent reasonably practicable, a description of any feasible alternatives to the controlled action that have been identified through the assessment, and their likely impact, including:**

- i. if relevant, the alternative of taking no action**
- ii. a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action, and**
- iii. sufficient detail to clarify why any alternative is preferred to another**

**Section 2.7** of this report addresses the alternative of taking no action.



As discussed in Section 2.3.3 of the EIS, Mt Owen has completed detailed iterative environmental studies to inform the proposed conceptual design for the Proposed Action. As part of these studies, a range of different mine design options including mine disturbance areas, dumping schedules, infrastructure design, fleet numbers, equipment type and location, and scheduling were considered. The purpose of the iterative environmental studies and the Proposed Action design was to identify potential mining options and the requirement for associated infrastructure that would allow the Proposed Action to achieve its objectives (refer to **Section 2.3** of this report).

Details regarding the various conceptual design options and other alternatives considered during iterative project design, including proposed mining and associated infrastructure are summarised below and detailed in Section 2.5 of the EIS.

### 3.3.1 Mining Domains

Section 2.5.1 of the EIS provides the mining alternatives considered as part of the Proposed Action which set the mining domain that enabled the Proposed Action to achieve its objectives.

The mining alternatives focussed on the avoidance of disturbance within the Ravensworth State Forest and the existing Biodiversity Offset Areas which are located within the Project Area. Other constraints were reviewed in the development of a mining domain that allowed maximising the resource recovery in Glencore owned tenements and maintaining the economic life of the Mt Owen Mine and the existing infrastructure. These plans optimised the use of previously approved disturbance areas, whilst providing a safe, stable and environmentally sound North Pit Continuation mining limit. The outcomes of the assessment of alternatives are provided below:

- The avoidance of disturbance within the Ravensworth State Forest, New Forest Area and the Southern Remnant (refer to **Figure 3.1**); with the extent of the Referral Area designed to ensure the State Forest areas, and existing Biodiversity Offset Areas and any endangered ecological communities (EECs), threatened species and migratory species in these areas were not disturbed by the Proposed Action.
- Minimal Harm Requirements to Main Creek – The proposed mining limit was originally designed to provide a minimum standoff of 150 metres between the proposed highwall and the alluvium of Main Creek in accordance with Management of stream/aquifer systems in coal mining developments, Department of Infrastructure, Planning and Natural Resources (DIPNR) (2005). However, upon release of the *NSW Aquifer Interference Policy* (2012), the location of the proposed mining limit was reviewed with respect to the minimal harm criteria, specifically that 'no mining activity to be below the natural ground surface within 200 metres laterally from the high bank or 100 metres vertically beneath (or the three dimensional extent of the alluvial water source – whichever is the lesser distance) of a high quality connected surface water source that is defined as reliable water supply'. The final Project conceptual design of the proposed mining limit is greater than 200 metres off the high bank of Main Creek.
- To improve the long term stability of the landform, the North Pit Continuation was moved west, resulting in a number of benefits, including:
  - a reduction of the Referral Area in this location and therefore a reduction in potential impacts on MNES (refer to **Figure 3.2**);
  - increased separation distance between the mining operation and the residential receivers to the east; and
  - a safe and stable final landform.



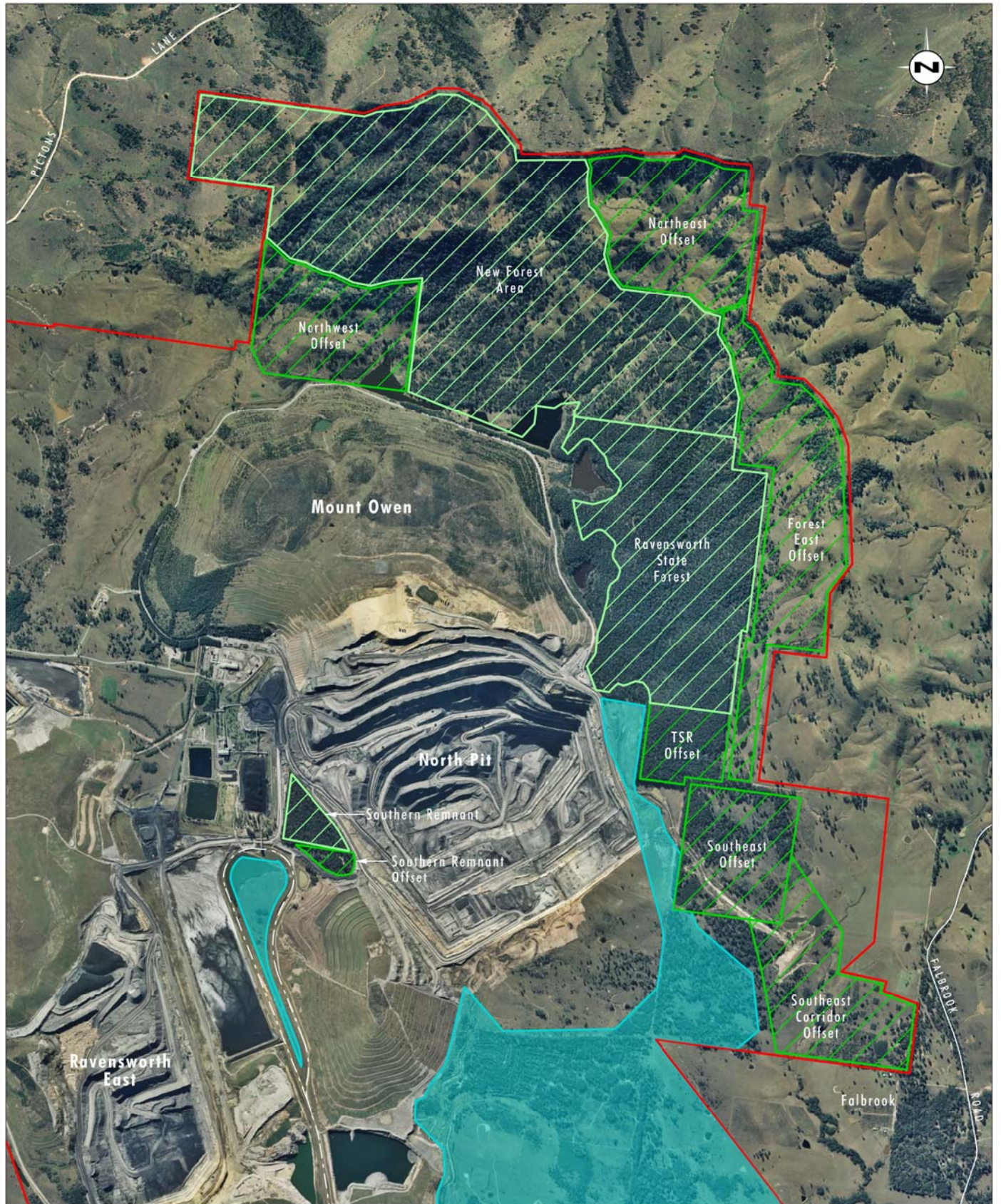


Image Source: Mount Owen (2013)  
Data Source: Mount Owen (2014)

0 0.5 1.0 2.0 km  
1:35 000

#### Legend

- Project Area
- Referral Area
- Existing Mount Owen Biodiversity Offset Area
- Ravensworth State Forest

FIGURE 3.1

Proposed Disturbance Area  
and Existing Offset Areas





Image Source: Mount Owen (2013)  
Data Source: Mount Owen (2014)

0 100 200 400m  
1:7 500

#### Legend

- Project Area
- Referral Area
- Previous Proposed Disturbance Area Boundary
- Proposed North Pit Mining Extent
- Previous Proposed North Pit Mining Extent

FIGURE 3.2  
Stand Off Main Creek

- Viability of Underground Mining – The steep seam dips and complex geology preclude the option for economic extraction utilising underground mining methods.
- Use of Mine Owned Tenements – The extent of the North Pit Continuation has been optimised to maximise resource recovery in Mt Owen's southern mining tenement area, where Integra owns the underlying mining lease. In the area overlying the Integra lease, the initial mine plan extracted all coal from the surface to the floor of the Bayswater seam. Optimisation of the mine plan was undertaken so that economic resource recovery was maximised through the area where the tenements transition from an unlimited depth to stratified. As a result further coal has been targeted from the Lemington seam to the floor of the Hebden seam.

### **3.3.2 Mine Plan Development**

#### **3.3.2.1 Design and Practice**

Two of the key issues for the local community identified through Project consultation were noise and air quality impacts. Mt Owen undertook significant preliminary and ongoing modelling and iterative mine plan refinements to determine the potential impacts to air quality and noise associated with different mine plan options, fleet numbers and type, and equipment location and scheduling.

This process identified the key drivers for air quality and noise impacts and allowed the Project team to optimise mining options to reduce the predicted air quality and noise impacts associated with the Project. This optimisation process has allowed the Project to meet several objectives including maximising the resource recovery and maintaining the economic life of the Mt Owen Mine, whilst developing environmental mitigation and management strategies to minimise the predicted impacts associated with the Project.

The iterative noise emission modelling and mine design process for the Proposed Action have demonstrated that practicable mitigation measures exist that can be implemented to manage predicted noise within the levels predicted in the Noise Impact Assessment. A range of mitigation measures including mine and haul road design processes as well as mine operational practices will be implemented by Mt Owen, in combination with a monitoring program to ensure that noise impacts are consistent with those predicted. Further details on proposed noise and air quality impact mitigation measures are provided in Sections 5.3 and 5.2 of the EIS.

#### **3.3.2.2 Final Landform/Land Use**

Mt Owen has reviewed a number of final landform options as part of the Proposed Action and is seeking to plan for and design a final landform that will be undulating and natural looking post mining. The initial conceptual final landform was designed based on the optimal in-pit overburden emplacement plan that resulted in a flat topped, uniform landform typical of previous mining landforms in the Hunter Valley. The conceptual final landform has been designed to meet the objectives of being safe and stable whilst providing opportunities for sustainable post mining land use options (refer to Section 5.19 of the EIS). This final landform will continue to be refined as part of the development of the Closure Plan.

The overall objectives of the proposed post-mining land use design integrate the area associated with the Proposed Action and the Mt Owen Complex, and include:

- establishment of a vegetation community consistent with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest on the post mining landform;

- contribution to effective native corridors through the area which promote fauna movements between the Mt Owen Complex, Ravensworth Operations, Liddell Coal Operations, Lake Liddell and the Ravensworth Operations Hillcrest Offset Area;
- maintaining and providing additional suitable habitat for a range of threatened fauna species including but not limited to the spotted-tailed quoll (*Dasyurus maculatus maculatus*);
- providing opportunities for future agricultural activities such as sustainable grazing;
- improving the visual amenity of the area post mining; and
- not to preclude other potential post-mining land use options should they be determined to be viable and preferable as part of the detailed mine closure planning process that will commence at least five years prior to the planned cessation of mining.

## 4.0 Description of the Existing Environment

3. *A description of the existing environment of the proposal location and the surrounding areas that may be affected by the action, including but not limited to:*
- a) *surveys using accepted methodology for targeting listed threatened species, ecological communities and their respective habitat, including but not limited to OEH's Survey and assessment guidelines (2009), available at: <http://www.environment.nsw.gov.au/threatenedspecies/surveymethodsfauna.htm> and the Department of the Environment's species-specific survey guidelines for nationally threatened species, available at: <http://www.environment.gov.au/cgi-bin/spravpublic/sprat.pl>*
  - b) *a description of the distribution and abundance of threatened species and ecological communities, as well as suitable habitat (including breeding, foraging, roosting habitat, habitat critical to the survival of threatened species) within the site and in surrounding areas that may be impacted by the proposal. Specifically, this must include but not be limited to the species at Appendix A.*
  - c) *the regional distribution and abundance of suitable and potential habitat for threatened species and ecological communities surrounding the site*
  - d) *a description of the important water resources within the site and in surrounding areas, including detailed information addressing the department's Water Resources Terms of Reference, currently in preparation, and*
  - e) *a description of water related assets that are dependent on any important water resources, including an estimation of the water requirements of those assets (i.e. regional water use).*

### 4.1 Biodiversity

#### 4.1.1 Survey Methodology for Listed Threatened Species and Ecological Communities

The survey methodology for EPBC Act listed threatened species and ecological communities is outlined below. A large amount of ecological data has been previously collected from the Project Area (i.e. the area covered for the purposes of the EIS) during past ecological surveys and assessment, and annual flora and fauna monitoring surveys undertaken between 1996 and 2014. Additionally, flora and fauna surveys were undertaken specifically for the Proposed Action focussing on the Referral Area. The extent of this information is referred to in this report, where relevant, to provide context and an understanding of the spatial patterns of vegetation communities, flora and fauna species.

Records from the DoE Protected Matters Database and a 10 kilometre radius search (from the centre of the Project Area) and of the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife were combined with records derived through literature reviews, 18 years of flora and fauna monitoring data and professional opinion to identify the full range of recorded or potentially occurring EPBC Act listed threatened species and ecological communities. The identification of potentially occurring threatened species was then used to assist in the development of appropriate survey methods to be used as part of the Ecological Assessment

for the Proposed Action and to determine those species that would be subject to an assessment of significance as part of this assessment.

The ecological survey strategy was designed in accordance with the requirements of the *Draft Threatened Species Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004), the *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians*, (DECCW 2009), the BioBanking Assessment Methodology (DECC 2008) and the revised draft BioBanking Assessment Methodology (OEH 2012). Consideration was also given to the range of species-specific survey guidelines for nationally threatened species, including threatened birds, bats, frog, mammals and reptiles (DEWHA 2010a; 2010b; 2010c; DSEWPC 2011a; 2011b). The flora survey included quadrat-based and meander transect surveys and analysis with appropriate seasonal consideration to target all of the potentially occurring threatened flora species and ecological communities that are known to occur in the local area. Additional fauna surveys targeted threatened fauna species and their habitats in order to be able to document the extent and quality of habitat that occurs within the Referral Area and an assessment of the type, condition and quality of fauna habitats.

In addition to existing seasonal monitoring, specific surveys were undertaken for the following species listed in Appendix A of the Supplementary DGRs:

- spotted-tailed quoll (*Dasyurus maculatus maculatus*);
- swift parrot (*Lathamus discolor*);
- regent honeyeater (*Anthochaera phrygia*);
- koala (*Phascolarctus cinereus*);
- green and golden bell frog (*Litoria aurea*); and
- large-eared pied bat (*Chalinolobus dwyeri*).

Targeted surveys were also undertaken for additional EPBC Act listed threatened species that are known to occur in the local area, or were considered to potentially occur based on the presence of suitable habitat. Species and communities targeted included:

- White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (CEEC);
- *Ozothamnus tessellatus*;
- Australian painted snipe (*Rostratula australis bengalensis*); and
- Grey-headed flying-fox (*Pteropus poliocephalus*).

Detailed descriptions of the survey methodology are further provided in Section 3.3 and 3.4 of the Ecological Assessment (refer to Appendix 11 of the EIS). Discussion relating to the potential presence of EPBC Act listed ecological communities is provided in Appendix A and Section 3.3.5 of the Ecological Assessment (refer to Appendix 11 of the EIS).

#### 4.1.1.1 Surveys for the Green and Golden Bell Frog

Researchers from The University of Newcastle have conducted extensive surveys for the green and golden bell frog in the Project Area since 1996. Currently 21 targeted frog survey monitoring locations are located within the Mt Owen Complex. These locations are shown in **Figure 4.1** and represent areas of potential habitat for the species.

Additional Project-specific surveys for the green and golden bell frog (*Litoria aurea*) were undertaken by Umwelt at 15 locations within the Project Area during the known breeding season of the species, that is, between October and March. Surveys were conducted in February 2012, January 2013 and February 2013 and each location was surveyed over two consecutive nights during each survey period. Additional survey of high quality potential habitat locations was also undertaken to supplement the survey effort and results. All surveys were conducted during appropriate weather conditions that maximised the chance of detecting the species if it was present.

Each survey commenced with five minutes of call playback of the species, followed by 5 minutes of listening for vocalising males. Directly following the call playback, 30 minutes of spotlighting was undertaken by two ecologists (a total of one person hour) at each site. These surveys involved searching through the edge of open water and fringing vegetation for individuals and listening for vocalisation by males.

The survey effort specific to the Proposed Action and location of the targeted surveys for the green and golden bell frog is shown on **Figure 4.2**.

#### 4.1.1.2 Surveys for the New Holland Mouse

Habitat for the New Holland mouse is surveyed annually within the Project Area, as part of the annual fauna monitoring program with the use of Elliot A trapping and pitfall trapping. The species was recorded in an area of mine rehabilitation and active regeneration each year during the annual monitoring between 2003-2007 in Elliot A traps.

Additional surveys for the New Holland mouse by Umwelt were undertaken as part of the terrestrial fauna survey that included terrestrial Elliot A and Elliot B trapping and terrestrial hair funnel trapping. Terrestrial Elliott A and Elliott B traps were set in pairs approximately 20 metres apart on the ground at each general fauna survey site (refer to **Figure 4.2**) and baited with a mixture of rolled oats and peanut butter. All traps were positioned where possible amongst habitat features such as logs, fallen bark, rocks and ground cover. A total of 400 terrestrial Elliott trap nights were completed across the Referral Area by Umwelt in February 2012, comprising 200 terrestrial Elliott A trap nights and 200 terrestrial Elliott B trap nights.

A total of 20 terrestrial hair funnels were set at each general fauna survey site (refer to **Figure 4.2**) in February 2012. Terrestrial hair funnels were baited with either meat (raw chicken necks) or a rolled oats and peanut butter mixture. All terrestrial hair funnels were positioned amongst habitat features such as logs, fallen bark, rocks and ground cover. All hair funnels were left in position for 25 nights and all hair samples collected were identified by Barbara Triggs, (a recognised expert in the field of hair and scat identification) of 'Dead Finish', Victoria. A total of 1,000 terrestrial hair funnel nights were completed across the Project Area by Umwelt.



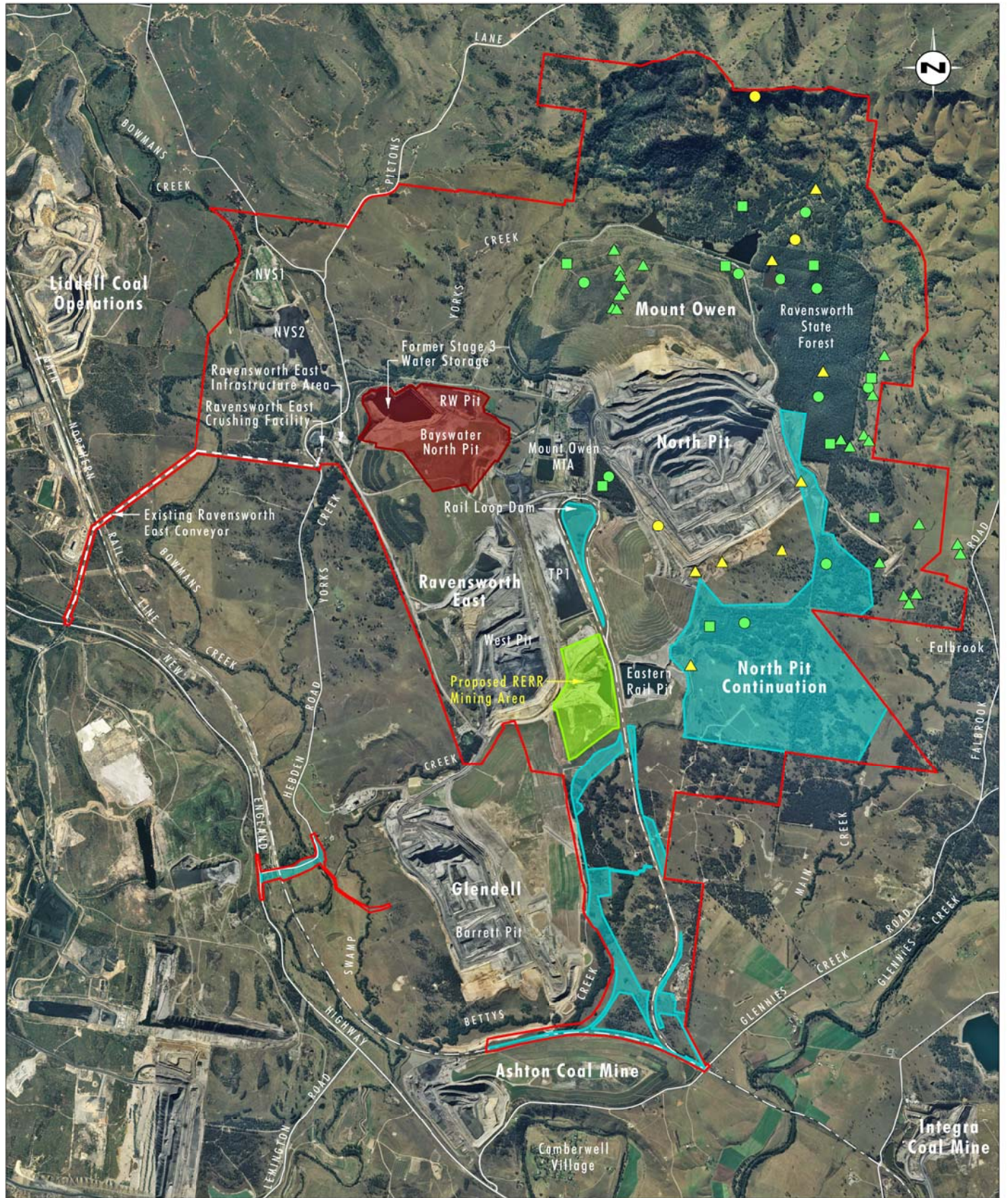


Image Source: Mount Owen (2012-2013)  
Data Source: Mount Owen (2014)

0 1 2 3 km  
1:60 000

### Legend

- Project Area
- Referral Area
- Bayswater North Pit
- Proposed RERR Mining Area

- Previous Monitoring Locations:
- ▲ Targeted Frog Survey Location
  - Targeted Microbat Survey Location

- Current Monitoring Locations:
- ▲ Targeted Frog Survey Location
  - Targeted Microbat Survey Location
  - General Fauna Survey Location

FIGURE 4.1

Mount Owen Annual  
Fauna Monitoring Locations



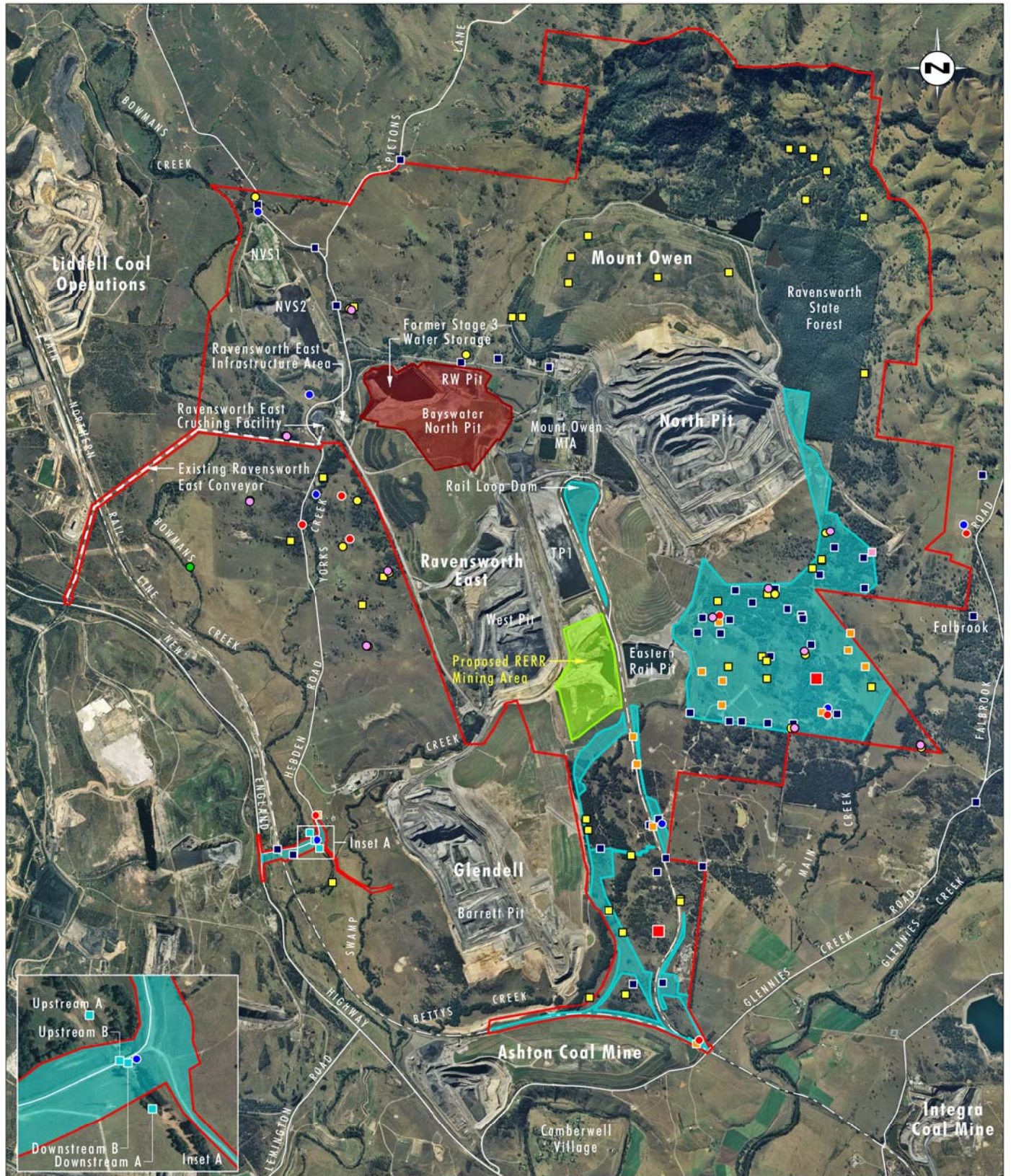


Image Source: Mount Owen (2012-2013)  
Data Source: Mount Owen (2014)

0 1 2 3km  
Main Scale 1:60 000  
0 150 300 450m  
Inset Scale 1:10 000

FIGURE 4.2

Fauna and Aquatic  
Survey Effort



## 4.1.2 Distribution and Abundance of Threatened Species and Ecological Communities

### 4.1.2.1 Regional Ecological Context

The vegetation communities mapped in the Project Area are consistent with the vegetation community descriptions described by Peake (2006) who mapped Hunter Valley floor vegetation on behalf of the Hunter-Central Rivers Catchment Management Authority (HCRCA).

All habitats in the region have been extensively cleared or modified for agriculture, largely for cattle grazing. Communities occurring on floodplains and more fertile soils on the Hunter Valley floor have been most extensively cleared (Peake 2006). Because of the widespread clearing of habitats in the region, those remaining contain important refuges for a number of fauna species, many of which are now threatened due to habitat loss and fragmentation. The broad fauna habitat types of grassland, riparian, woodland/forest and aquatic habitat found within the Project Area are representative of the broad habitat types within the surrounding region.

Most remaining forest and woodland remnants on the Hunter Valley floor are small, with 87 percent being less than 10 hectares in size, and the median remnant size being 1.6 hectares (Peake 2006). Approximately 65 percent of all remnant vegetation on the Hunter Valley floor occurs within the relatively few remnants that are over 100 hectares in area, with the largest remnant, mostly within Myambat Military Area near Denman, being approximately 2,250 hectares. Two large national parks are situated approximately 18 kilometres to the south-west of the Project Area (Wollemi and Yengo National Parks). These national parks contain large areas of native vegetation and offer a wide range of good quality fauna habitats. Smaller, yet significant areas of National Park also exist approximately 30 kilometres to the north-east of the Project Area (Mount Royal and Barrington Tops National Parks).

Ravensworth State Forest and the adjoining existing Mt Owen Biodiversity Offset Areas (refer to **Figure 4.3**) represent an important link and refuge area between remnant patches of vegetation in the central Hunter Valley. Ravensworth State Forest (including the New Forest area) is located in the north-eastern portion of the Project Area and is zoned for environmental protection and conservation under the Singleton Local Environmental Plan (LEP) 2013. This forest forms an important and integral component of the preservation of the flora and fauna of the upper Hunter Valley (Umwelt 2003). A key project design objective was to avoid disturbance of Ravensworth State Forest and the existing Mt Owen Biodiversity Offset Areas.

### 4.1.2.2 Proposed Action Referral Area

Detailed and targeted surveys in the Referral Area have been supplemented by the results of intensive annual ecological monitoring surveys that have been undertaken seasonally within the Mt Owen land holding since 1996 including portions of the Referral Area (refer to Section 3.5.3 of Appendix 11 of the EIS).

Based on previous survey and ecological monitoring of the Project Area and surveys within the Referral Area undertaken by Umwelt as part of the Proposed Action, the listed threatened species within **Table 4.1** are known to have been recorded within the Project Area. **Table 4.1** presents these species' presence in the Project Area, Referral Area and their regional distribution. **Figure 4.4** illustrates their distribution across the Project Area.

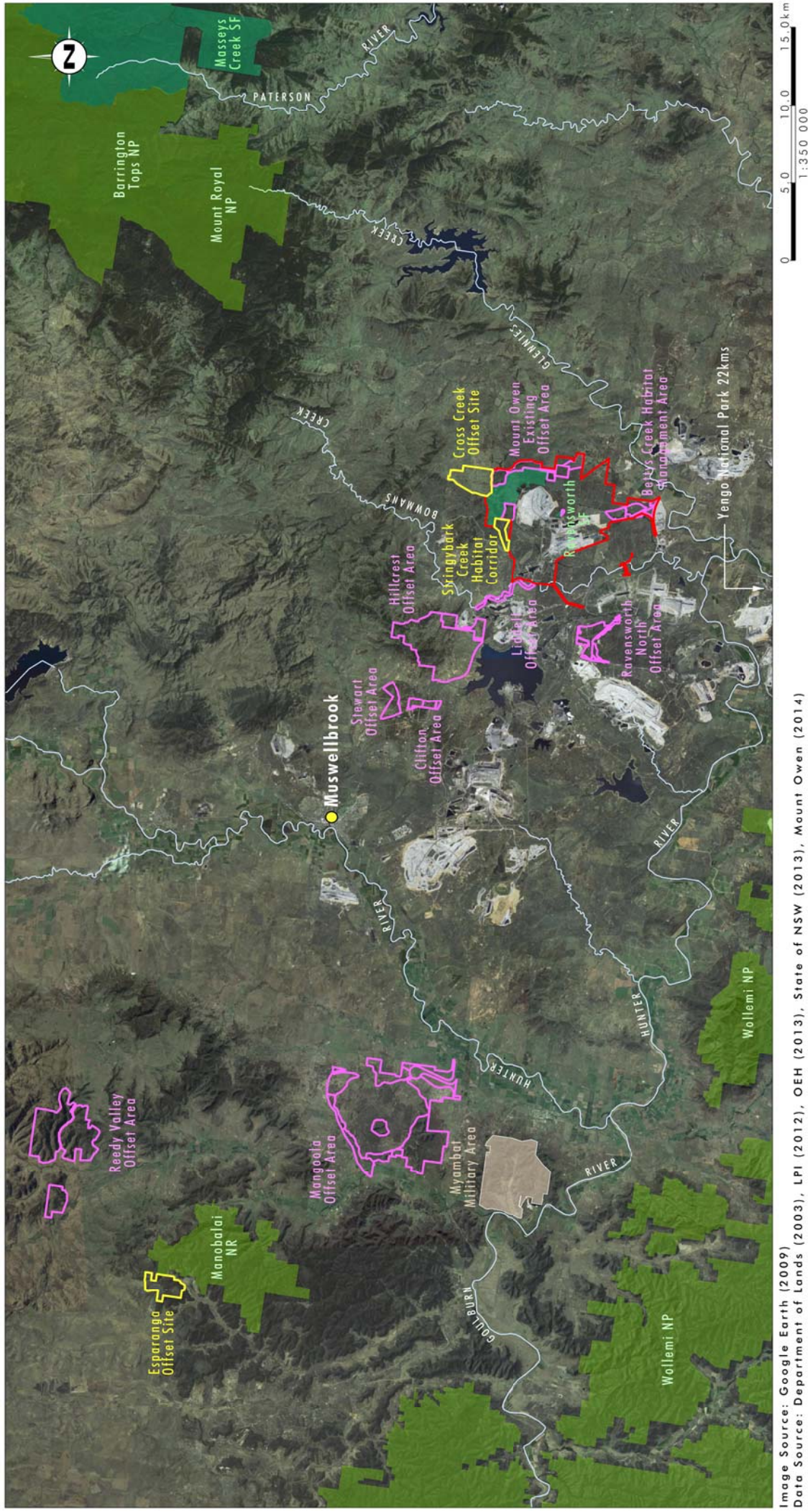


FIGURE 4.3

## Glencore Biodiversity Offset Areas Regional Setting



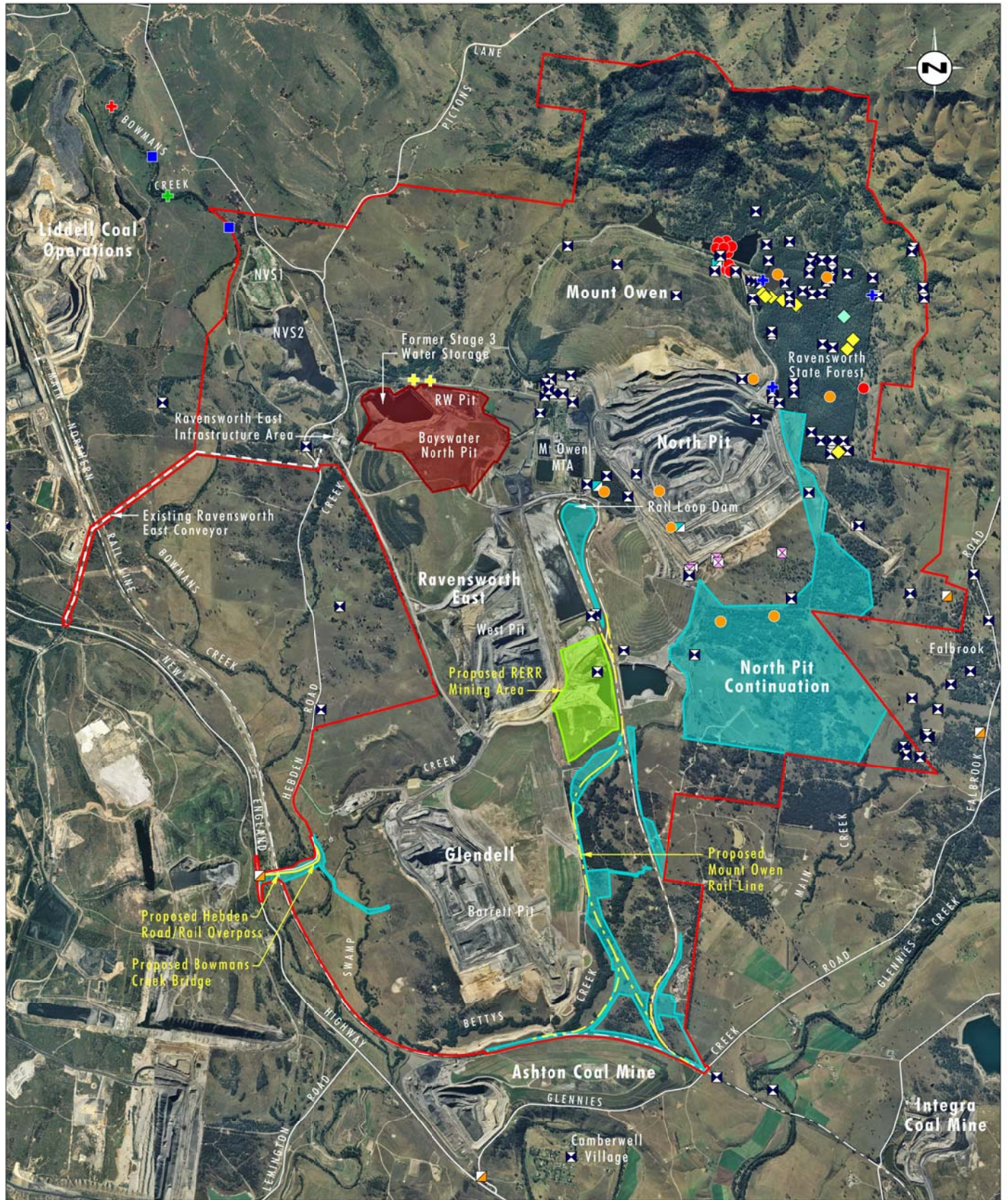


Image Source: Mount Owen (2012-2013)  
Data Source: Mount Owen (2014), OEH (2012),  
Forest Fauna Surveys and Newcastle Innovation (2012)

0 1 2 3km  
1:60 000

#### Legend

- |   |   |
|---|---|
| <span style="border: 1px solid red; padding: 2px;"> </span> Mount Owen Complex              | <span style="border: 1px solid cyan; padding: 2px;"> </span> Large-eared Pied Bat           |
| <span style="border: 1px solid cyan; padding: 2px;"> </span> Referral Area                  | <span style="border: 1px solid blue; padding: 2px;"> </span> Spotted-tailed Quoll           |
| <span style="border: 1px solid green; padding: 2px;"> </span> Rail Upgrade Works            | <span style="border: 1px solid yellow; padding: 2px;"> </span> Swift Parrot                 |
| <span style="border: 1px solid darkgreen; padding: 2px;"> </span> Hebden Road Upgrade Works | <span style="border: 1px solid blue; padding: 2px;"> </span> Australian Painted Snipe       |
| <span style="color: red;">●</span> Threatened Species:                                      | <span style="border: 1px solid orange; padding: 2px;"> </span> Koala                        |
| <span style="color: red;">●</span> New Holland Mouse  | <span style="border: 1px solid green; padding: 2px;"> </span> <i>Ozothamnus tessellatus</i> |
| <span style="color: purple;">⊗</span> Green and Golden Bell Frog                            |   |
| <span style="color: orange;">●</span> Grey-headed Flying-fox                                |   |

#### Other Features:

- + Spotted-tailed Quoll Den Site
- + Spotted-tailed Quoll Den Site with Confirmed Breeding
- + Spotted-tailed Quoll Latrine Site
- + Juvenile Spotted-tailed Quoll
- + Road Kill (indicative)

FIGURE 4.4

Mount Owen Complex EPBC-listed  
Threatened Species



**Table 4.1 – Listed Threatened Species Recorded within the Project Area/Referral Area and Regional Distribution**

Species	Recorded in Project Area?	Recorded in Referral Area?	Last Known Record	Location of Local Records and Regional Distribution
swift parrot <i>Lathamus discolor</i>	Yes	No	2014	<p>This species has been recorded during annual monitoring surveys of the Project Area in suitable habitat in Ravensworth State Forest on the eastern edges of the Project Area. The species was recorded foraging during a mass eucalypt flowering event, with approximately 20 individuals recorded in 2005 and approximately five in 2007. Two individuals were recorded feeding in eucalypts in 2014 in the eastern portion of the Project Area.</p> <p>The swift parrot migrates annually from breeding grounds in Tasmania to the winter foraging grounds on the coastal plains and slope woodlands of mainland eastern Australia. Approximately 200 mature birds (approximately 10 percent of the total estimated population) have been known to over-winter in the Lower Hunter Region of NSW in some previous years. There have been few records of the species within the central Hunter Valley in the past few years, however recent sightings were reported in the winter 2012 season in the Muswellbrook and Bulga areas. This species has potential to make use of the box-gum forest and woodland habitats of the Referral Area, particularly where there are prolific flowering eucalypts.</p>
spotted-tailed quoll <i>Dasyurus maculatus maculatus</i>	Yes	Yes	2014	<p>The species has been recorded regularly at Mt Owen during fauna monitoring, with the species recorded in Ravensworth State Forest and surrounding woodland and forest communities. The species has also been recorded at Bowmans Creek during fauna monitoring undertaken at the nearby Liddell Mine and in the Ravensworth North Project Hillcrest Offset Area approximately 6 kilometres to the north-west of the Project Area.</p> <p>All natural and derived vegetation communities in the disturbance area are likely to provide known habitat for the spotted-tailed quoll. The records of the species indicate a small local population of the species occurs in the locality. The species is known to occur throughout the Hunter Valley, however few areas within the Valley are of sufficient size to support the home range of this species.</p>

**Table 4.1 – Listed Threatened Species Recorded within the Project Area/Referral Area and Regional Distribution (cont.)**

Species	Recorded in Project Area?	Recorded in Referral Area?	Last Known Record	Location of Local Records and Regional Distribution
green and golden bell frog <i>Litoria aurea</i>	Yes	No	1999	<p>The green and golden bell frog was 'rediscovered' in the upper Hunter in 1994 at Mt Owen where it was subsequently recorded 1996, 1997 and 1999. Despite extensive surveys, the species has not been recorded in the Project Area since 1999. An unconfirmed record of the species exists from the north-west shore of Lake Liddell in 2006 and the species was recorded during surveys of the Ravensworth North Offset Area for the Ravensworth North Project in 2009 and previously in that locality in 1998 and 2000.</p> <p>These records form part of the Upper Hunter Green and Golden Bell Frog Key Population. This population is known from approximately eight verified locations and has an assumed diffuse distribution. The absence of individuals at historical sites, or the intermittent observation of single individuals, fits with the pattern of observation of bell frogs in the Upper Hunter over a period of more than a decade. The Upper Hunter, which is at the inland edge of the current, contracted distribution of the bell frog, appears to support only a precarious regional population, with few known habitat areas likely to support the species.</p>
New Holland mouse <i>Pseudomys novaehollandiae</i>	Yes	No	2007	<p>The New Holland mouse has been recorded during five of the last 18 years of fauna monitoring in the Project Area in areas of rehabilitation in the North Pit and to the east of Ravensworth State Forest.</p> <p>Habitat requirements for the species' inland distribution include open heathland, open woodland with a heathland understorey and is usually found to peak in abundance during the early to mid stages of vegetation succession three to five years after fire or other disturbances. The presence of the species within Mt Owen is considered to comprise part of an important population as the majority of records of the species occur within coastal areas and habitats. Atlas of NSW Wildlife identifies five regional records of the species at Mt Owen and one near Jerrys Plains in the upper Hunter Valley and a number of records in the Kurri Kurri/Cessnock area. It is expected that the species has a diffuse distribution across the region where habitats and conditions are favourable.</p>

**Table 4.1 – Listed Threatened Species Recorded within the Project Area/Referral Area and Regional Distribution (cont.)**

Species	Recorded in Project Area?	Recorded in Referral Area?	Last Known Record	Location of Local Records and Regional Distribution
grey-headed flying-fox <i>Pteropus poliocephalus</i>	Yes	Yes	2010	<p>Individuals of this species have been occasionally recorded in the Project Area during annual monitoring surveys, usually when eucalypt species are flowering. All woodland vegetation within the Project Area is expected to provide potential foraging habitat for this species, however camp sites have not been identified.</p> <p>The nearest substantial roost camp site to the Project Area is at Burdekin Park, Singleton (approx. 17 kilometres from the Project Area). Two smaller roost camp sites of the species occur at East Cessnock (approximately 60 kilometres south south-east the Project Area) and Lorn (approximately 65 kilometres south-east of the Project Area).</p>
large-eared pied-bat <i>Chalinolobus dwyeri</i>	Yes (tentative record*)	No	1999	<p>The species has been tentatively recorded in the Project Area during annual fauna monitoring surveys using call echolocation recording however no individuals have been captured to confirm its presence. The Referral Area is considered to comprise an area of potential foraging habitat for this species however no roosting habitat for this cave roosting species has been identified.</p> <p>The species is known to occur on the western borders of the Hunter Valley around Broke, Denman and west of Muswellbrook in nearby areas of cliffline and escarpment habitat.</p>
koala <i>Phascolarctus cinereus</i>	Yes	Yes	2012	<p>The species was tentatively recorded during monitoring in 1995 through the collection of scats resembling those of the koala. Although no evidence of this species has been recorded within the Project Area since a recent database record occurs near the intersection of the New England Highway and Hebden Road near Bowmans Creek. The koala has been recorded approximately 6 kilometres to the north-west of the Project Area. The Referral Area is considered to comprise potential foraging and dispersal habitat for this species although it has not been confirmed in the area.</p> <p>The koala has been recorded throughout the Hunter Valley, however records are scattered and only recorded occasionally.</p>



**Table 4.1 – Listed Threatened Species Recorded within the Project Area/Referral Area and Regional Distribution (cont.)**

Species	Recorded in Project Area?	Recorded in Referral Area?	Last Known Record	Location of Local Records and Regional Distribution
<i>Ozothamnus tessellatus</i>	Yes	No	2003	<p>This species has been previously recorded during surveys undertaken within Ravensworth State Forest in the north-east of the Project Area. The species has not been recorded within the Referral Area and is considered unlikely to occur due to past disturbances and current grazing pressures and the substantial survey effort in the area.</p> <p>A historic record of the species occurs to the east of Manobalai Nature Reserve, however no other records occur within the main Hunter Valley. The species is mainly known in Goulburn River National Park and near Bylong.</p>

Potential habitat for the regent honeyeater (*Anthochaera phrygia*) and Australian painted snipe (*Rostratula benghalensis australis*) has also been identified within the Project Area; however, these species have not been recorded during annual fauna monitoring or during specific fauna surveys undertaken for the Proposed Action.

No threatened ecological communities have been previously recorded in the Project Area. Detailed survey and analysis was undertaken to determine the presence or otherwise of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC. Survey and assessment results indicate that the community does not occur in the Project Area including the Referral Area. Vegetation communities identified during surveys were compared to threatened ecological communities (TECs) listed under the Commonwealth EPBC Act and an assessment of similarity with TECs, including White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC was undertaken using the following approach:

- comparison with published species lists, including lists of 'important species' for the communities referred to by the Threatened Species Scientific Committee Listing Advice;
- comparison with habitat descriptions and distributions for listed TECs;
- assessment using guidelines published by the Commonwealth DoE and the NSW OEH;
- collection of 'box' and 'red gum' eucalypt specimens to determine if white box (*Eucalyptus albens*) and Blakely's red gum (*Eucalyptus blakelyi*) or their hybrids white box/grey box intergrade (*Eucalyptus albens—moluccana*) or Blakely's red gum/forest red gum intergrade (*Eucalyptus blakelyi—tereticornis*) are present in the Mt Owen Complex;
- formal identification of potential 'box' and 'red gum' eucalypt specimens by eucalypt experts from the Royal Botanic Gardens, Sydney; and
- comparison with other assessments of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the region.

Vegetation communities recorded within the Project Area, including the Referral Area, are not considered to be consistent with White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC. None of the vegetation communities are dominated by Blakely's red gum, and no white box or yellow box or their hybrids are present in the Project Area. None of these species is likely to have previously occurred in any higher level of frequency than it does today, as a result of clearing since European settlement. As there is no white box, yellow box, Blakely's red gum, or their hybrids, present in the Project Area including the Referral Area, there is no potential for the CEEC to be present within the Referral Area.

Section 4.0 of the Ecological Assessment (refer to Appendix 11 of the EIS) describes the results of the flora and fauna surveys, literature review and database searches undertaken as part of the assessment. Each of the EPBC Act listed flora and fauna species recorded in the Project Area is described along with a description of suitable habitat in the Referral Area. A description of the habitats identified in the Referral Area and broader Project Area are provided in Section 4.2.1 of the Ecological Assessment (refer to Appendix 11 of the EIS).

#### **4.1.3 Regional Distribution and Abundance of Suitable and Potential Habitat**

The broad fauna habitat types of grassland, riparian, woodland/forest and aquatic habitat found within the Referral Area are representative of the broad habitat types within the surrounding region. All habitats in the region have been extensively cleared or modified for agriculture, largely for cattle grazing. Communities occurring on floodplains and more fertile soils in the Hunter Valley floor have been most extensively cleared (Peake 2006). As a result of the widespread clearing of habitats in the region, those remaining contain important refuges for a number of fauna species, many of which are now threatened due to habitat loss and fragmentation.

Approximately 65 percent of all remnant vegetation on the Hunter Valley floor occurs within the relatively few remnants that are over 100 hectares in area, with the largest remnant, which is mostly within Myambat Military Area near Denman, being approximately 2,250 hectares.

**Table 4.1** presents the threatened species recorded within the Project Area in the context of their regional distribution. A detailed description of the threatened species and habitat identified in the broader region that surrounds the Project Area is documented in Sections 2.5 and 2.6 of the Ecological Assessment (refer to Appendix 11 of the EIS).

## **4.2 Water Resources**

It is noted that the Supplementary DGRs refer to DoE's Water Resources Terms of Reference, which were not available during preparation of this document. Consultation with the NSW DP&E and DoE has indicated that the information addressing the 'Water Resources' component of the NSW's DGRs will meet this requirement.

### **4.2.1 Surface Water Resources**

A detailed assessment of the impacts of the Project (i.e. the Project as defined by the EIS (refer to **Section 3.1**), including the Referral Area, on surface water resources was undertaken by Umwelt and is contained in full in Appendix 9 of the EIS.

The full extent of the information in the Surface Water Assessment is included, where relevant, to provide context and understanding of the overall surface water resources of the Referral Area and the local surrounding area. A summary of the key points as it relates to the Supplementary DGRs is contained below.

#### 4.2.1.1 Catchment Areas and Watercourses

The Project Area is located within the catchments of Bowmans Creek and Glennies Creek, both of which flow into the Hunter River to the south of the Project Area. Bowmans Creek catchment is located to the north and west of the Project Area, while Glennies Creek catchment is located to the east and south (refer to **Figure 4.5**). **Figure 4.5** also illustrates the area of the Proposed Action.

The Bowmans Creek catchment includes the sub catchments of Stringybark Creek, Yorks Creek, Swamp Creek and Bettys Creek (refer to **Figure 4.5**); while the Glennies Creek catchment includes the sub-catchment of Main Creek. The existing Mt Owen Complex water management system (WMS) is located within the Project Area, the extent of which is illustrated on **Figure 4.6**. Bettys Creek has been the subject of three approved diversions known as the upper, middle and lower Bettys Creek diversions (refer to **Figure 4.6**). Both Yorks Creek and Swamp Creek have also been the subject of approved diversions (refer to **Figure 4.6**).

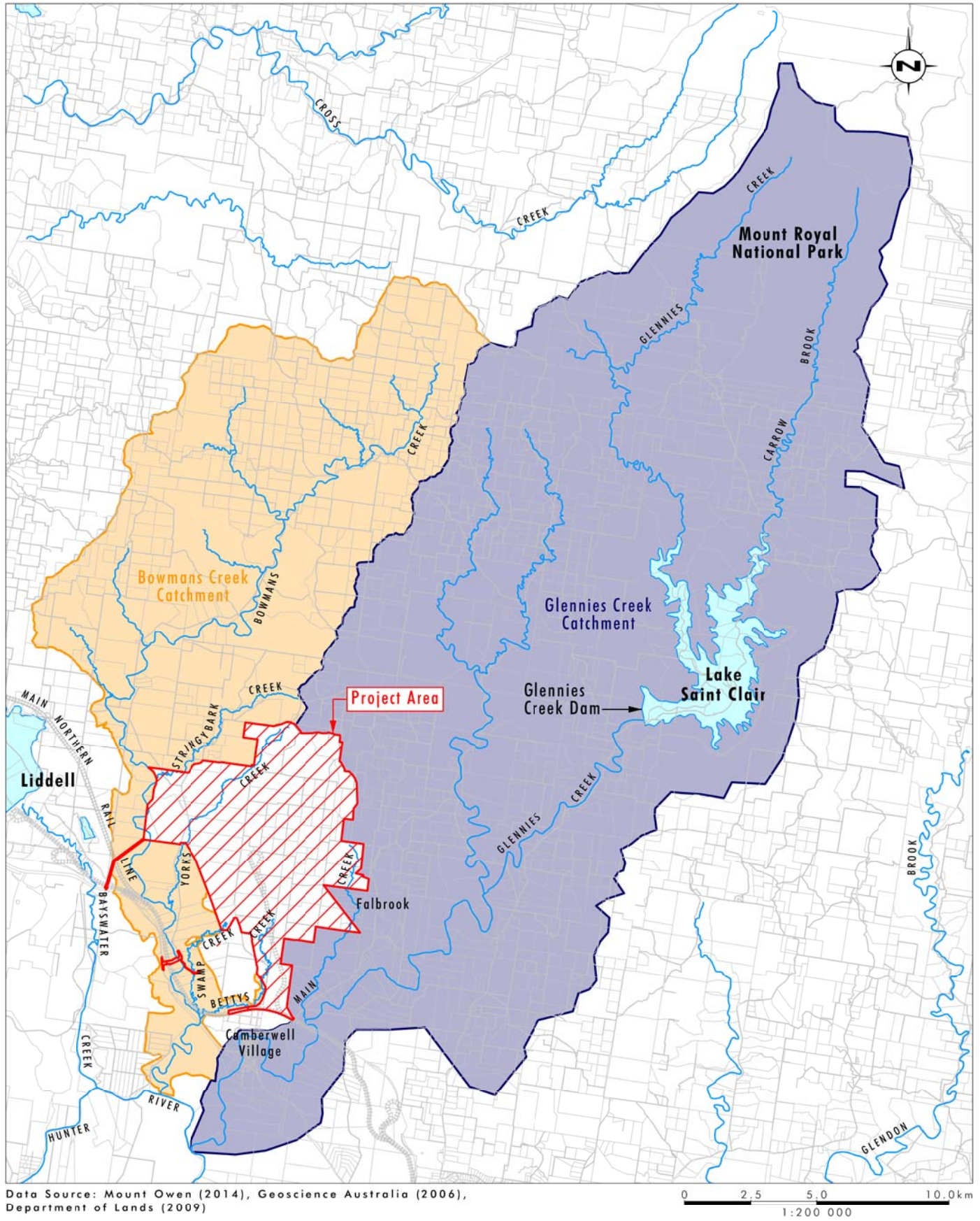
Land uses within and immediately surrounding the Project Area include other mining operations, State Forest, biodiversity offset areas, and rural and rural residential land holdings. Downstream water users are discussed further in **Section 4.2.3.1** below. Previous mining operations within the Project Area have modified local catchments through the capture of runoff from mining areas within the mine WMS and diversion of upslope runoff around the mining operations.

Further details on both Bowmans Creek and Glennies Creek catchments and their sub catchments are provided in the Surface Water Assessment (refer to Appendix 9 of the EIS).

#### 4.2.1.2 Surface Water Quality

Surface water monitoring at the Mt Owen Complex is documented in the Mt Owen Complex Surface Water Monitoring Program (Xstrata Coal 2012d). Existing surface water quality monitoring locations for the Mt Owen Complex and monitoring locations that are shared with Ashton and Liddell Operations are illustrated on **Figure 4.7**.

The relevant default ANZECC trigger values and site specific trigger values (based on the 80<sup>th</sup> percentile of historical data and the default ANZECC trigger values) for the key water quality indicators monitored by Mount Owen are presented in **Table 4.2**. These include pH, electrical conductivity (EC), total suspended solids (TSS) and total dissolved solids (TDS). The site specific trigger values for Bowmans Creek and for flow conditions in the ephemeral creeks are the same as the ANZECC default trigger values for pH, EC and TSS. The trigger value for TDS for Bowmans Creek and for flow conditions in the ephemeral creeks is based on historic data and is lower than the default ANZECC trigger values.



#### Legend

- Project Area
- Glennies Creek Catchment Area
- Bowmans Creek Catchment Area
- Cadastre
- Railway
- Drainage Line

File Name (A4): R12/3109\_947.dgn  
20140902 10.06

FIGURE 4.5  
Catchment Context



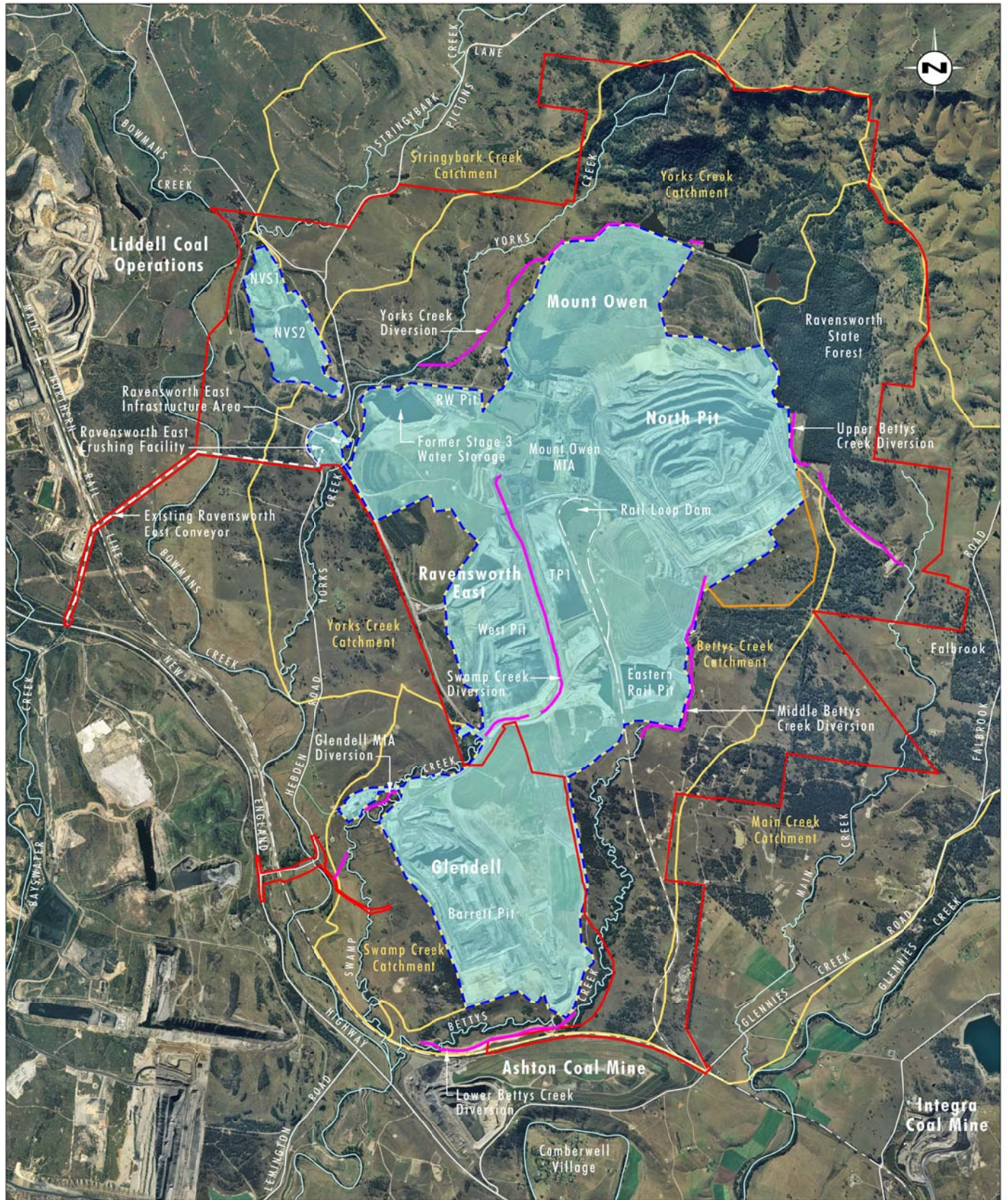


Image Source: Mount Owen (2012-2013)  
Data Source: Mount Owen (2014)

0 1 2 3 km  
1:60 000

#### Legend

- Project Area
- Approved North Pit Mining Extent
- - - Mount Owen Complex Water Management System Catchment
- Catchment Boundary
- Existing Diversion Channel

FIGURE 4.6

Project Area  
Surface Water  
Catchment Context



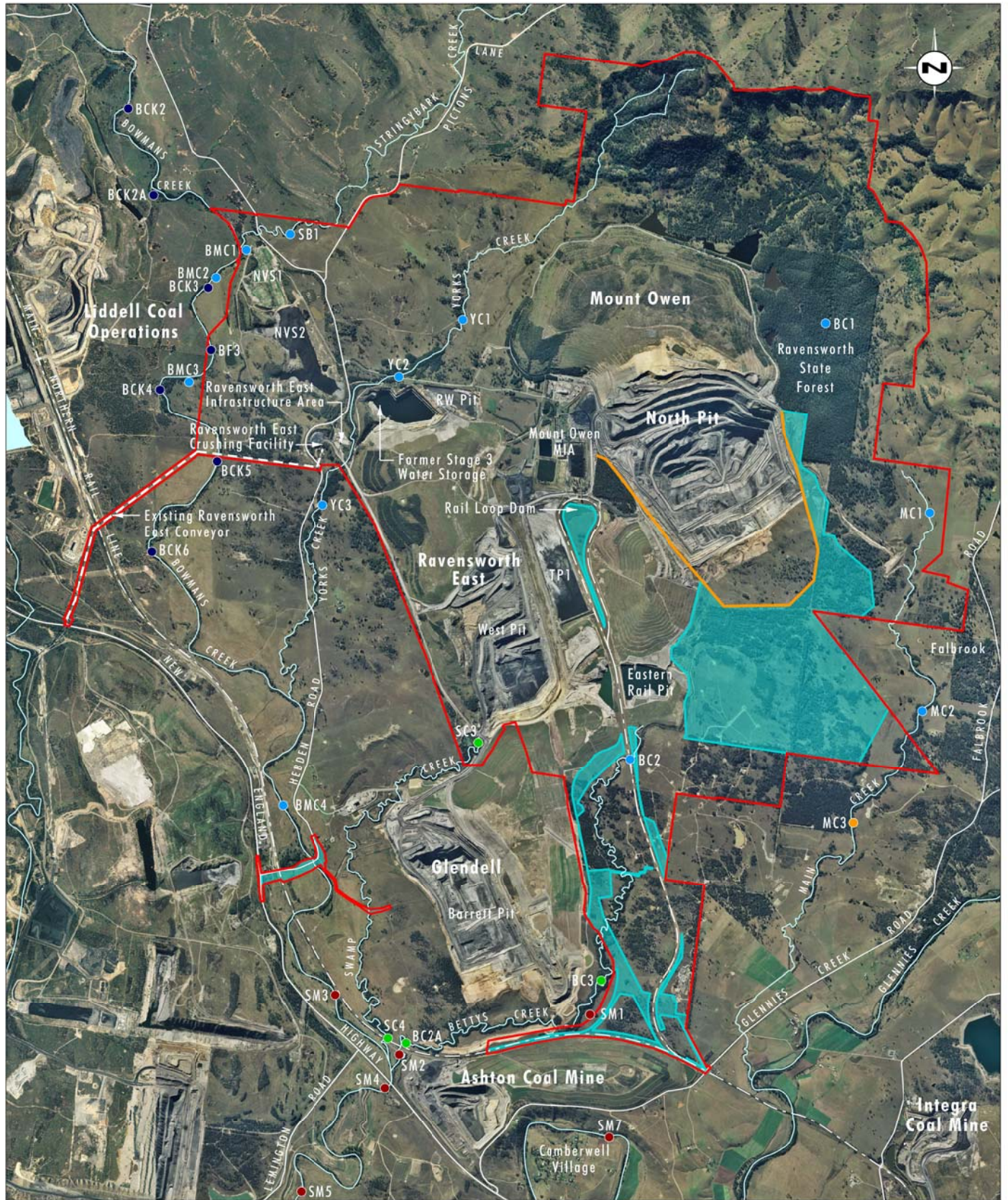


Image Source: Mount Owen (2012-2013)  
Data Source: Mount Owen (2014)

0 1 2 3 km  
1:60 000

#### Legend

- ▬ Project Area
- ▬ Referral Area
- ▬ Approved North Pit Mining Extent
- Mount Owen Surface Water Monitoring Location
- Ashton Surface Water Monitoring Location
- Liddell Surface Water Monitoring Location
- Glendell Surface Water Monitoring Location
- Proposed Future Water Monitoring Location

File Name (A4): R12/3109\_949.dgn  
20141007 9.07

FIGURE 4.7

Surface Water Quality  
Monitoring Locations



**Table 4.2 – Water Quality Parameters and Trigger Levels**

Parameter Monitored	ANZECC default trigger	Site Specific Trigger Values <sup>1</sup>		
		Bowmans Creek	Ephemeral Creek Systems	
			Flow Conditions	No Flow Conditions
pH	6.5 to 8.0	6.5 to 8.0	6.5 to 8.0	6.5 to 8.6
EC (µs/cm)	2,200	2,200	2,200	5,400
TSS (mg/L)	50	50	50	50
TDS (mg/L)	4,000 to 5,000 <sup>2</sup>	1,480	1,480	4,700

1. Source: Mt Owen Complex Surface Water Monitoring Program (Xstrata Coal 2012d)

2. Source: ANZECC guidelines (2000) - recommended concentration of TDS in drinking water for beef cattle as no default trigger value is provided by the ANZECC guidelines (2000) for ecosystem protection.

Background water quality data indicates that Bowmans Creek historically has elevated pH, while EC and TDS are typically within site specific trigger values. Tributaries of Bowmans Creek, including Yorks Creek and Swamp Creek historically have elevated concentrations of EC and TDS during periods of reduced flow, and elevated TSS concentrations during rainfall events. Swamp Creek occasionally shows elevated pH levels during periods of low flow. Bettys Creek typically has consistent EC and TDS, with elevated TSS concentrations during rainfall events. The historic water quality in Main Creek occasionally displays elevated EC and elevated TSS concentrations during high rainfall events. The full record of available water quality results from August 2008 to March 2014 for pH, EC, TSS and TDS is included in Appendix 9 of the EIS.

Mt Owen also monitors water quality within the WMS for operational purposes, on an as needs basis to assist in the day to day management of operations as discussed in detail in Appendix 9 of the EIS.

#### **4.2.2 Groundwater Resources**

A detailed assessment of the impacts of the Project (i.e. the Project as defined by the EIS (refer to **Section 3.1**)), including the Referral Area, on groundwater resources was undertaken by Jacobs Group (Australia) Pty Limited (Jacobs) and is contained in full in Appendix 10 of the EIS.

Key information in the Groundwater Impact Assessment is included, where relevant, to provide context and understanding of the overall groundwater resources of the Referral Area and the local surrounding area. A summary of the key points as it relates to the Supplementary DGRs is contained below.

##### **4.2.2.1 Groundwater Systems and Water Quality**

The alluvial aquifers associated with the Hunter River and its tributaries are generally characterised by unconsolidated deposits of silts, sands, and gravels of varying permeability. The morphology of the alluvial deposits comprises a vertical succession of three distinct units, including basal coarse grained sand and cobble size deposits, finer grained levee deposits, and floodplain deposits. The basal coarse grained sand and gravel unit forms the main alluvial aquifer and in places may be confined by the overlying finer grained terrace deposits. These unconsolidated aquifers discharge groundwater to surface water features in the region, with their varying morphology and extent leading to complex and variable surface water interactions (Jacobs 2014).

The hard rock aquifer associated with the Permian coal measures exhibits varying levels of groundwater storage and transmission. The most permeable horizons are the coal seams themselves; non-coal interburden strata generally exhibit permeabilities at least one to two orders of magnitude less than the coal seams. Secondary porosity in the non-coal strata may be developed within fractures and joints; however the degree to which this occurs is quite variable and generally unpredictable. Enhanced transmission will develop over underground workings where induced cracking above the goaf will increase porosity and permeability. Independent studies of the extent and magnitude of this enhanced cracking have been used to establish a relationship for increased transmissivity above underground workings for the Upper Hunter Valley area.

Section 5.6.1.1 of the EIS discusses the two main hydrogeological features occurring within and surrounding the Referral Area:

- **The alluvial aquifers along the creek lines** – as discussed in **Section 4.2.1.1**, the Project Area contains Bettys, Swamp and Yorks Creeks, tributaries of Bowmans Creek, and Main Creek, a tributary of Glennies Creek. Both Bowmans and Glennies Creeks are tributaries of the Hunter River. The alluvial aquifers associated with these systems are shallow and highly porous with a rapid transmission of groundwater responding to rainfall events, with a small amount of groundwater baseflow relative to total flow. Alluvials associated with Bettys Creek, Swamp Creek, Yorks Creek and Main Creek are not high yield systems. The alluvial aquifers associated with Bettys Creek and Bowmans Creek underlie the Referral Area in the areas identified for the proposed infrastructure.
- **The deeper hard rock aquifers that contain the coal measures** – these aquifers are semi-confined and contain sandstones, siltstones and coal seams. Water yields from the hard rock aquifers within the Project Area are not high and are much lower than for the alluvial aquifers as well as having slower groundwater movement. There has been extensive depressurisation of these hard rock aquifers within and surrounding the Project Area, as a result of previous and current mining operations.

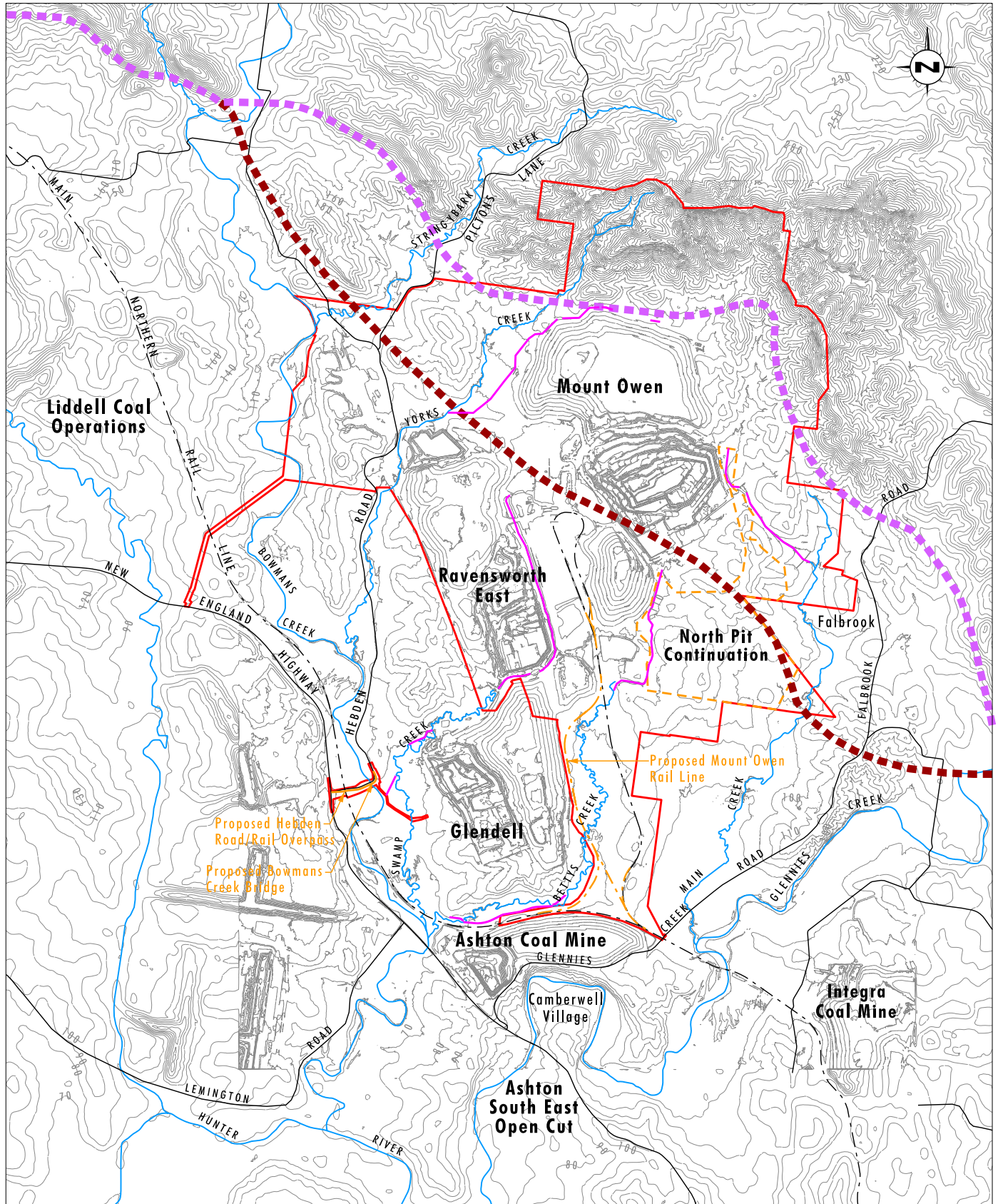
Groundwater in the regional hard rock aquifer moves down dip and down gradient from areas of recharge where individual seams sub-crop and outcrop in the north near the Hunter Thrust (refer to **Figure 4.8**) and in the west near Lake Liddell. Rates of recharge are very low through unweathered Permian bedrock, but slightly higher where more permeable rocks sub-crop and outcrop. Monitoring indicates that the Hunter Thrust is a significant barrier to groundwater flow.

Extensive coal mining in the area has been undertaken for many years and has resulted in the depressurisation of the hard rock aquifer and corresponding effects on the local hydrogeological regime.

The existing groundwater monitoring program at the Mt Owen Complex and surrounds consists of a series of nested piezometers targeting the alluvium and deeper hard rock aquifers. Additional bores were installed between 2012 and 2014 targeting the alluvial aquifers associated with Bowmans Creek and Glennies Creek and their tributaries (Yorks Creek, Swamp Creek, Main Creek and Bettys Creek) as well as a number of additional bores targeting further definition of the hard rock aquifer.

Groundwater quality in the alluvial and hard rock aquifers in the region varies with water quality in the alluvium generally slightly less saline than in the coal measures. Alluvial groundwater in the region is generally classified as fresh to brackish while the coal seams aquifers are generally brackish.





Data Source: Mount Owen (2014), Department of Lands (2006), SKM (2013)  
 Note: Contour Interval 10m

0 1.0 2.0 4.0 km  
 1:80 000

#### Legend

- Project Area
- Proposed North Pit Continuation
- Rail Upgrade Works
- Hebdon Road Upgrade Works
- Drainage Line
- Diversion Drainage Line
- Hunter Thrust
- Hebdon Thrust

File Name (A4): R12/3109\_959.dgn  
 20141009 10.10

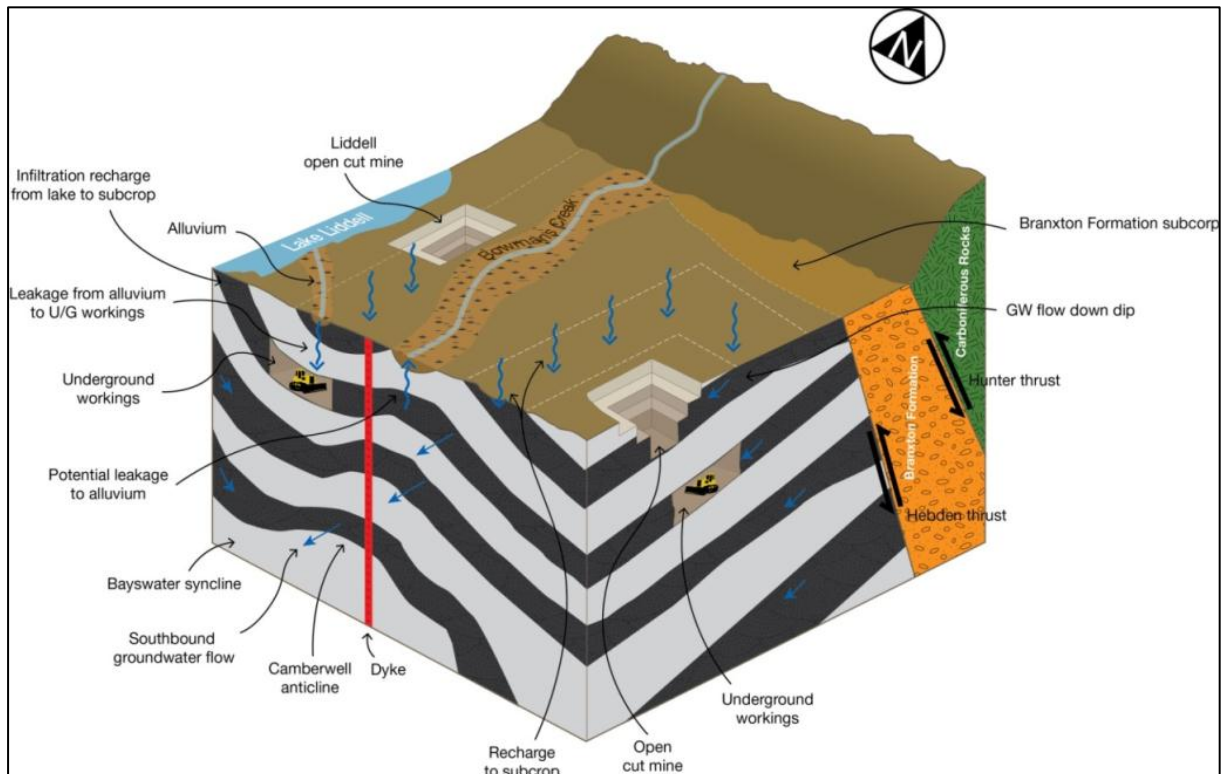
FIGURE 4.8

Geological Structures

Further information describing the groundwater resources within and surrounding the Proposed Action is contained in the Groundwater Impact Assessment in Appendix 10 of the EIS.

#### 4.2.2.2 Conceptual Model

Jacobs (2014) developed a conceptual model (as shown below) in accordance with *Australian Groundwater Modelling Guidelines* describing the general hydrogeological regime and groundwater relationships which has been used to guide the development of the numerical groundwater flow model for the Greater Ravensworth region. For further detail refer to the Groundwater Report (Appendix 10 of the EIS).



The conceptual model identifies the key hydrogeological processes present across the region, including accounting for the effect of current and former open cut and underground mining operations on groundwater flow regimes and the presence of the Hunter Thrust as a barrier to regional groundwater flow. The layering developed considers the complexity of the region's geology and combines relevant units into single layers. Structural features are deduced from existing geological mapping, mine constructions and available hydrogeological data. Additionally the development and construction of the model has been undertaken in consultation with the NSW Office of Water, who, in line with the introduction of WSPs under the *Water Management Act 2000* and the AIP (NSW 2012), have supported the development of a regional scale model to assess the potential cumulative impacts of mining operations in the area. For further detail regarding the groundwater model please refer to Appendix 10 of the EIS.

The model includes 20 layers representing stratigraphy from the ground surface down to the Saltwater Creek Formation, with a description of each model layer provided in **Table 4.3**.

**Table 4.3: Description of Model Layers (from Jacobs 2014)**

Layer	Name	Description
1	Alluvium	Alluvial deposits surrounding the major rivers.
2	Alluvium/Regolith	Basal Alluvial sediments surrounding the rivers and Regolith (weathered rock) elsewhere.
3	Overburden	Everything between the base of weathering and the top of the Bayswater Seam, can include seams, but mostly sandstone, claystone and/or siltstone.
4	Bayswater Seam	All the Bayswater Seams. Includes the upper Bayswater 1, upper Bayswater 2 and Lower Bayswater at Liddell. Also includes interburden between these seams.
5-6	Interburden	Everything between the base of the Bayswater Seam and the top of the Upper Pikes Gully Seam (includes Lemington Seam).
7	Upper Pikes Gully Seam	Upper Pikes Gully Seam.
8	Interburden	Everything between the base of the upper Pikes Gully Seam and the top of the middle Pikes Gully Seam.
9	Middle and lower Pikes Gully Seam	Everything between the top of the middle Pikes Gully Seam and the base of the lower Pikes Gully Seam (includes interburden between the two seams).
10	Interburden	Everything between the base of the lower Pikes Gully Seam and the top of the Arties Seam.
11	Arties Seam	All the Arties Seams. Includes the Arties A, Arties B, Arties L1 and Arties L2 at Liddell.
12	Interburden	Everything between the base of the lower Pikes Gully Seam and the top of the Arties Seam.
13	Liddell Seam Sections A & B	All the Liddell Seams in Sections A and B. Includes the Liddell A1, Liddell Parting, Liddell B1, upper Liddell B2 and lower Liddell B2 at Liddell. Also includes interburden between these seams.
14	Liddell Seam Section C	All the Liddell Seams in Section C. Includes the upper Liddell C1, lower Liddell C1 at Liddell. Also includes interburden between the two seams.
15	Liddell Seam Section D	All the Liddell Seams in Section D. Includes the upper Liddell D1, lower Liddell D1 at Liddell. Also includes interburden between the two seams.
16	Interburden	Everything between the base of the Liddell Seam Section D and the top of the Barrett Seam.
17	Barrett Seam	All the Barrett Seams. Includes the Barrett A, upper Barrett B, middle Barrett B, lower Barrett B, Barrett C1, Barrett C2 and Barrett D at Liddell. Also includes interburden between these seams.
18	Interburden	Everything between the base of the Barrett Seam and the top of the Hebden Seam.
19	Hebden Seam	All the Hebden Seams. Includes upper Hebden and lower Hebden at Liddell. Also includes interburden between the two seams.
20	Saltwater Creek Formation	This layer represents the basement below the Hebden Seam, its upper part is composed of the Saltwater Creek Formation.

The model also includes consideration of faults and dykes, surface water features, fracture zone, regional mining operations, refer to Appendix 10 of the EIS for further detail.

#### 4.2.2.3 Groundwater model calibration

Calibration of the regional scale model was undertaken using a stochastic calibration methodology designed to meet the following objectives:

- Establish datasets of model parameters that match measured groundwater levels within acceptable error limits. These parameter sets are reported collectively as the 'stochastic datasets'.
- Run the predictive simulations with the stochastic datasets to obtain an envelope of possible outcomes that also collectively represent the uncertainties associated with predictive modelling.

The stochastic approach was adopted in preference to a deterministic calibration methodology as it is capable of meeting the agreed objectives while offering the additional benefits of providing appropriate predictive uncertainty analysis. This concept is highlighted specifically in the Australian Groundwater Modelling Guidelines. Further details on the calibration simulations and analyses are provided in Appendix 10 of the EIS.

#### 4.2.3 Water Related Assets

The water related assets that are dependent on surface and groundwater within the vicinity of the Proposed Action include surface and groundwater users and Groundwater Dependent Ecosystems (GDEs). These are discussed in **Sections 4.2.3.1 to 4.2.3.3** below.

##### 4.2.3.1 Downstream Surface Water Users

The NSW *Water Management Act 2000* (NSW WM Act) defines water access and water sharing strategies. As part of this Act, Water Sharing Plans (WSPs) have been developed across NSW to protect the health of rivers, whilst at the same time securing sustainable access to water for all users. The WSP's specify maximum water extractions and allocations.

The Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009 (NOW 2009) applies to watercourses in the vicinity of the Project Area and alluvial groundwaters. The catchment of Bowmans Creek is located within the Jerrys Water Source and the catchment of Main Creek is located within the Glennies Water Source. As both Bowmans Creek and Main Creek are covered by water sharing plans, water use in the Project Area is governed by the NSW WM Act. The groundwater associated with the hard rock aquifers (i.e. coal seams) is not covered by a water sharing plan but is governed under the NSW *Water Act 1912*.

Water is extracted from Glennies Creek and the Hunter River downstream of Project Area by Ashton Coal. Ashton also hold irrigation licences for Bowmans Creek, and is an underground mine with approved depressurisation impacts.

There are no known licensed water users on waterways directly downstream of the Project Area along Yorks Creek, Swamp Creek, Bettys Creek or Main Creek; however, landholders downstream of the Project Area on Main Creek, Glennies Creek and Bowmans Creek retain basic landholder rights for domestic and stock use.

The majority of land adjacent to Yorks Creek, Bettys Creek and Swamp Creek downstream of the Mt Owen WMS to the New England Highway is owned by Glencore. There is one lot on Yorks Creek owned by a government authority and one lot on Bettys Creek owned by the Crown. As such there are no private landholders located immediately downstream of the Project Area on Yorks Creek, Swamp Creek or Bettys Creek. There are two private landholders with access to Main Creek, located downstream of the Project Area.

#### **4.2.3.2 Groundwater Users**

A search of the NSW Office of Water (NOW) database identified 47 registered bores within 4 kilometres of the Project Area. All of the bores within the 4 kilometre radius of the Project Area are owned by Glencore operations or other mining companies. The nearest privately owned bore is located over 4 kilometres from the Project Area.

No registered bores or groundwater users are located within the extent of predicted drawdown.

#### **4.2.3.3 Groundwater Dependent Ecosystems**

As discussed further in the Ecological Assessment contained in Appendix 11 of the EIS, the Project Area contains three vegetation communities (Central Hunter Swamp Oak Forest, Hunter Lowland Red Gum Forest and Hunter Valley River Oak Forest) that are expected to be dependent on shallow groundwater resources during periods of reduced surface water flow. The locations of these communities are illustrated on **Figure 4.9**. Central Hunter Swamp Oak Forest and Hunter Valley River Oak Forest are located within the Referral Area. Neither are listed as EECs.

**Section 5.0** describes the potential ecological and water resources impacts.



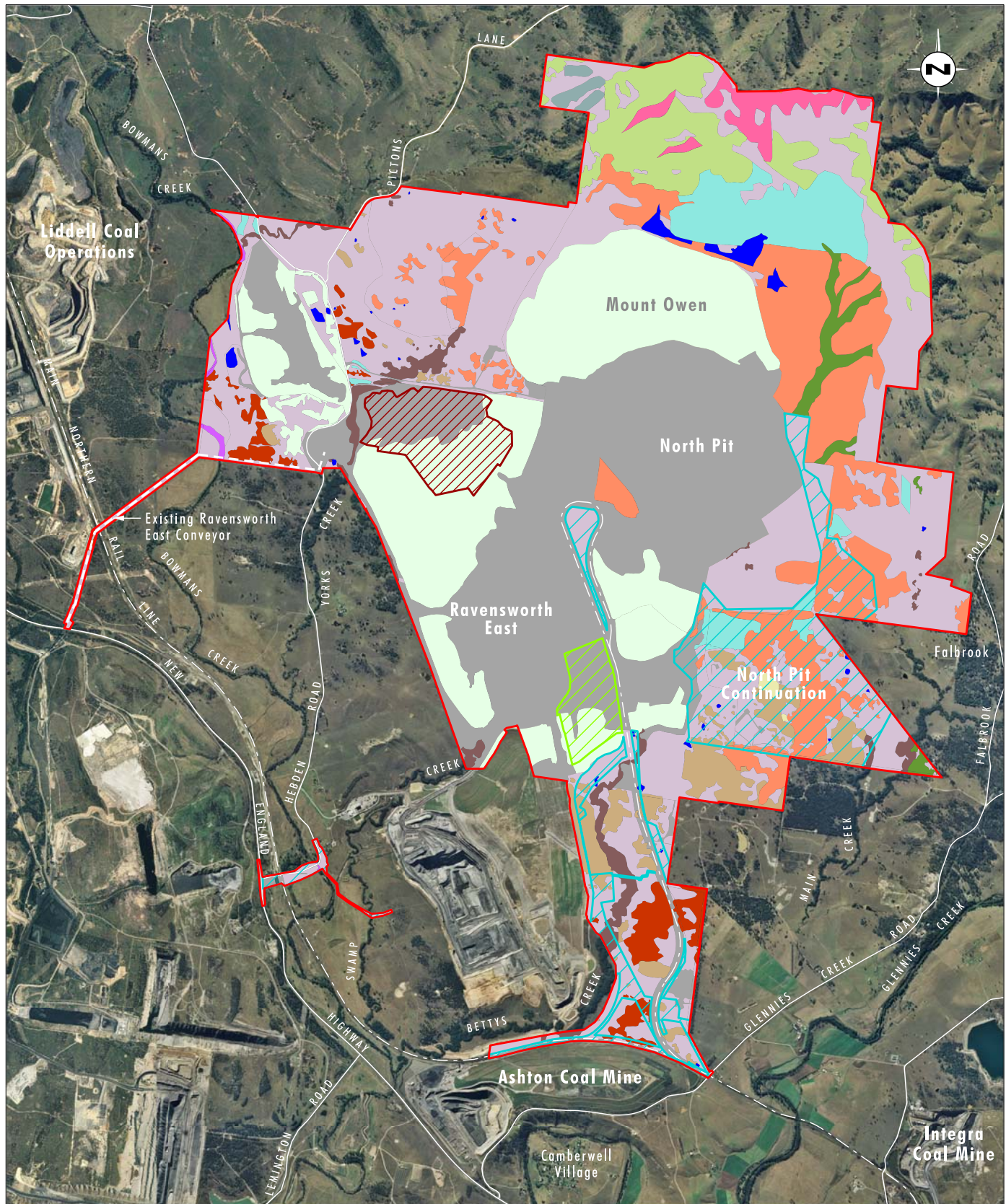


Image Source: Mount Owen (2012-2013)  
Data Source: Mount Owen (2014)

0 1 2 3 km  
1:60 000

### Legend

- |  |   |   |
|--|---|---|
| <span style="border: 2px solid red; padding: 2px;"> </span> Project Area   | <span style="background-color: orange; border: 1px solid black; padding: 2px;"> </span> Central Hunter Ironbark - Spotted Gum - Grey Box Forest | <span style="background-color: blue; border: 1px solid black; padding: 2px;"> </span> Water Body                |
| <span style="background-color: lightblue; border: 1px solid black; padding: 2px;"> </span> Referral Area                                 | <span style="background-color: brown; border: 1px solid black; padding: 2px;"> </span> Central Hunter Grey Box - Ironbark Woodland              | <span style="background-color: lightgreen; border: 1px solid black; padding: 2px;"> </span> Mine Rehabilitation |
| <span style="background-color: pink; border: 1px solid black; padding: 2px;"> </span> Bayswater North Pit                                | <span style="background-color: lightpurple; border: 1px solid black; padding: 2px;"> </span> Derived Native Grassland                           |   |
| <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Proposed RERR Mining Area                        | <span style="background-color: pink; border: 1px solid black; padding: 2px;"> </span> Dry Rainforest  |   |
| <span style="background-color: grey; border: 1px solid black; padding: 2px;"> </span> Vegetation Communities:                            | <span style="background-color: green; border: 1px solid black; padding: 2px;"> </span> Hunter Lowland Red Gum Forest                            |   |
| <span style="background-color: grey; border: 1px solid black; padding: 2px;"> </span> Disturbed Land                                     | <span style="background-color: darkgreen; border: 1px solid black; padding: 2px;"> </span> Hunter Footslopes Sheltered Forest                   |   |
| <span style="background-color: lightgreen; border: 1px solid black; padding: 2px;"> </span> Barrington Footslopes Dry Spotted Gum Forest | <span style="background-color: purple; border: 1px solid black; padding: 2px;"> </span> Hunter Valley River Oak Forest                          |   |
| <span style="background-color: brown; border: 1px solid black; padding: 2px;"> </span> Central Hunter Bullock Forest Regeneration        | <span style="background-color: lightblue; border: 1px solid black; padding: 2px;"> </span> Planted Ironbark - Spotted Gum - Grey Box Forest     |   |
| <span style="background-color: darkbrown; border: 1px solid black; padding: 2px;"> </span> Central Hunter Swamp Oak Forest               | <span style="background-color: yellow; border: 1px solid black; padding: 2px;"> </span> Kunzea Closed Shrubland                                 |   |

FIGURE 4.9

**Vegetation Communities  
within the Project Area**

## 5.0 Description of the Relevant Impacts of the Controlled Action

**4. An assessment of all relevant impacts with reference to the EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance (2009), Draft significant impact guidelines: Coal seam gas and large coal mining developments - impacts on water resources and species specific guidelines as relevant (available at: [www.environment.gov.au/epbc/guidelines-policies.html](http://www.environment.gov.au/epbc/guidelines-policies.html)) that the controlled action has, will have or is likely to have.**

**Information must include:**

- a) a description of the relevant impacts of the action on matters of national environmental significance:**
  - **listed species and communities (including, but not limited to, those listed in Appendix A), and**
  - **water resources**
- b) a detailed assessment of the nature and extent of the likely short term and long term relevant impacts**
- c) a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible**
- d) analyses of the significance of the relevant impacts, and**
- e) any technical data and other information used or needed to make a detailed assessment of the relevant impacts**

### 5.1 Ecological Impacts

A detailed ecological assessment has been prepared as part of the EIS. Section 5.0 of the Ecological Assessment (refer to Appendix 11 of the EIS) describes the relevant impacts of the Proposed Action on listed species and communities and includes discussion of impact avoidance and minimisation measures proposed to be implemented. In summary, there are no EPBC Act listed vegetation communities or flora species present in the Referral Area; there are three EPBC Act species known to occur within the Referral Area; however, impacts to these species have been assessed as not significant.

#### 5.1.1 Nature and Extent of the Likely Short Term and Long Term Relevant Impacts

The Proposed Action will result in the disturbance of approximately 485 hectares of land which includes approximately 228.4 hectares of native woodland/forest, riparian and shrubland vegetation and 223.1 hectares of Derived Native Grassland and 33.5 hectares of other land (including dams and disturbed land) (refer to **Table 5.1**). A total of 2,794 hectares of native vegetation occurs in the Project Area providing known habitat for 9 threatened fauna species and one threatened flora species listed under the EPBC Act. Of the 10 EPBC Act listed species recorded in the Project Area, three have been recorded in the Referral Area and will be directly impacted by the Proposed Action; these are the:

- spotted-tailed quoll (*Dasyurus maculatus maculatus*);
- grey-headed flying-fox (*Pteropus poliocephalus*); and

- koala (*Phascolarctos cinereus*).

**Table 5.1** provides a list of the vegetation communities impacted by the Proposed Action.

**Table 5.1 – Native Vegetation Communities Impacted by the Proposed Action**

Formation	Vegetation Community	Area of Vegetation to be Removed (ha)
Derived Native Grassland	Derived Native Grassland	223.1
Forest and Woodland	Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC	131.9
	Central Hunter Bulloak Forest Regeneration	54.0
	Planted Ironbark – Spotted Gum – Grey Box Forest EEC	27.4
	Central Hunter Grey Box - Ironbark Woodland EEC	4.4
Shrubland	Kunzea Closed Shrubland	4.7
Riparian	Hunter Valley River Oak Forest	0.2
	Central Hunter Swamp Oak Forest	5.8
<b>Total</b>		<b>451.5</b>

The Project Area is located within a large area of remnant vegetation on the central Hunter Valley floor, a landscape which has been heavily cleared and disturbed over a long period of time. Whilst analysis of historical aerial photography confirms that the majority of the Referral Area is regrowth less than 20 years old, the vegetation remnants of the type and size occurring in the Referral Area and wider Project Area are important at local and regional scales.

The ecological values identified in the Project Area that have been considered in determining the impact of the Proposed Action and the development of impact mitigation and biodiversity offsetting requirements include:

- high quality threatened species habitat including:
  - contiguous native woodland, forest and riparian vegetation that is part of one of the few remaining large remnants in the local area (large remnants being >100 hectares (Peake 2006)). The vegetation of the Project Area is of local and regional importance due to its size and the presence of active regeneration of canopy species. The remnant provides an important corridor in a local and regional context and provides habitat for many species that are unable to persist in small, fragmented remnants.
  - Important habitat for the spotted-tailed quoll (*Dasyurus maculatus*). The species has been recorded many times within the Project Area and the surrounding locality, with breeding records identified in 2012 for the local population on Bowmans Creek west of the Project Area.
  - 223.7 hectares of woodland, forest and riparian habitat for state listed threatened woodland birds and micro-bats including brown treecreeper (*Climacteris picumnus victoriae*), grey-crowned babbler (*Pomatostomus temporalis temporalis*), diamond firetail (*Stagonopleura guttata*), east coast freetail-bat (*Mormopterus norfolkensis*) and southern myotis (*Myotis macropus*).

- 131.9 hectares of woodland habitat with high hollow-bearing tree densities (75 hollows per hectare), which is a limited resource across the Hunter Valley, providing hollow-dependent fauna habitat including threatened species habitat.
- Winter flowering woodland foraging habitat for the endangered swift parrot (*Lathamus discolor*) and potential foraging habitat for the critically endangered regent honeyeater (*Anthochaera phrygia*) in the central Hunter Valley.

Although an extensive impact mitigation strategy will be undertaken, a Biodiversity Offset Strategy will be required to address the residual impacts of the Proposed Action. The Proposed Action will result in the removal of approximately 451.5 hectares of native vegetation, including (approximately) 159.3 hectares of Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC (including the Planted variant) and 223.1 hectares of Derived Native Grassland.

The Proposed Action will result in a 17 percent reduction in the size of a regionally significant large remnant of vegetation and habitats within the Mt Owen Complex. This remnant provides a known dispersal corridor and important habitat for a range of flora and fauna in a region that has been historically widely disturbed and fragmented as a result of agriculture and mining activities.

For those threatened species recorded in the local proximity to, or considered to be potentially impacted by the Proposed Action (refer to Appendix A of the Ecological Assessment (Appendix 11 of the EIS)), an Assessment of Significance has been undertaken in accordance with the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance (October 2009) (refer to Appendix F of the Ecological Assessment). This assessment concluded that a significant impact was unlikely for the MNES subject to an Assessment of Significance. These were:

- regent honeyeater (*Anthochaera phrygia*);
- swift parrot (*Lathamus discolor*);
- spotted-tailed quoll (*Dasyurus maculatus maculatus*) SE mainland population;
- Australian painted snipe (*Rostratula benghalensis australis*);
- green and golden bell frog (*Litoria aurea*);
- koala (*Phascolarctos cinereus*);
- grey-headed flying-fox (*Pteropus poliocephalus*);
- large-eared pied bat (*Chalinolobus dwyeri*);
- New Holland mouse (*Pseudomys novaehollandiae*);
- *Ozothamnus tessellatus*; and
- migratory species protected under international agreements.

There are three terrestrial vegetation communities (refer to Section 4.3.4 of Appendix 9) that are expected to be dependent on shallow groundwater resources during periods of reduced surface water flow. The surface water assessment (refer to Section 5.5 of the EIS) identified that the changes in annual flow volumes associated with proposed changes to catchment areas for Yorks Creek, Swamp Creek, Bettys Creek and Main Creek are considered to be



small within the context of ephemeral streams. The changes in annual flow volumes are also considered to be small on a regional scale, with the change in flows being less than the seasonal and annual variations in flow volumes comparing dry years to wet years. Thus, reductions in surface water flow to the three terrestrial vegetation communities identified in Section 4.3.4 are expected to be negligible which further reduces the potential for the communities potentially dependent on shallow groundwater resources to be adversely impacted.

An assessment of the potential impacts on groundwater systems has been undertaken by Jacobs (2014) and is summarised in Section 5.6 of the EIS. Potential impacts to GDEs could result from leakage from alluvial aquifers and changes to baseflows or from groundwater drawdowns in alluvial and hard rock aquifers.

The predicted reductions in groundwater flow to the Main Creek and Bettys Creek alluvial aquifers are predicted to be minimal. Peak incremental losses for the Main Creek alluvium are predicted to be less than 15 ML/year (from 2023). Peak losses for the Bettys Creek alluvium are predicted to be less than 6 ML/year (from 2022). The predicted direct impact to Bowmans creek and Glennies Creek alluvium will be negligible.

There is predicted to be negligible drawdown impact to the alluvial aquifers of Bowmans Creek and Glennies Creek, the only two GDEs identified on the Bureau of Meteorology (BoM) GDE Atlas. The drawdown in the Bettys Creek and Main Creek alluvial aquifers is limited to the upper reaches of these creek systems where the volume of alluvium is relatively small compared to other reaches of the creeks. Greater than 2 metres drawdown is predicted in some areas of the alluvium within these creeks, however the impact of this drawdown on the creek systems is unlikely to have a significant impact on surface water-groundwater interactions along Bettys Creek and Main Creek given the low flow volumes and ephemeral conditions in addition to limited extent, depth and condition of alluvium within Bettys and Main Creek.

Based on the outcomes of the Groundwater Assessment, the Proposed Action is not expected to result in an adverse impact on GDEs identified in the Referral Area and surrounding areas as leakage from alluvial aquifers and changes to base flows in drainage lines are expected to be negligible; and there is predicted to be negligible drawdown impact to the alluvial aquifers of Bowmans and Glennies Creeks as a result of the Proposed Action.

The assessment has determined that the GDEs identified within the Referral Area do not comprise potential or known habitat for the green and golden bell frog.

### **5.1.2 Are any Relevant Impacts Likely to be Unknown, Unpredictable or Irreversible?**

The relevant impacts of the Proposed Action are considered to be well known and predictable based on the extensive knowledge of the ecological values of the Project Area and a sound understanding of the impacts of the Proposed Action (e.g. clearing of vegetation, earthworks and water management). The direct impacts of the Proposed Action, as they relate to the clearing of threatened and migratory species habitat is predicted to be permanent; however, a detailed rehabilitation program has been proposed as part of the Proposed Action in order to compensate for the residual impacts of habitat loss that cannot be adequately avoided or minimised. The proposed rehabilitation and reinstatement of habitat (described below) will mean that, over time, impacts will not be completely irreversible as most key ecological features will be recovered.



The indicative post mining land use for the Project Area will primarily involve the establishment of woodland areas, specifically a vegetation community consistent with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest. The objective is to create a native vegetation corridor network that promotes regional fauna movements between the Mt Owen Complex, Ravensworth Operations, Liddell Coal Operations and associated offset areas, Lake Liddell and the Ravensworth Operations Hillcrest Offset Area.

A minor proportion of Mt Owen, including the tops of overburden dump areas and flatter portions of the final landform will be revegetated with open grassland that incorporates pockets of native vegetation. Subject to the outcomes of final land use analysis to be completed as part of detailed closure planning process, it is the intent that these areas could be used for sustainable agricultural purposes such as grazing. As such, revegetation may involve the use of suitable pasture species for the establishment of grasslands in these areas. It is proposed that the ecological value of successful post-mining rehabilitation areas will contribute to the overall Biodiversity Offset Strategy for the Project.

In addition, the rehabilitation objective will also be to maintain and provide additional suitable habitat for a range of threatened fauna species including but not limited to the spotted-tailed quoll (*Dasyurus maculatus maculatus*). This will include the restoration of spotted-tailed quoll habitat comprising vegetation communities consistent with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC as well as Central Hunter Swamp Oak Forest along Stringybark Creek.

The Stringybark Creek Habitat Corridor will be designed with the objective of providing an effective east to west (and vice versa) linkage from the Mt Owen Complex offset and rehabilitation areas situated to the north of the Project Area through to the rehabilitated former tailings dams, Bowmans Creek and Liddell Coal Operations rehabilitation areas to the north-west. This is a key component of the Biodiversity Offset Strategy for the Proposed Action and will include a mixture of tree plantings and habitat structures such as log piles constructed adjacent to the creekline on non-mine disturbed land.

### 5.1.3 Analyses of the Significance of the Relevant Impacts

For those threatened species recorded in proximity to the Referral Area or considered to be potentially impacted by the Proposed Action, an Assessment of Significance was undertaken in accordance with the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance (October 2009) and EPBC Act Policy Statement 3.19 Significant Impact guidelines for the vulnerable green and golden bell frog *Litoria aurea* (DEWHA 2009b) to determine whether the Proposed Action would result in a significant impact on threatened species.

Detailed Assessments of Significance are included as Appendix F and are summarised in Section of 5.8.4 of the Ecological Assessment (refer to Appendix 11 of the EIS).

The outcome of the Assessment of Significance in relation to threatened and migratory species listed under the EPBC Act concluded that the Proposed Action is not likely to result in a significant impact on any of the threatened species known, or considered to potentially occur in the Referral Area.

Table 5.2 – Summary of Assessments of EPBC Act Significance

Matter of National Environmental Significance	Conservation Status	Recorded in the Referral Area	Habitat Status in the Referral Area	Outcome of Assessment of Significance
Swift parrot ( <i>Lathamus discolor</i> )	Endangered	No	Known habitat for the species within the Referral Area comprising 163.7 hectares of box-gum ironbark woodlands.	It is considered unlikely that the Proposed Action would result in a significant impact on the swift parrot as it has not been recorded in the Referral Area and there is no breeding habitat for this species.
Regent honeyeater ( <i>Anthochaera phrygia</i> )	Endangered	No	Potential habitat for the species within the Referral Area comprising 163.7 hectares of box-gum ironbark woodlands.	It is considered unlikely that the Proposed Action would result in a significant impact on the regent honeyeater as it has not been recorded within 10 kilometres of the Referral Area and there is no breeding habitat for this species.
Australian painted snipe ( <i>Rostratula benghalensis australis</i> )	Endangered	No	Potential habitat for the species within the Referral Area comprising 0.6 hectares of highly modified and degraded waterway and farm dams.	It is considered unlikely that the Proposed Action would result in a significant impact on the Australian painted snipe as it has not been recorded in the Referral Area and the small area of habitat within the Referral Area is unlikely to be of importance to this species.
Spotted-tailed quoll ( <i>Dasyurus maculatus maculatus</i> )	Endangered	Yes	Known habitat for this species within the Referral Area comprising 223.7 hectares of woodland, forest and riparian habitat and 223.1 hectares derived native grassland vegetation.	It is considered unlikely that the Proposed Action would result in a significant impact on the spotted-tailed quoll as no known breeding habitat, den sites and latrines will be impacted.

Table 5.2 – Summary of Assessments of EPBC Act Significance (cont.)

Matter of National Environmental Significance	Conservation Status	Recorded in the Referral Area	Habitat Status in the Referral Area	Outcome of Assessment of Significance
Green and golden bell frog ( <i>Litoria aurea</i> )	Vulnerable	No	Potential habitat for the species within the Referral Area comprising various farm dams and associated terrestrial habitats.	It is considered unlikely that the Proposed Action would result in a significant impact on the green and golden bell frog as the species is not known to be extant within the Referral Area and the persistence of the species within the Referral Area is expected to be limited due to infection by Chytrid virus.
New Holland mouse ( <i>Pseudomys novaehollandiae</i> )	Vulnerable	No	No preferred habitat for this species within the Referral Area.	It is considered unlikely that the Proposed Action would result in a significant impact on the New Holland mouse as there are no recent records of this species within the Referral Area and habitats within the Referral Area are likely to have reached a condition where they no longer provide suitable habitat for this successional species.
Grey-headed flying-fox ( <i>Pteropus poliocephalus</i> )	Vulnerable	Yes	Potential foraging habitat for the species within the Referral Area comprising 163.7 hectares of eucalypt-dominated woodland vegetation.	It is considered unlikely that the Proposed Action would result in a significant impact on the grey-headed flying fox as the Referral Area is considered to comprise an area of potential foraging habitat only for this species and does not contain any known camp sites.



**Table 5.2 – Summary of Assessments of EPBC Act Significance (cont.)**

<b>Matter of National Environmental Significance</b>	<b>Conservation Status</b>	<b>Recorded in the Referral Area</b>	<b>Habitat Status in the Referral Area</b>	<b>Outcome of Assessment of Significance</b>
Large-eared pied-bat ( <i>Chalinolobus dwyeri</i> )	Vulnerable	No	Potential foraging habitat for the species within the Referral Area comprising 223.7 hectares of woodland, forest and riparian vegetation.	It is considered unlikely that the Proposed Action would result in a significant impact on the large-eared pied-bat as the species has not been confirmed and there is no preferred roosting or breeding habitat within the Referral Area. No evidence exists of the species roosting in tree hollows (DERM 2011). The Referral Area is considered unlikely to represent important habitat for this species.
Koala ( <i>Phascolarctos cinereus</i> )	Vulnerable	Yes	Potential habitat for the species within the Referral Area comprising 163.7 hectares of eucalypt-dominated woodland vegetation.	It is considered unlikely that the Proposed Action would result in a significant impact on the koala as the Referral Area is considered unlikely to represent important habitat for this species.
<i>Ozothamnus tessellatus</i>	Vulnerable	No	Potential habitat for the species within the Referral Area comprising 163.7 hectares of eucalypt-dominated woodland vegetation.	It is considered unlikely that the Proposed Action would result in a significant impact on <i>Ozothamnus tessellatus</i> as the species has not been recorded in the Referral Area and it is considered unlikely to represent important habitat for this species.

### Assessment of the Koala in Relation to the Koala Referral Guidelines

The Assessment of Significance prepared for the koala as part of the Ecological Assessment has been reviewed in consideration of the DoE's recently released Draft Koala Referral Guidelines.

The Assessment of Significance, undertaken in accordance with the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance (DoE 2013) determined that the Project Area was unlikely to comprise an important population of the species.

The DoE's Draft Referral Guidelines advise that the assessment of significant impacts on the koala is undertaken primarily through the assessment of habitat critical to the survival of the koala and actions that interfere substantially with the recovery of the koala. This approach aims to avoid and address habitat loss as well as promote a streamlined assessment and approval process.

In accordance with the Draft Referral Guidelines, the habitat assessment tool was applied to the Referral Area which determined that the extent of vegetation that contains at least one known koala food tree, which corresponds to 163.7 hectares of woodland and forest communities that contain eucalypt species. These include:

- Central Hunter Grey Box – Ironbark Woodland; and
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest (including Planted variant).

As these habitats scored higher than five using the Draft Referral Guideline habitat assessment tool, the Referral Area is considered to contain habitat critical to the survival of the species in accordance with the Draft Referral Guideline.

Following determination of the importance of the habitat for the koala in the Referral Area an assessment was undertaken to determine the impacts which are likely to substantially interfere with the recovery of the koala. The Draft Referral Guideline identifies the following impacts listed in **Table 5.3** as likely to substantially interfere with the recovery of the koala.

**Table 5.3 Assessment of Impacts that are Likely to Substantially Interfere with the Recovery of the Koala In Accordance with the Draft Referral Guidelines for the Koala (DoE 2013)**

Potential Impact to the Koala As Identified in the Draft Koala Referral Guidelines	Level of Impact Operating in the Project Area
Introducing or increasing koala fatalities in an area due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities.	The Proposed Action is not expected to result in increase vehicle or train movements such that the koala would be subjected to increased mortality levels. It is noted that the Proposed Action would result in a continuation of mining activity and associated vehicle movements within the mining areas. However it is not expected that koala will access these active mining areas.
Introducing or increasing koala fatalities in an area due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.	The Proposed Action will not result in the introduction or increase of dogs to the local area and therefore will not increase the threat of dog attacks to any local koala population. Wild dogs are currently controlled across the Project Area as part of the <i>Mt Owen Complex Flora and Fauna Management Plan</i>
Creating a barrier to movement within or between habitat critical to the survival of the koala that is likely to result in a long-term reduction in koala movement and therefore gene flow, or prevent access to important resources (such as areas with a high density of food trees or of drought refuge).	The Proposed Action is a continuation to the existing operation and is unlikely to result in the creation of substantial additional barriers to koala movement in the local area. Retained vegetation along the existing offset corridors will remain connected to high quality vegetation within Ravensworth State Forest and the New Forest Area.

**Table 5.3 Assessment of Impacts that are Likely to Substantially Interfere with the Recovery of the Koala In Accordance with the Draft Referral Guidelines for the Koala (DoE 2013) (cont.)**

Potential Impact to the Koala As Identified in the Draft Koala Referral Guidelines	Level of Impact Operating in the Project Area
Facilitating the introduction or spread of disease or pathogens to an area, for example Chlamydia or <i>Phytophthora cinnamomi</i> , which are likely to significantly reduce the reproductive output of female koalas or reduce the carrying capacity of the habitat.	The Proposed Action is not expected to facilitate the introduction or spread of pathogens as <i>Phytophthora cinnamomi</i> and Chlamydia have not been recorded in the environments of the Referral Area or within the local population of koala.
Increasing the risk of high-intensity fire to areas of habitat critical to the survival of the koala.	Mt Owen currently manage the potential risk of bushfires through the implementation of the existing <i>Bushfire Management Plan</i> . It is proposed that the existing <i>Bushfire Management Plan</i> would be updated as required to include the Proposed Action. With the implementation of the management actions as defined in the <i>Bushfire Management Plan</i> , the Proposed Action is not expected to increase the risk of high intensity fires.
Degradation of habitat critical to the survival of the koala resulting from hydrological change to the extent that the function and integrity of the habitat is jeopardised.	The Proposed Action will not impact the existing Biodiversity Offset Areas or the New Forest Area at Mt Owen. The Proposed Action is not expected to result in the degradation of retained vegetation within the surrounding Project Area such that the function and integrity of the existing habitat for the koala is jeopardised.

In summary, while the Draft Referral Guidelines indicates that the Referral Area contains habitat critical to the survival of the koala, the impacts of the Proposed Action are not expected to result in substantial interference to the recovery of the koala. Further consideration of the Assessment of Significance outcomes for the Proposed Action confirms that the Referral Area is unlikely to contain an important population of the koala as the criteria for determining an important population are not met in the Referral Area. That is, an important population is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

The koala is known to occur in eucalypt woodlands and forests of the central and north coasts of NSW with few populations occurring west of the Great Dividing Range and the Referral Area is not at the limit of the species' range. The species was tentatively recorded in the Project Area during monitoring in 1995 through the collection of scats resembling those of the koala (Forest Fauna Surveys and Newcastle Innovation 2012). A historic database record of the species (1980) is located in the south-east of the Project Area. Although no evidence of this species has been recorded within the Referral Area since (Forest Fauna Surveys and Newcastle Innovation 2014) an Atlas of NSW Wildlife database record exists near the intersection of the New England Highway and Hebden Road near Bowmans Creek (OEH 2014). The species was not recorded during Umwelt surveys and few preferred feed trees were recorded within the Referral Area. The koala has been recorded approximately 6



kilometres to the north-west of the Project Area in the Hillcrest Offset Area that was established as part of the Ravensworth Continued Operations Project (Umwelt 2010).

The outcome of the assessment of significance is that the koala is not likely to be significantly impacted by the Proposed Action as the Referral Area does not contain an important population as described above and the Proposed Action will not result in those impacts that the Draft Referral Guidelines determines are likely to substantially interfere with the recovery of the species. The Proposed Action is not expected to result in a residual impact on the koala and specific biodiversity offsetting for the species is therefore not required.

### **Groundwater Dependant Ecosystems**

As outlined in **Section 5.1.1**, the Proposed Action is not expected to result in an adverse impact on GDEs identified in the Referral Area as leakage from alluvial aquifers and changes to base flows in drainage lines are expected to be negligible; and there is predicted to be no drawdown impact to the alluvial aquifers of Bowmans and Glennies Creeks as a result of the Proposed Action.

#### **5.1.4 Summary of Technical Data and Other Information Used or Needed to Make a Detailed Assessment of the Relevant Impacts**

The detailed assessment of the relevant impacts of the Proposed Action was based on a thorough review of technical data and other relevant information, including but not limited to:

- results from the comprehensive ecological surveys;
- detailed annual fauna monitoring results (1996-2013) from within the Project Area;
- outcomes from the University of Newcastle Ravensworth State Forest Vegetation Complex Research Program;
- outcomes of an on-site spotted-tailed quoll (*Dasyurus maculatus maculatus*) radio-tracking program conducted in the Project Area by Thiess (2013);
- relevant national and NSW recovery and threat abatement plans; and
- DoE Protected Matters Database and OEH Atlas of NSW Wildlife database records.

The technical data and other information considered in determining the relevant impacts of the Proposed Action on listed threatened and migratory species is provided in Sections 3.1 and 3.2 of the Ecological Assessment (refer to Appendix 11 of the EIS).

### 5.1.5 Relevant Impacts on EPBC Act listed Threatened Species

**5. Where there is a potential habitat for EPBC Act listed species (Appendix A), surveys must be undertaken. These surveys must be timed appropriately and undertaken for a suitable period of time by a qualified person. A subsequent description of the relevant impacts on such EPBC Act listed species should include, inter alia, direct, indirect, cumulative and facilitative impacts on the:**

- a) population of the species at the site**
- b) area of occupancy of the species**
- c) habitat critical to the survival of the species**
- d) breeding cycle of the population, and**
- e) availability or quality of habitat for the species**

***If an endangered ecological community or threatened species listed at Appendix A is not believed to be present on the proposed site, detailed information must be included in the Environmental Impact Assessment to demonstrate that this community will not be impacted.***

As discussed in **Sections 4.1.1** and **4.1.2**, an appropriate survey methodology was designed to determine the extent and abundance of threatened EPBC Act listed threatened species and communities occurring in the Referral Area. The range of EPBC Act listed species and communities that were considered in the Assessment are included in Tables 1, 2 and 3 of Appendix A of the Ecological Assessment (refer to Appendix 11 of the EIS) and these tables include justification for the predicted presence or absence of EPBC Act listed threatened and migratory species.

Detailed Assessments of Significance relating to the relevant impacts of the Proposed Action are included as Appendix F and are summarised in Section of 5.8.4 of the Ecological Assessment (refer to Appendix 11 of the EIS). Assessments of Significance were conducted for each of the listed threatened species included in Appendix A of the Supplementary DGRs, along with a suite of additional species that had been previously recorded in the local area, or that could occur and were considered to be potentially impacted by the Proposed Action (refer to **Section 5.1.1** for full list of species). The Assessments of Significance included thorough consideration of each of the assessment criteria listed in the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance (October 2009), including information regarding the extent of the population of the species, the area of occupancy of the species, the presence and extent of habitat critical to the survival of the species occurring within the Project Area and Referral Area, the breeding cycle of the population, and the availability or quality of habitat for the species.

The Referral Area and the surrounding Project Area have been subject to a range of historic disturbances from land clearing, agriculture and mining. Over the last decade, Mount Owen Complex has experienced modifications at both the Mount Owen and Glendell Mines. The history of land clearing, agriculture and mining has resulted in an incremental loss of vegetation and fauna habitat across the broader Ravensworth locality. This cumulative loss of habitat places pressure on local threatened flora and fauna species and ecological communities.

Additionally, a range of other developments have resulted in the incremental loss of a range of fauna and flora habitats in the locality and the wider Hunter Valley. The Ravensworth Operations Project, located approximately two kilometres to the west of the Referral Area, was approved in 2011 and involved the removal of 512 hectares of native woodland and forest vegetation that was found to provide potential habitat for a range of threatened species

including foraging habitat for the grey-headed flying fox (*Pteropus poliocephalus*). The currently proposed Liddell Coal Operations Extension Project, located approximately three kilometres to the west of the Referral Area, proposes to remove 123 hectares of native woodland and forest vegetation that is likely to provide habitat for a locally occurring population of the spotted-tailed quoll (*Dasyurus maculatus maculatus*). In the wider Hunter Valley, the Bulga Optimisation Project was recently granted Commonwealth approval to remove 611 hectares of native woodland vegetation and habitat approximately 25 kilometres to the south of the Project Area. This area is known to contain potential foraging habitat for a range of threatened species including regent honeyeater (*Anthochaera phrygia*), swift parrot (*Lathamus discolor*), large-eared pied bat (*Chalinolobus dwyeri*) and grey-headed flying-fox.

The incremental loss of these habitats in the central Hunter Valley will result in the remnant vegetation in the Project Area becoming one of few remaining large remnants that supports fauna habitats with a reasonable degree of ecological integrity, although most remain modified by historic disturbances. It is important to note that the majority of the remaining remnant within the broader Project Area is currently within State Forest Areas and existing Biodiversity offsets areas and will not be impacted as part of the Proposed Action. In acknowledgement of the impacts to these habitats losses, the recently approved developments described above have been required (or are likely to require) to undertake substantial biodiversity mitigation and offsetting actions, together with significant habitat rehabilitation programs.

The cumulative impact of the Proposed Action and surrounding developments within the Hunter Valley is taken into consideration in the assessments of significance documented in Appendices E and F of the Ecological Assessment. Threats to species listed under the TSC Act, Fisheries Management Act 1994 (FM Act) and EPBC Act include those that are cumulative in nature, and the assessments undertaken implicitly consider the contribution of cumulative impacts on these species.

As discussed above in Section 5.1.3, the outcome of the Assessment of Significance in relation to threatened and migratory species listed under the EPBC Act concluded that the Proposed Action is not likely to result in a significant impact on any of the threatened species known, or considered to potentially occur in the Project Area.

## 5.2 Water Resources Impacts

A consolidated assessment of the impacts on water resources as a result of the Proposed Action was assessed directly against the Significant Impact Guidelines: Coal Seam Gas and Large Coal Mining Developments. Further details on water resources impacts are provided in the sections following this table.

**Table 5.4 – Assessment against Significant Impact Guidelines: Coal Seam Gas and Large Coal Mining Developments  
– Impacts on Water Resources**

Aspect	Impact
Flow Regimes	<p>The Proposed Action is a proposed continuation of the existing open cut operations at the same rate and scale of production. The footprint of the mine will increase with the Proposed Action and water from this increased area will be captured, treated and reused within the water management system. As outlined in <b>Section 5.3.1.1</b> below, the changes to catchment areas as a result of the Proposed Action will result in negligible to minor changes to downstream flow regimes. As outlined in <b>Section 5.3.1</b>, the Proposed Action will also result in negligible to minor changes in flood flow velocities and depths, and will not adversely impact downstream landholders and watercourse stability</p>
Recharge Rates; Aquifer pressure or pressure relationships between aquifers; Groundwater table levels	<p>A detailed groundwater impact assessment has been completed for the Proposed Action (refer to Appendix 10 of the EIS). The proposed mining limit has been specifically designed such that it is located 200 metres off the high bank of Main Creek in order to minimise impacts on the Main Creek alluvium.</p> <p>The groundwater modelling and impact assessment indicates that the Project will cause negligible impacts to the alluvial aquifers associated with Glennies Creek and Bowmans Creek. Minimal drawdown is predicted within the alluvial aquifers of Bettys Creek and Main Creek. Drawdown in alluvial aquifers associated with Main Creek and Bettys Creek, minor tributaries to Glennies Creek and Bowmans Creek respectively, is predicted to exceed the minimal impact criteria (greater than 2 m drawdown) for aquifer interference activities as specified in the Aquifer Interference Policy (NSW, 2012) (AIP). Further assessment identified that the significance of these alluvial aquifers is limited, with both creeks having low volume, ephemeral surface water flow, and they largely act as drainage courses for local runoff. The assessment indicates no groundwater-dependent assets (i.e. groundwater users or environmental requirements) are impacted by the predicted drawdown.</p> <p>Both Bettys Creek and Main Creek are ephemeral surface water features that largely act as drainage lines for the local area and only generate incidental baseflow following sustained rain. Peak incremental groundwater losses from the Bettys Creek alluvium (representing maximum potential baseflow loss to the creek, assuming groundwater intercepts and flow within the creek) are predicted to be less than 6 ML/year and correlate to mining of the RERR Mining Area. Mining in the BNP is not predicted to impact on the alluvial aquifers. Peak incremental groundwater losses from the Main Creek alluvium (representing maximum potential baseflow loss to the creek, assuming groundwater intercepts and flow within the creek) are predicted to be less than 15 ML/year and correlate to continuation of the North Pit. As stated, these creek systems are ephemeral and as such it is considered that the modelled baseflow impacts in the Bettys Creek and Main Creek systems are overestimated in the modelling and are in reality negligible. The Bayswater seam represents the primary seam mined in the North Pit Continuation.</p> <p>Drawdown on the Bayswater seam was modelled with significant reductions in groundwater pressures of up to 165 metres at the end of mining. The drawdown within the Bayswater seam is limited to within the Referral Area and no existing groundwater users are impacted. The groundwater impact assessment is an inherently cumulative impact assessment and considers a comparison of a 'base case' and 'Project case' in determining impacts on drawdown; <b>Section 5.3.2.7</b> of this report provides further details.</p>



**Table 5.4 – Assessment against Significant Impact Guidelines: Coal Seam Gas and Large Coal Mining Developments  
– Impacts on Water Resources (cont.)**

Aspect	Impact
Groundwater/surface water interactions	As discussed above, the Proposed Action is predicted to result in negligible changes to the groundwater contribution to baseflows in surface drainage systems. Groundwater seepage into the mining void will be managed within the water management system and reused by the Proposed Action.
River/floodplain connectivity	No changes to river/floodplain connectivity are predicted as a result of the revised Proposed Action.
Inter-aquifer connectivity	As discussed above, a detailed groundwater assessment for the Proposed Action identified that the Proposed Action will result in minimal harm to aquifers. No material impacts on inter-aquifer connectivity are predicted as a result of the Proposed Action.
Coastal Processes	No impact.
Impact on water users	<p>No private groundwater users have been identified as being affected or potentially affected by the Proposed Action.</p> <p>There are no private landholders located immediately downstream of the Project Area on Yorks Creek, Bettys Creek or Swamp Creek. There are two private landholders with access to Main Creek located downstream of the Mt Owen WMS. There are known licensed water users on Bowmans Creek and Glennies Creek downstream of the Project Area. There are private landholders downstream of the Project Area on Main Creek, Glennies Creek and Bowmans Creek that retain basic landholder rights for domestic and stock use.</p> <p>All water take associated with the Proposed Action will be licensed in accordance with the WM Act and <i>Water Act 1912</i>. The Proposed Action will not significantly change water availability for surface water users.</p>
State Water Resource Plans	The surface water and alluvial water sources within the Project Area are managed under the <i>Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009</i> . In addition, water extraction from Glennies Creek is managed under the <i>Water Sharing Plan for the Hunter Regulated River Water Source 2003</i> . Both the <i>Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009</i> and the <i>Water Sharing Plan for the Hunter Regulated River Water Source 2003</i> are State Water Resource Plans and are governed under the WM Act. The NSW Government Water Sharing Plans provide a regional water balance for these water sources and consider cumulative water use. The coal measure aquifers in the Project Area are not covered by a water sharing plan and as such are governed under the <i>Water Act 1912</i> . Water take for the Proposed Action will comply with the above listed water sharing plans and Acts which are designed to provide for the sustainable use of NSW's water resources.

**Table 5.4 – Assessment against Significant Impact Guidelines: Coal Seam Gas and Large Coal Mining Developments  
– Impacts on Water Resources (cont.)**

Aspect	Impact
Water Quality	<p>Mt Owen has a comprehensive water management system in place to manage the potential impacts of its mining operations on water resources. The water management system for the Proposed Action has been designed in accordance with relevant government standards to limit potential impacts on downstream water qualities by managing water that has the potential to cause environmental harm. To manage water quality during construction, operation and rehabilitation phases of the Proposed Action, Mt Owen will implement erosion and sediment control measures, and other water quality control measures in accordance with the relevant government standards to minimise any potential impact on water quality. Monitoring results are assessed against the relevant site specific and default ANZECC trigger values.</p> <p>Mt Owen proposes to continue to discharge surplus water from its water management system in accordance with relevant approvals. The quality of such discharges will be in accordance with relevant Environment Protection Licences (EPL's) and consistent with the provisions of the Hunter River Salinity Trading Scheme (HRSTS). As part of the development of the HRSTS, the NSW Government has determined the sustainable salt load for the Hunter River, considering the impacts on the environment. The HRSTS is managed such that discharges from industrial operations can only occur in suitable conditions. Discharges from the Proposed Action will be monitored prior to release to ensure compliance with the requirements of the HRSTS; discharges are also therefore not considered likely to result in significant cumulative impacts.</p> <p>The Proposed Action is not predicted to affect groundwater quality in any identified aquifers.</p>

As requested by DoE a risk assessment relating to significant impacts on water resources was completed and is provided in **Appendix 2**.

## 5.3 Assessment of Water Resources Impacts

### 5.3.1 Surface Water Impacts

A detailed assessment of the potential surface water impacts of the Proposed Action is provided in the Surface Water Assessment included in Appendix 9 of the EIS with a summary of the key assessment findings included in Section 5.5 of the EIS main text and below.

#### 5.3.1.1 Catchment Areas and Annual Flow Volumes

The Proposed Action will result in the need to divert runoff upslope of the operational areas and manage runoff from disturbed areas during the operational and rehabilitation phases of the Proposed Action. In the absence of local stream gauging data, catchment areas provide an indicator of the potential relative changes in flow volumes that might occur. As such changes in catchment areas have been used to predict the potential impacts on annual flow volumes.

**Table 5.5** summarises the predicted impacts on the catchment areas in the Project Area for the following scenarios:

- prior to any mining;
- currently approved final landform;
- Year 5 of the Proposed Action (the year of the Proposed Action with the largest area of catchment contained in the WMS); and
- proposed final landform.

**Table 5.5 – Predicted Impacts on Catchment Areas**

Catchment	Pre-Mining (ha)	Current Area (2012) (ha) <sup>1</sup>	Approved Final Landform (ha)	Proposed Action		
				Year 5 <sup>1</sup> (ha)	Final Landform <sup>2</sup>	
					Area (ha)	% <sup>4</sup>
<b>Bowmans Creek<sup>3</sup></b>	<b>25,055</b>	<b>22,010</b>	<b>20,390</b>	<b>21,590</b>	<b>20,520</b>	<b>99.4%</b>
- Stringybark Creek	1,290	1,220	1,300	1,300	1,300	100%
- Yorks Creek	1,230	1,580	1,660	1,800	1,920	116%
- Swamp Creek	2,380	410	1,440	390	1,230	85%
- Bettys Creek	1,810	660	960	700	780	81%
<b>Glennies Creek<sup>3</sup></b>	<b>52,335</b>	<b>50,265</b>	<b>50,405</b>	<b>50,215</b>	<b>50,255</b>	<b>99.7%</b>
- Main Creek	2,000	2,480	2,620 <sup>5</sup>	2,430	2,470	94%

Notes: 1) Excluding WMS.

2) Final Landform is when both the decommissioning of infrastructure and the rehabilitation of the post mining landform are completed.

3) Catchment areas modified to reflect changes due to the Proposed Action and approved and proposed Liddell Operations. This does not include impacts from other modifications (such as other mining operations) downstream of the Project Area.

4) Project final landform catchment area as a percentage of the current approved final landform.

5) Catchment area updated and larger than identified in Mount Owen Operations EIS, 2003 (previously 1750 ha), as more accurate terrain data is now available (LiDAR) over entire catchment.

In summary, the Proposed Action will result in the following changes to the local catchments, and subsequent annual flow volumes, within which the Proposed Action is located:

- no changes to the currently approved final landform, associated catchment areas or annual flow volumes for Stringybark Creek;
- changes to the currently approved final landform catchment areas of Yorks Creek, Swamp Creek, Bettys Creek and Main Creek;
  - an increase in catchment contributing to Yorks Creek (therefore annual flow volumes for Yorks Creek are expected to increase) – considered to be small within the context of ephemeral streams (i.e. the change in flows is less than the seasonal and annual variations in flow volumes);
  - changes in annual flow volumes associated with reductions in catchment areas for Swamp Creek and Bettys Creek – considered to be small within the context of ephemeral streams (i.e. the change in flows is less than the seasonal and annual variations in flow volumes);
  - the proposed reduction of the Main Creek catchment area returning the annual flow volumes closer to those of the pre-mining catchment than would have been achieved by the current approved final landform; and
- negligible impact on major downstream watercourses including Bowmans Creek, Glennies Creek and the Hunter River (due to the limited localised impact; reduction in total contributing catchment is less than 0.6 percent for both Bowmans Creek and Glennies Creek).

The full details of changes to catchments and annual flow volumes are provided in Appendix 9 of the EIS.

### 5.3.1.2 Flooding

Dynamic flood modelling of the waterways and catchments surrounding the Project Area was undertaken for the current landform, current approved final landform, the Proposed Action Year 5 landform (i.e. when the catchment of the WMS is largest during the Project), and the proposed final landform. Flood events that were simulated included the 10 per cent, 5 per cent and 1 per cent Annual Exceedance Probability (AEP) events (also referred to as the 10 year, 20 year and 100 year average recurrence interval (ARI) events). The assessment determined that the Proposed Action, with the proposed mitigation measures (refer to **Appendix 9**), will result in a range of impacts from negligible to minor on flood flow velocities and depths, downstream landholders, access along public roads and watercourse stability. It is considered that with the proposed management and monitoring measures (refer to Appendix 9 of the EIS) the potential impacts are acceptable. Proposed mitigation measures include additional off line detention capacity adjacent to the Ravensworth East MIA and flow conveyance at Hebden Road along Yorks Creek. Further details on the flooding assessment assumptions and methodologies are provided in the Surface Water Assessment report (refer to Appendix 9 of the EIS).

### 5.3.1.3 Proposed Infrastructure Crossings

Two waterway crossings are proposed as part of the Proposed Action; the proposed Bowmans Creek Bridge on Hebden Road and the proposed rail bridge over Bettys Creek.

Currently, during the 1 per cent AEP flood event (that is, the 100 year ARI event) the approaches to the existing Bowmans Creek Bridge on Hebden Road are inundated.



Modelling indicates that the proposed Bowmans Creek Bridge on Hebden Road will have negligible impact on peak depth and velocity downstream of the proposed bridge for the 1 percent AEP event. The peak depth and velocity in Bowmans Creek upstream of the proposed Bowmans Creek Bridge is anticipated to increase slightly due to the raised road embankments for the proposed bridge restricting floodplain flows. There are no private properties within the affected zone with all land adjacent to Bowmans Creek in this area owned by Glencore with the exception of one parcel owned by a government authority. Modelling indicates that peak flows for the 1 percent AEP event, similar to the existing approaches, will overtop the proposed approaches to the Bowmans Creek Bridge across the Bowmans Creek floodplain, but the proposed bridge will not be overtopped.

The proposed rail bridge across Bettys Creek, along with the proposed reduction in Bettys Creek catchment will result in reduced flows, depths and velocities in Bettys Creek both upstream and downstream of the proposed rail bridge for the 1 percent AEP event. There are modelled localised water depth and velocity increases at the proposed rail bridge. The increase in flood depths at the crossing are localised and will not affect any private properties as the land adjacent to Bettys Creek is owned by Glencore. Modelling indicates that peak flows for the 1 percent AEP event do not overtop the proposed rail bridge on Bettys Creek. As such it is considered that the proposed rail bridge on Bettys Creek will have negligible impact on flooding and watercourse stability.

#### 5.3.1.4 Water Quality

It is proposed to integrate water management for the Proposed Action within the existing Mt Owen WMS as detailed in the *Mt Owen Complex Water Management Plan* (WMP) to limit the potential impacts of the Proposed Action on downstream water quality by managing water that has the potential to cause environmental harm. In conjunction with the proposed WMS, a series of erosion and sediment control measures will be utilised during construction, operation and rehabilitation phases of the Proposed Action to manage water quality.

The Project WMS is designed to enable Mt Owen to manage and operate the WMS to meet licence conditions within the requirements of the *NSW Protection of the Environment Operations Act 1997* (POEO Act), taking account of both historical and current water qualities in the surrounding watercourses and current and future downstream water users. The risk of spilling and potential impacts associated with spilling is currently managed by the Mt Owen WMP. The WMP allows for the ongoing assessment of risk as mining operations progress and the implementation of improvements and changes where required.

Controlled discharges to Swamp Creek will flow via Bowmans Creek to the Hunter River in accordance with existing EPL's and the HRSTS. There are specific requirements for discharge under the HRSTS including certain parameters relating to flow volumes that must be followed to reduce potential impact during discharge events. Any discharges will be controlled so as to stay within the existing creek banks and at a rate to minimise erosion impacts.

The proposed final landform has been designed to minimise the catchment contributing to the proposed final voids. The water balance for the final voids indicates that, at the predicted recovery rates, the equilibrium water levels with the North Pit final void will be approximately 19 mAHD. As such, it is predicted that the final void will remain a self contained system with no surface spills predicted to downstream watercourses. Final void water quality is described in **Section 5.3.2.4** of this report.

Mt Owen is committed to updating the WMP and associated monitoring programs as required.

It is considered, that with the measures proposed above, the Proposed Action will have minimal impact on surface water quality in downstream watercourses.

Further details on erosion and sediment control measures during both the construction and operational phases of the Proposed Action are provided in Appendix 9 of the EIS.

#### **5.3.1.5 Geomorphological and Hydrological Values**

The Proposed Action is not expected to have a significant impact on the geomorphological and hydrological values of local surface water systems. Potential impacts on geomorphological stability and changes to potential erodibility and scour as a result of the Proposed Action are as follows:

- Higher peak flows with increased flood levels and increased velocities along Yorks Creek due to diversion of clean water runoff from the North Pit emplacement area. Peak flood depths and flow velocities during flood events will increase from the approved final landform; however, it is proposed to manage any potential stability impacts and changes to access along Hebden Road by providing additional off line detention capacity adjacent to the Ravensworth East MIA and flow conveyance at Hebden Road along Yorks Creek. Peak flood flows, depths and velocities in Bowmans Creek will not be influenced by the modelled increases in Yorks Creek. It is considered that with the proposed management and monitoring measures the potential impacts are acceptable.
- Lower peak flows with similar or slightly reduced flood levels and velocities in the lower reaches of Swamp Creek and Bettys Creek downstream of the Project Area. Scour potential along the lower reaches of Swamp Creek and Bettys Creek downstream of the Project Area will not be increased from the approved final landform due to the Proposed Action.
- Lower peak flows with reduced flood levels and reduced flood duration in the lower reaches of Main Creek compared to the current approved landform. Peak velocities of flow during flood events will remain the same for the Proposed Action as the approved final landform. Scour potential along the lower reaches of Main Creek will not be increased from the approved final landform due to the Proposed Action.

#### **5.3.1.6 Riparian and Ecological Values**

The changes in annual flow volumes associated with changes to catchment areas for Yorks Creek, Swamp Creek, Bettys Creek and Main Creek from the current approved final landform to the proposed final landform are considered to be small within the context of ephemeral streams. The changes in annual flow volumes are also considered to be small on a regional scale. That is, the change in flows being less than the seasonal and annual variations in flow volumes, when comparing dry years to wet years. In addition, the Proposed Action is considered to have negligible impacts on baseflows (refer to Appendix 9 of the EIS). The Proposed Action is consequently considered likely to have limited impact on ecosystems and downstream users as the predicted impact is within the natural variation of the existing creek systems.

#### **5.3.1.7 Water Users**

As discussed in **Section 4.2.3.1**, there are no private landholders located immediately downstream of the Project Area on Yorks Creek, Swamp Creek and Bettys Creek. There are two private landholders with access to Main Creek located downstream of the Mount Owen WMS.

There are no known licensed water users on waterways directly downstream of the Project Area along Yorks Creek, Swamp Creek, Bettys Creek or Main Creek; however, there are known licensed water users on Bowmans Creek and Glennies Creek downstream of the Project Area. In addition, there are private landholders downstream of the Project Area on Main Creek, Glennies Creek and Bowmans Creek that retain landholder rights for domestic and stock use.

The Proposed Action will not reduce annual flow volumes in Main Creek compared to the currently approved landform conditions (refer to **Table 5.5**), therefore, basic landholder rights on Main Creek and Glennies Creek will not be affected by the Proposed Action.

The Proposed Action will result in a negligible reduction to the catchment area of Bowmans Creek and Glennies Creek (less than 0.6 per cent). As such, the Proposed Action is considered to have negligible impact on basic landholder rights downstream of the Project Area on Bowmans Creek or Glennies Creek.

#### **5.3.1.8 Cumulative Surface Water Impacts**

The surface water assessment provides a cumulative assessment in that the impact analysis considers current and proposed catchment conditions.

The surface water assessment indicates that the Proposed Action is expected to have negligible impacts on flows, water quality and water users relative to the existing approved impacts immediately downstream of the Project Area, on Bowmans Creek and Glennies Creek, and on the Hunter River.

It is considered that the Proposed Action will have negligible cumulative impacts on flows in downstream watercourses, water quality and downstream users in comparison to the current approved final landform.

Further details on cumulative impact are provided in the Surface Water Assessment in Appendix 9 of the EIS.

#### **5.3.2 Groundwater Impacts**

Potential groundwater impacts associated with the Proposed Action were assessed through a computer based model of regional groundwater systems extending approximately 20 kilometres around the Project Area undertaken by Jacobs. The model includes 20 layers representing stratigraphy from the ground surface down to the Saltwater Creek Formation (refer to **Figure 5.1**). The model includes all existing and approved mining operations within the model domain.

The groundwater model allows for the evaluation of future scenarios by the detailed simulation and calibration process and provides an assessment of the median predicted drawdown in addition to the median plus one standard deviation drawdown as part of the assessment. Further details on the approach to groundwater modelling for the Proposed Action are contained in Appendix 10 of the EIS.

The potential groundwater impacts arising from the Proposed Action and the associated modelling predictions are summarised in **Table 5.6** based on the detailed assessment findings provided in Appendix 10 of the EIS. These potential impacts are discussed in further detail below.

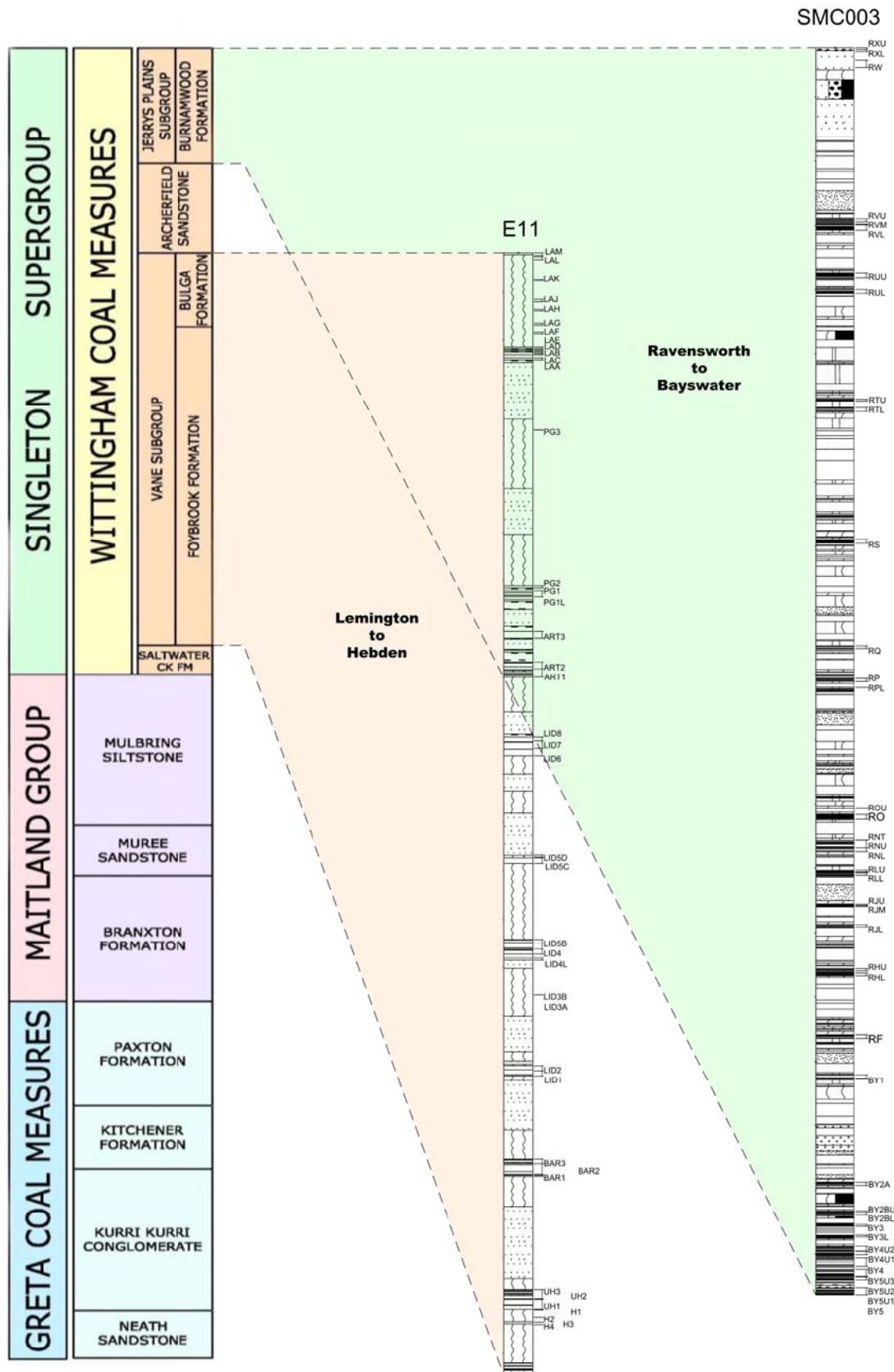


FIGURE 5.1  
Stratigraphic Column



**Table 5.6 – Summary of Groundwater Impact Predictions**

Potential Environmental Impact	Assessment Predictions
Leakage of groundwater from shallow alluvial aquifers of Bowmans and Glennies creeks and associated tributaries	Negligible Impact
Changes to baseflows in surface drainage systems	Negligible Impact
Impacts on water supply bores and wells	Negligible Impact
Change in water quality	Negligible Impact
Groundwater dependent ecosystems	Negligible Impact

### 5.3.2.1 Groundwater Drawdowns and Changes to Baseflow

#### Alluvial Aquifers

In accordance with the NSW Aquifer Interference Policy (2012), and as discussed in **Section 3.3** of this report (and Section 2.5.1 of the EIS), the proposed North Pit Continuation mining limit has been specifically designed such that it is located a minimum of 200 metres off the high bank of Main Creek in order to minimise impacts on the Main Creek alluvium.

There is predicted to be negligible drawdown of the alluvial aquifers of Bowmans Creek and Glennies Creek as a result of the Proposed Action. Minimal drawdown is predicted within the alluvial aquifers of Bettys Creek and Main Creek, which are minor tributaries to Glennies Creek and Bowmans Creek respectively. The drawdown on Bettys Creek and Main Creek is predicted to exceed the minimal impact criteria (greater than 2 metres drawdown) for aquifer interference activities as specified in the NSW Aquifer Interference Policy (2012). Further assessment identified that the significance of these alluvial aquifers is limited, with both creeks having low flow volumes, ephemeral surface water flow, and they largely act as drainage courses for local runoff. The assessment indicates no groundwater-dependent assets (i.e. groundwater users or GDEs) are impacted by the predicted drawdown.

The peak predicted water take from Main Creek alluvium is less than 15 ML/year (from 2023), while predicted peak water take from the Bettys Creek alluvium is less than 6 ML/year (from 2022). The estimated reductions in groundwater flow to the alluvial aquifers represent less than 0.2 per cent of estimated baseflow contributions to these other water features. Negligible direct impact to the alluvial aquifers associated with Glennies Creek and Bowmans Creek is predicted as a result of the Proposed Action. The predicted direct impact to Bowmans Creek alluvium is estimated to be negligible at less than 1 ML/year.

No registered bores or groundwater users are located within the extent of predicted drawdown of alluvial aquifers.

#### Hard Rock Aquifers

Drawdown on the Bayswater seam was modelled for the Proposed Action as the Bayswater seam represents the primary seam mined in the North Pit Continuation. The model predicts significant reductions in groundwater pressures with the maximum predicted drawdown in the Bayswater seam of up to 165 metres at the end of mining. The drawdown within the Bayswater seam is limited to within the Project area and is unlikely to adversely affect groundwater quality. No existing groundwater users are expected to be impacted.

### 5.3.2.2 Groundwater Users

The nearest private bore holder is located greater than 4 kilometres from the Project Area. No private groundwater users have been identified as being affected or potentially affected by the Proposed Action.

### 5.3.2.3 Groundwater Quality

The Proposed Action is not predicted to affect groundwater quality in any identified aquifers due to the following:

- Potential impacts to groundwater quality in alluvial aquifers are estimated to be limited,
- the Wittingham Coal measures that contain the target seams do not have any significant acid forming potential that could subsequently impact on surface and groundwater resources,
- while there is potential for upward movement of groundwater from the lower quality hard rock aquifer to the alluvial aquifers, historical and current mining in the area will limit this potential by reducing upward leakage (where present) from the more saline hard rock aquifer as a result of depressurisation of the hard rock aquifer, and
- , the North Pit Continuation final void will remain a sink and therefore not pose a threat to aquifer water quality.

### 5.3.2.4 Final Void Water

At the end of mining an open void will remain. The final void will receive inflows through infiltration through spoils, direct rainfall and runoff. The void will also lose water to the atmosphere through evaporation.

The groundwater model predicts that the North Pit Continuation will act as a groundwater sink. Salinity in the final void will remain below observed levels in the receiving aquifers for at least 200 years post-mining (refer to Appendix 9 of the EIS).

### 5.3.2.5 Groundwater Dependent Ecosystems

As discussed further in the Ecology Assessment contained in Appendix 11 of the EIS and **Section 4.2.3.3** of this report, the Project Area contains three vegetation communities that are expected to be dependent on shallow groundwater resources during periods of reduced surface water flow. Two terrestrial vegetation communities, Central Hunter Swamp Oak Forest and Hunter Valley River Oak Forest (approximately 6 hectares) located within the Referral Area are expected to be dependent on shallow groundwater resources during periods of reduce surface water flow. With the exception of these GDEs, the Proposed Action is not expected to result in an adverse impact on GDEs identified in the Project Area as leakage from alluvial aquifers and changes to baseflows in drainage lines are expected to be negligible.

A review of the Bureau of Meteorology Atlas of GDEs identified Bowmans Creek and Glennies Creek as systems with potential GDEs within the vicinity of the Project Area. However, impacts to the alluvial aquifers of Bowmans and Glennies Creek are predicted to be negligible and therefore impacts to their GDEs are also expected to be negligible.

### 5.3.2.6 Pit Inflows and Dewatering

Groundwater modelling undertaken for the Proposed Action includes estimates for the volume and rate of groundwater flow into the open cut pit and dewatering requirements. These estimates are a consideration for the water balance and water management system and in establishing the requirements for water licensing (discussed further in Section 5.5 of the main text of the EIS).

Estimates of the groundwater extraction rates required to accommodate the Proposed Action are generally less than 500 ML/year, with a broad peak from 2022 through 2026 up to 750 ML/year. Predicted inflows for other years during the Proposed Action are generally below 500 ML/year. These volumes of pit inflow are within the volumes allowed under licenses currently held by Mt Owen, as discussed in further detail in Section 5.6.4 of the EIS.

### 5.3.2.7 Cumulative Impacts

Potential groundwater impacts associated with the Proposed Action were assessed through a computer based model of regional groundwater systems extending approximately 20 kilometres around the Project Area. The numerical groundwater model developed for the Project is based on a regional scale model that includes existing approved open cut and underground mining operations within the model range (approximately 20.5 kilometres x 22.1 kilometres), referred to as the 'base case'. The mining operations associated with the Proposed Action are then incorporated into the model in addition to the currently approved mining operations, known as the 'Project case'. The assessment of potential groundwater impacts as a result of the Proposed Action is determined as the incremental difference between the 'base case' and the 'Project case'. Therefore, the cumulative impact of Proposed Action is inherent in the groundwater impact assessment.

## 5.4 Assessment of Independent Expert Scientific Committee Matters

**6. Under sections 24D and 24E of the EPBC Act, a water resource in relation to coal seam gas and large coal mining development has been determined a controlling provision in relation to this project. The documentation provided must include information addressing all relevant impacts on water resources and water related values. The information must be consistent with the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development's Information Guidelines for Proposals Relating to the Development of Coal Seam Gas and Large Coal Mines where there is a Significant Impact on Water Resources. The Guidelines are available at: <http://www.environment.gov.au/coal-seam-gasmining/pubs/iesc-information-guidelines.pdf>. The information must include:**

- **a detailed assessment of potential impacts (including cumulative impacts) on the quality and quantity of existing surface and ground water resources, including:**
  - a. **detailed modelling of potential groundwater impacts, including any potential impacts on alluvial aquifers**

Refer to **Section 5.3.2** of this report and Appendix 10 of the EIS.

***b. impacts on affected licensed water users and basic landholder rights***

Impacts on surface water users and groundwater users are discussed in **Section 5.3.1.7** and **Section 5.3.2.2** of this report, respectively.

Basic landholder rights with respect to surface water use are presented in **Section 4.2.3.1** of this report.

No private registered bores or groundwater users are located within the extent of predicted drawdown.

Further details on surface water and groundwater impacts and basic landholder rights are provided in Appendix 9 and Appendix 10 of the EIS.

***c. impacts on riparian, ecological, geo-morphological and hydrological values of watercourses, including environmental flows, and***

Detailed assessments on riparian, ecological, geo-morphological and hydrological values of watercourses, including environmental flows impacts are provided in the following sections of this report:

- riparian/ecological – **Section 3.2, 5.1.1, 5.3.1.6** and **5.3.2.5** of this report, and the Ecological Assessment (refer to Appendix 11 of the EIS); and
- geomorphological and hydrological flows of watercourses including environmental flows – **Section 5.3.1.1** and **Section 5.3.1.5** of this report, and the Surface Water Assessment (refer to Appendix 9 of the EIS).

***d. a flood assessment including identification of any necessary flood impact mitigation measures***

**Section 5.3.1.2** of this report and the Surface Water Assessment (refer to Appendix 9 of the EIS) provide details on the flood assessment and any necessary impact mitigation measures.

## **5.5 Site Water Balance, Water Discharges and Salinity**

- ***a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume, salinity and frequency of any water discharges), water supply infrastructure and water storage structures***

A detailed site water balance has been completed for the Mount Owen Complex during the mining activities to be undertaken for the Proposed Action (refer to Appendix 9 of the EIS). Inflows to the water balance include site rainfall runoff, tailings decant water, groundwater inflows to open cut pits, transfers from other mines within the GRWSS and water extracted under licence from Glennies Creek.

Water is supplied to the Mount Owen Complex from both the GRWSS and Glennies Creek. Mount Owen currently holds 1,056 Units per year of High Security Entitlement and 861 Units per year of General Security Entitlement Water Access Licences under the *Hunter Regulated River Water Sharing Plan 2003*, for extraction of water from Glennies Creek.

Surplus water at the Mount Owen Complex is able to be managed by either transfers to the GRWSS or discharge via the HRSTS via either Ravensworth Operations or Liddell Coal Mine or from the Mount Owen Complex.



**Table 5.7** presents a summary of the gross water balance in isolation from the GRWSS, and corresponding annual import and export volumes to and from the GRWSS for the conceptual mine plans for Year 1, Year 5 and Year 10 of the Proposed Action.

As there is limited excess water storage capacity at the complex, the GRWSS will be used to transfer water to Mount Owen to meet water demands during dry periods and transferred from Mount Owen to manage water surplus during wet periods. For example, over the course of a single year, during periods of high or prolonged rainfall there may be a surplus of water at one time during the year while a prolonged dry period may result in a water deficit at another time. This is likely to result in water transfers that will be greater than the stated gross water balance.

**Table 5.7 – Proposed Action Gross Water Balance, Annual Import Volumes and Annual Export Volumes**

Scenario	10 <sup>th</sup> Percentile (ML)	50 <sup>th</sup> Percentile (ML)	90 <sup>th</sup> Percentile (ML)
<b><i>Project Gross Water Balance</i></b>			
Year 1	-2,325	-810	1,660
Year 5	-2,200	-665	1,810
Year 10	-800	340	2,310
<b><i>Annual Import Volumes (ML)</i></b>			
Year 1	2,325	1,450	1,840
Year 5	2,210	1,320	1,745
Year 10	670	280	505
<b><i>Annual Export Volumes (ML)</i></b>			
Year 1	190	640	3,790
Year 5	195	650	3,840
Year 10	105	530	2,950

The 50<sup>th</sup> percentile gross water balance indicates that the Proposed Action is estimated to be in water deficit in Year 1 and Year 5, while Year 10 of the Proposed Action is predicted to operate at a surplus as a result of lower ROM production and, therefore, lower CHPP demands and losses to tailings.

### 5.5.1 Water Discharge, Quality and Flows

- ***an assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives***

The Mount Owen Complex has an extensive existing WMS, which includes mine dewatering systems, water storages, sedimentation and retention basins, settling and tailings ponds, diversion drains, levee banks and earth bunding around the main stockpile, laydown hardstand areas and fuelling areas. The WMS is managed as 'closed' system that diverts clean water around active operational areas to reduce the amount of water captured within the WMS.

Key objectives and functions of the Mount Owen Complex WMS include:

- diversion of clean water around mining operations to minimise capture of upslope runoff and separate clean water runoff from mining activities;

- segregating mine impacted water and runoff from undisturbed and revegetated areas with better water quality to minimise the volume of mine impacted water that requires reuse;
- reuse of mine impacted water within the WMS and within the GRWSS to reduce reliance on raw/clean water (e.g. extraction from Glennies Creek);
- minimising adverse effects on downstream waterways (i.e. hydraulic and water quality impacts);
- reducing the discharge of pollutants from the mine to the environment; and
- managing approved water discharges to meet licence conditions.

The WMS includes a series of catch drains and sediment dams located to capture and manage runoff from disturbed areas. The WMS is, and will continue to be, designed in accordance with Managing Urban Stormwater: Soils and Construction (the Blue Book), Volumes 1 and 2E - Mines and Quarries (Landcom 2004 and DECC 2008) to manage runoff from the 5 day, 95th percentile rainfall event.

As mining progresses, runoff from disturbed areas will be managed within the water management system and reused, or if water quality meets required guidelines, will be released to downstream waterways. The sediment dams will be emptied using a pump and pipe or gravity systems after rainfall events.

Dirty water diversion drains will be sized to safely convey the 5 per cent AEP storm event. All diversion drains will be constructed to ensure that the design flow velocities are non-scouring. Rock protection and energy dissipation structures will be installed at the downstream outlets, where required, to ensure that runoff does not cause scour or erosion in downstream drainage systems. By designing this component of the WMS in accordance with Blue Book criteria, the risk of environmental impacts associated with spills is minimised. If spill was to occur, it would only be in periods of prolonged rainfall with any spill highly diluted to the high rainfall event. Accordingly, with the management measures identified above, it is considered that any impact to water quality, in the event of a potential spill would be minimal.

Erosion and sediment controls will be implemented to mitigate the impacts of construction and mining operations on nearby watercourses and the surrounding environment. Standard erosion and sediment control techniques will be used in accordance with the requirements of Managing Urban Stormwater: Soils and Construction (the Blue Book) (Landcom 2004 and DECC 2008).

Water discharge quality and quantities, and flows have been assessed for the Proposed Action as part of the Surface Water Assessment (refer to Appendix 9 of the EIS) and Groundwater Impact Assessment (refer to Appendix 10 of the EIS). The key findings are presented in this report in the following sections:

### **Surface Water**

- surface water quality – **Section 5.3.1.4;**
- surface water flows – **Section 5.3.1.1;**
- flow impacts from proposed infrastructure – **Section 5.3.1.3;** and
- geomorphological and hydrological values – **Section 5.3.1.5.**

### **Groundwater**

- groundwater quality – **Section 5.3.2.3;**
- changes to baseflow – **Section 5.3.2.1;**
- pit inflows – **Section 5.3.2.6;** and
- final void water inflows – **Section 5.3.2.4.**

### **5.5.2 Salinity**

- ***assessment of impacts of salinity from mining operations, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to surface and groundwater sources***

Assessments of impacts of salinity from mining operations, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to surface and groundwater sources are included in the Surface Water Assessment and Groundwater Impact Assessment (refer to Appendix 9 and Appendix 10 of the EIS, respectively).

The final void associated with the Proposed Action is predicted to be a groundwater sink and accordingly there are no impacts to surface water or groundwater quality, surface water or baseflows, geomorphological or hydrological values downstream water users, alluvial aquifers and GDEs predicted.

## **5.6 NSW Aquifer Interference Policy and Groundwater Licensing**

### **5.6.1 Assessment of Groundwater Impacts**

- ***assessment of groundwater impacts against the minimal impact considerations in the NSW Aquifer Interference Policy***

A detailed discussion of the NSW Aquifer Interference Policy (2012) is contained within Appendix 10 of the EIS with a summary contained below.

The Policy describes the requirements for a proponent when designing a project and completing an EIS and how the NSW Government will assess and regulate aquifer interference activities.

The Policy describes also minimal impact considerations (or minimal harm criteria) for water pressure, water table and water quality.

Predicted groundwater impacts associated with the Proposed Action have been assessed in relation to the minimal harm criteria with respect to highly productive groundwater sources. The Proposed Action was determined to have a Level 2 impact and therefore required a detailed assessment. A summary of the results of this detailed assessment against the minimal harm criteria for both the alluvial and hard rock water sources is contained in **Table 5.8** below:

**Table 5.8 – Summary of Assessment of Minimal Harm Criteria**

<b>Requirement</b>	<b>Assessment</b>
Level 2 impact considerations – highly productive groundwater sources – alluvial water sources	<p><i>Water Table</i></p> <ul style="list-style-type: none"> <li>No high priority GDEs or culturally significant sites have been identified within 40 m of the predicted water table variations.</li> <li>Model simulations predict negligible drawdown within the Glennies Creek and Bowmans Creek alluvial aquifers.</li> <li>Model simulations predict drawdown within the Main Creek and Bettys Creek alluvial aquifers greater than 2 metres. This exceeds the minimal impact criteria specified in the NSW Aquifer Interference Policy (2012), however assessment in accordance with the policy indicates the impacts would not adversely impact or prevent the long-term viability of any water-dependent asset.</li> <li>The areal extent of predicted drawdown is localised to small reaches of Main Creek and Bettys Creek. No registered bores are located within the extent of predicted drawdown for either creek. Only monitoring bore NPZ3, which is part of the Mount Owen Complex groundwater monitoring network, is located within the extent of predicted drawdown. No groundwater users or water supply works are identified within the predicted extent of drawdown.</li> </ul> <p><i>Water Pressure</i></p> <ul style="list-style-type: none"> <li>Post-mining equilibrium simulations indicate groundwater levels within the Main Creek and Bettys Creek alluvial aquifers recover to levels equal to or above observed levels at the introduction of the WSPs. For Main Creek the Hunter Regulated River WSP commenced in February 2009, and for Bettys Creek the Hunter Unregulated and Alluvial WSP commenced in August 2009.</li> </ul> <p><i>Water Quality</i></p> <ul style="list-style-type: none"> <li>Model simulations provide no indication that the Project will alter the hydrogeologic regime in a manner that would adversely affect groundwater quality within the Main Creek and Bettys Creek alluvial aquifers.</li> </ul>
Level 2 impact considerations – less productive groundwater sources – porous and fractured rock water sources	<p><i>Water Table</i></p> <ul style="list-style-type: none"> <li>No high priority GDEs or culturally significant sites have been identified within 40 m of the predicted water table variations.</li> </ul> <p><i>Water Pressure</i></p> <ul style="list-style-type: none"> <li>No water supply works have been identified within the depressurisation zone predicted in model simulations.</li> </ul> <p><i>Water Quality</i></p> <ul style="list-style-type: none"> <li>Post-mining simulations predict that void waters will remain fresher than local groundwaters for at least 100 years following the end of mining. The North Pit Continuation will remain a sink to groundwater and hence not pose a threat to aquifer water quality</li> </ul>



## 5.6.2 Groundwater Licensing

- ***identification of any licensing requirements or other approvals under the Water Act 1912 and/or Water Management Act 2000***
- ***demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP)***
- ***a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo***

A detailed discussion of groundwater licensing requirements for the Proposed Action is contained within Appendix 10 of the EIS with a summary provided below.

Mt Owen currently holds licenses to extract groundwater from water sources in the area to accommodate mining operations. Licenses are also held under the *Water Act 1912* to extract water from the deep hard rock aquifer.

A review of current licenses held by Mt Owen against the licensing requirements identified for the Proposed Action confirms that the current licenses held by Mt Owen provide adequate allocation for predicted groundwater extraction associated with the Proposed Action.

**Section 5.5** above also discusses the application of the relevant WSP for the Proposed Action.

**Section 5.7.2.1** and **Section 5.7.3** of this report describe the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP.

**Section 8.0** of this report also details requisite licensing and approvals for the Proposed Action.

## 5.7 Water Management

- ***a detailed description of the proposed water management system (including sewage), water monitoring program and measures to mitigate surface and groundwater impacts***

### 5.7.1 Existing Surface Water Management System

As outlined above, key objectives and functions of the Mt Owen Complex WMS include:

- diversion of clean water around mining operations to minimise capture of upslope runoff and separate clean water runoff from mining activities;
- segregating mine impacted water and runoff from undisturbed and revegetated areas with better water quality to minimise the volume of water that requires reuse;
- reuse of mine impacted water within the WMS and within the GRWSS to reduce reliance on raw/clean water (e.g. extraction from Glennies Creek);
- minimising adverse effects on downstream waterways (i.e. hydraulic and water quality impacts);

- reducing the discharge of pollutants from the mine to the environment; and
- managing approved water discharges to meet licence conditions.

The aim of the WMS is to manage the potential impacts of mining operations on water resources. The approach to existing water management includes measures to convey clean water away from the areas disturbed by mining activities and associated infrastructure areas, and contain and reuse water that has been affected by mining related activities.

The key features of the existing WMS are illustrated in **Figure 5.2**. The existing WMS is used to control runoff and all mine water managed within the WMS as the mining progresses.

Diversions of the upper catchments of Yorks Creek, Swamp Creek and Bettys Creek have been undertaken as part of currently approved operations to reduce the volume of clean water entering and requiring management within the WMS.

Water is supplied to the Mount Owen Complex from both the GRWSS and Glennies Creek. Mount Owen currently holds 1,056 Units per year of High Security Entitlement and 861 Units per year of General Security Entitlement Water Access Licences for extraction of raw water from Glennies Creek. Raw water extracted from Glennies Creek is treated for use as potable water at the administration building and bath houses. Raw water is also used at the workshop and as the water supply for the fire fighting systems.

Dirty water and mine water is shared between mines as part of the GRWSS to assist in minimising the demand for raw/clean water across the GRWSS. Discharges also occur from the GRWSS in accordance with Ravensworth Operations and Liddell Coal Mines EPLs. Excess water that cannot be shared to the GRWSS will be discharged in accordance with the HRSTS. Since 2005, no discharges have occurred from the WMS to the HRSTS with surplus water transferred to and utilised by the GRWSS, in preference to being discharged.

Wastewater from on-site facilities, including sewage, is collected and treated on site by a number of aerated wastewater treatment plants which are licensed by Singleton Council. The effluent from the wastewater treatment plants at Mt Owen.

The full details of the existing WMS are provided in Appendix 9 of the EIS.

## **5.7.2 Proposed Water Management System**

### **5.7.2.1 Water Management Strategy**

The water management strategy for the Proposed Action has been designed to integrate water management requirements of the Proposed Action with the existing WMS for the Mt Owen Complex. The strategy includes the separation of clean and dirty water, preventing the contamination of clean water by mining activities and managing compliance with statutory obligations.

A detailed description of the proposed conceptual WMS is provided in Appendix 9 of the EIS.

For the Proposed Action, three categories of water have been identified to be managed, each with different potential to cause environmental harm, namely:

- Clean water - Runoff from undisturbed or rehabilitated areas where vegetation is fully established, and the water quality is suitable for release/discharge. Clean water includes raw water imported under licence.



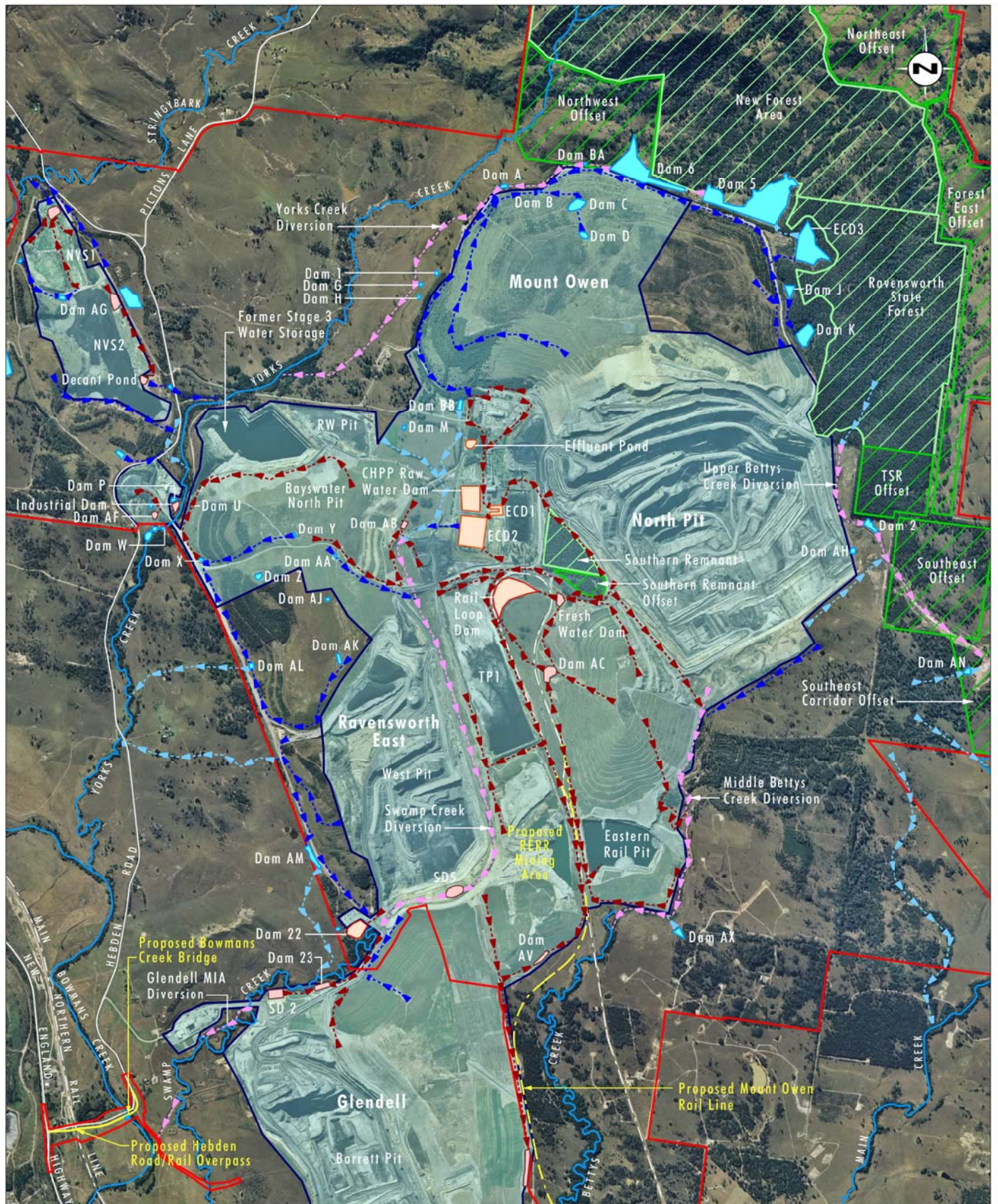


Image Source: Mount Owen (2013)  
Data Source: Mount Owen (2014)

0 0.5 1.0 2.0 km  
1:40 000

### Legend

- Project Area
- Existing Biodiversity Offset Areas
- Ravensworth State Forest
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Clean Water Dam
- Sediment Dam
- Mine Water Dam
- Existing Flow Path
- Clean Water Diversion Drain
- Dirty Water Drain
- Existing Diversion Channel
- Drainage Line
- Existing Railway
- Mount Owen Complex Water Management System Catchment

FIGURE 5.2

Existing Surface  
Water Management



- Dirty water - Runoff from disturbed areas, such as active overburden emplacement areas or overburden emplacement areas where vegetation is not fully established. These areas have the potential for elevated TSS.
- Mine water - Mine water, being water exposed to coal or used in coal processing and runoff within MIAs. This water quality is typically of a higher level of salinity.

Each type of water requires different management measures to minimise the risk of contamination of downstream drainage systems. The target design criteria for the three categories of water are summarised in **Table 5.9**.

**Table 5.9 – Design Criteria for Components of the WMS**

Water Category	Water Description	Target Design Criteria
Clean	Runoff from undisturbed or rehabilitated areas	Release, where practicable, to downstream environment.
Dirty	Runoff from disturbed areas	Managed in line with the Blue Book ( <i>Managing Urban Stormwater: Soils and Construction Volumes 1 and 2E</i> ).
Mine	Runoff from areas exposed to coal or water used in coal processing or from coal stockpile areas	Contained for events up to and including the 1 percent AEP 24 hour storm event.

Dirty water and mine water is shared between Glencore's regional mining operations as part of the GRWSS to assist in minimising the demand for raw/clean water across the GRWSS. Excess water that cannot be shared in the GRWSS may be discharged in accordance with the HRSTS.

Raw water supply and wastewater treatment and disposal for the Proposed Action will be the same as for the existing operations.

The WMS for the Proposed Action will make provision for ongoing evaluation of all existing and proposed components of the WMS using additional data obtained through ongoing water quality sampling together with risk assessments, where required, to ensure the objectives of the WMS are achieved.

### 5.7.2.2 Proposed Water Management System

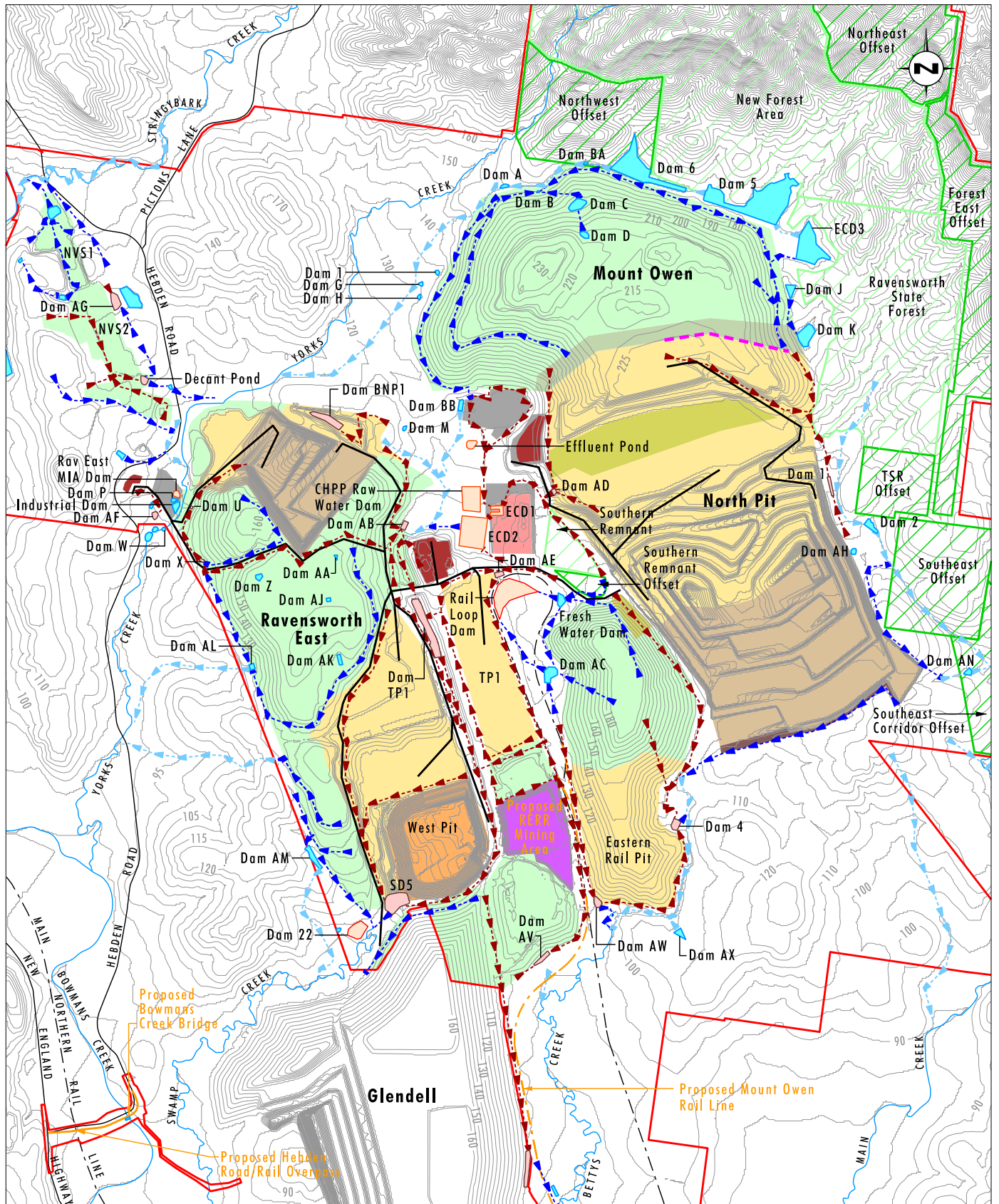
While changes are proposed to the WMS, the objectives of the WMS remain as set out in **Section 5.7.1**.

**Figures 5.3 to 5.6** illustrate the conceptual WMS for key stages during the life of the Proposed Action. It is important to note that stage plans indicate only the components of the WMS which are required for the particular stage of the mine and does not preclude construction of some components throughout the Proposed Action.

The water management requirements for the Proposed Action will be integrated with the existing WMS. Mine water and dirty water runoff will continue to be directed to the WMS. Clean water diversions will continue to be diverted runoff off the upper catchments of Yorks Creek, Swamp Creek and Bettys Creek around the WMS.

Full details on the proposed staged WMS are provided in Appendix 9 of the EIS.





Data Source: Mount Owen (2014)  
 Note: Contour Interval 5m(AHD). Subject to refinement as part of WMP process

#### Legend

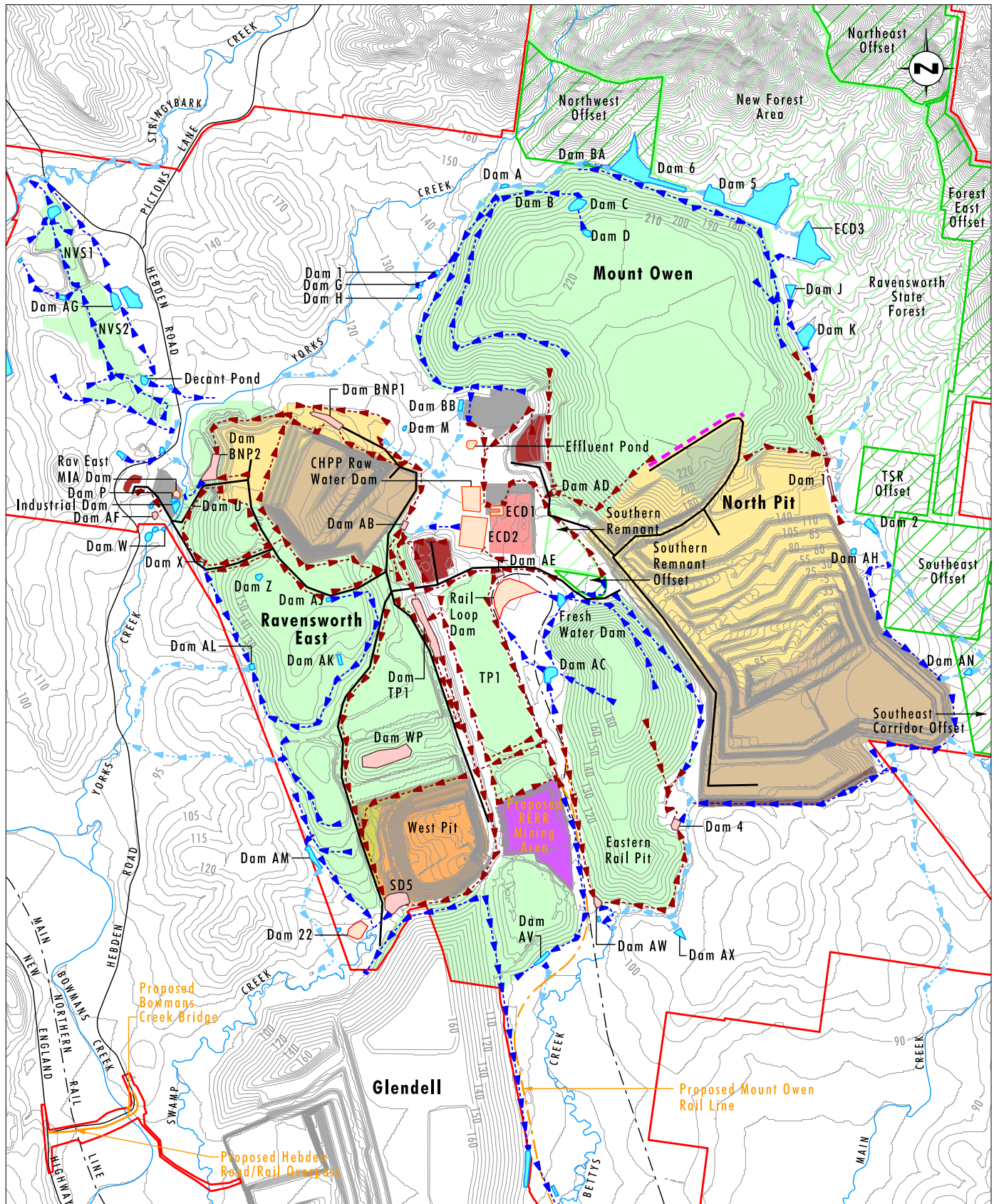
- |   |  |  |
|---|--|--|
| <span style="border: 1px solid red; display: inline-block; width: 10px; height: 10px;"></span> Project Area                                 | <span style="color: blue;">---</span> Existing Flow Path   | <span style="background-color: #f08080; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Coal Stockpile - Product   |
| <span style="border: 1px dashed green; display: inline-block; width: 10px; height: 10px;"></span> Existing Biodiversity Offset Areas        | <span style="color: blue;">---</span> Clean Water Diversion Drain  | <span style="background-color: #800000; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Coal Stockpile - ROM       |
| <span style="border: 1px dashed green; display: inline-block; width: 10px; height: 10px;"></span> Ravensworth State Forest                  | <span style="color: red;">---</span> Dirty Water Drain   | <span style="background-color: #808080; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Infrastructure             |
| <span style="color: black;">---</span> Existing Railway   | <span style="color: magenta;">---</span> Windrow   | <span style="background-color: #800080; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Proposed RERR Mining Area  |
| <span style="color: orange;">---</span> Proposed Rail Upgrade Works   | <span style="color: blue;">---</span> Drainage Line  | <span style="background-color: #90ee90; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Rehabilitation - Complete  |
| <span style="color: orange;">---</span> Proposed Hebden Road Upgrade Works  | <span style="color: black;">---</span> Haul Road   | <span style="background-color: #90ee90; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Rehabilitation - Temporary |
| <span style="background-color: #00bfff; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Clean Water Dam | <span style="background-color: #d2b48c; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Active Mining Area                 | <span style="background-color: #808080; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Shaped Not Seeded          |
| <span style="background-color: #f08080; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Sediment Dam    | <span style="background-color: #f0e68c; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Active Overburden Emplacement Area | <span style="background-color: #ff8c00; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Tailings Placement         |
| <span style="background-color: #ffa500; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Mine Water Dam  | <span style="background-color: #800000; border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Topsoil Removal                    |  |

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 20140916 10.31

0 0.5 1.0 2.0 km  
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**FIGURE 5.3**  
 Conceptual Surface  
 Water Management  
 Year 1





Data Source: Mount Owen (2014)  
 Note: Contour Interval 5m(AHD). Subject to refinement as part of WMP process

#### Legend

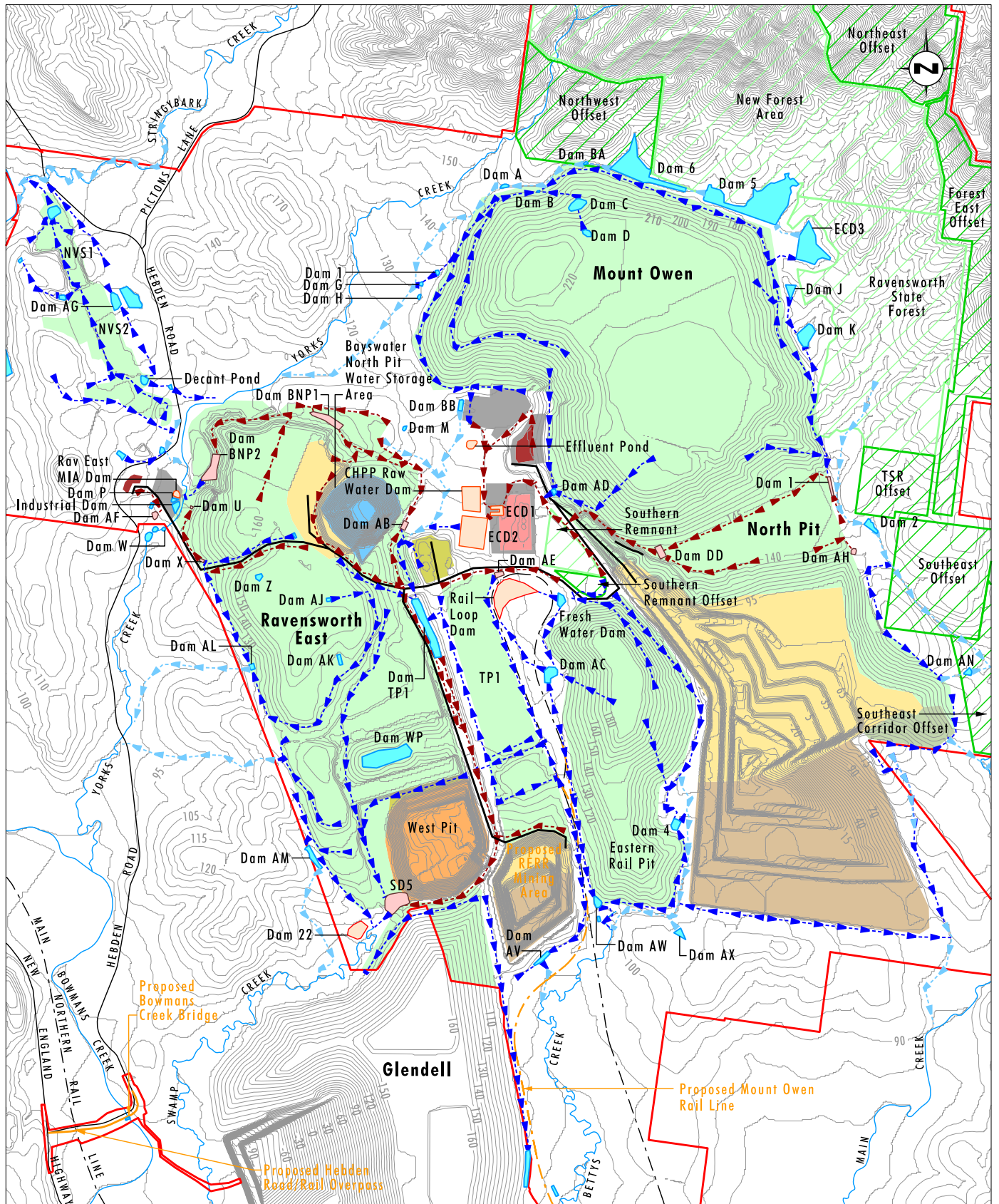
- |  |  |  |
|--|--|--|
| <span style="color: red;">—</span> Project Area                          | <span style="color: blue;">—</span> Existing Flow Path                   | <span style="color: red;">■</span> Coal Stockpile - Product          |
| <span style="color: green;">—</span> Existing Biodiversity Offset Areas  | <span style="color: blue;">—</span> Clean Water Diversion Drain          | <span style="color: brown;">■</span> Coal Stockpile - ROM            |
| <span style="color: green;">—</span> Ravensworth State Forest            | <span style="color: red;">—</span> Dirty Water Drain                     | <span style="color: grey;">■</span> Infrastructure                   |
| <span style="color: black;">—</span> Existing Railway                    | <span style="color: magenta;">—</span> Windrow                           | <span style="color: purple;">■</span> Proposed RERR Mining Area      |
| <span style="color: orange;">—</span> Proposed Rail Upgrade Works        | <span style="color: blue;">—</span> Drainage Line                        | <span style="color: green;">■</span> Rehabilitation - Complete       |
| <span style="color: orange;">—</span> Proposed Hebden Road Upgrade Works | <span style="color: black;">—</span> Haul Road                           | <span style="color: lightgreen;">■</span> Rehabilitation - Temporary |
| <span style="color: cyan;">■</span> Clean Water Dam                      | <span style="color: brown;">■</span> Active Mining Area                  | <span style="color: grey;">■</span> Shaped Not Seeded                |
| <span style="color: pink;">■</span> Sediment Dam                         | <span style="color: yellow;">■</span> Active Overburden Emplacement Area | <span style="color: orange;">■</span> Tailings Placement             |
| <span style="color: orange;">■</span> Mine Water Dam                     | <span style="color: brown;">■</span> Topsoil Removal                     |  |

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 20140916 10.37

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 1:40 000

**FIGURE 5.4**  
 Conceptual Surface  
 Water Management  
 Year 5





Data Source: Mount Owen (2014)  
Note: Contour Interval 5m(AHD). Subject to refinement as part of WMP process

#### Legend

- |  |   |  |
|--|---|--|
| <span style="color: red;">—</span> Project Area                                    | <span style="color: blue;">---</span> Existing Flow Path                            | <span style="background-color: grey;"> </span> Infrastructure                  |
| <span style="background-color: green;"> </span> Existing Biodiversity Offset Areas | <span style="color: blue;">---</span> Clean Water Diversion Drain                   | <span style="background-color: lightgreen;"> </span> Rehabilitation - Complete |
| <span style="background-color: lightgreen;"> </span> Ravensworth State Forest      | <span style="color: red;">---</span> Dirty Water Drain                              | <span style="background-color: yellow;"> </span> Rehabilitation - Temporary    |
| <span style="color: black;">---</span> Existing Railway                            | <span style="color: blue;">---</span> Drainage Line                                 | <span style="background-color: lightgrey;"> </span> Shaped Not Seeded          |
| <span style="color: orange;">---</span> Proposed Rail Upgrade Works                | <span style="color: black;">---</span> Haul Road                                    | <span style="background-color: orange;"> </span> Tailings Placement            |
| <span style="color: orange;">---</span> Proposed Hebdon Road Upgrade Works         | <span style="background-color: brown;"> </span> Active Mining Area                  | <span style="background-color: lightblue;"> </span> Water Storage Area         |
| <span style="background-color: lightblue;"> </span> Clean Water Dam                | <span style="background-color: yellow;"> </span> Active Overburden Emplacement Area |  |
| <span style="background-color: pink;"> </span> Sediment Dam                        | <span style="background-color: pink;"> </span> Coal Stockpile - Product             |  |
| <span style="background-color: orange;"> </span> Mine Water Dam                    | <span style="background-color: red;"> </span> Coal Stockpile - ROM                  |  |

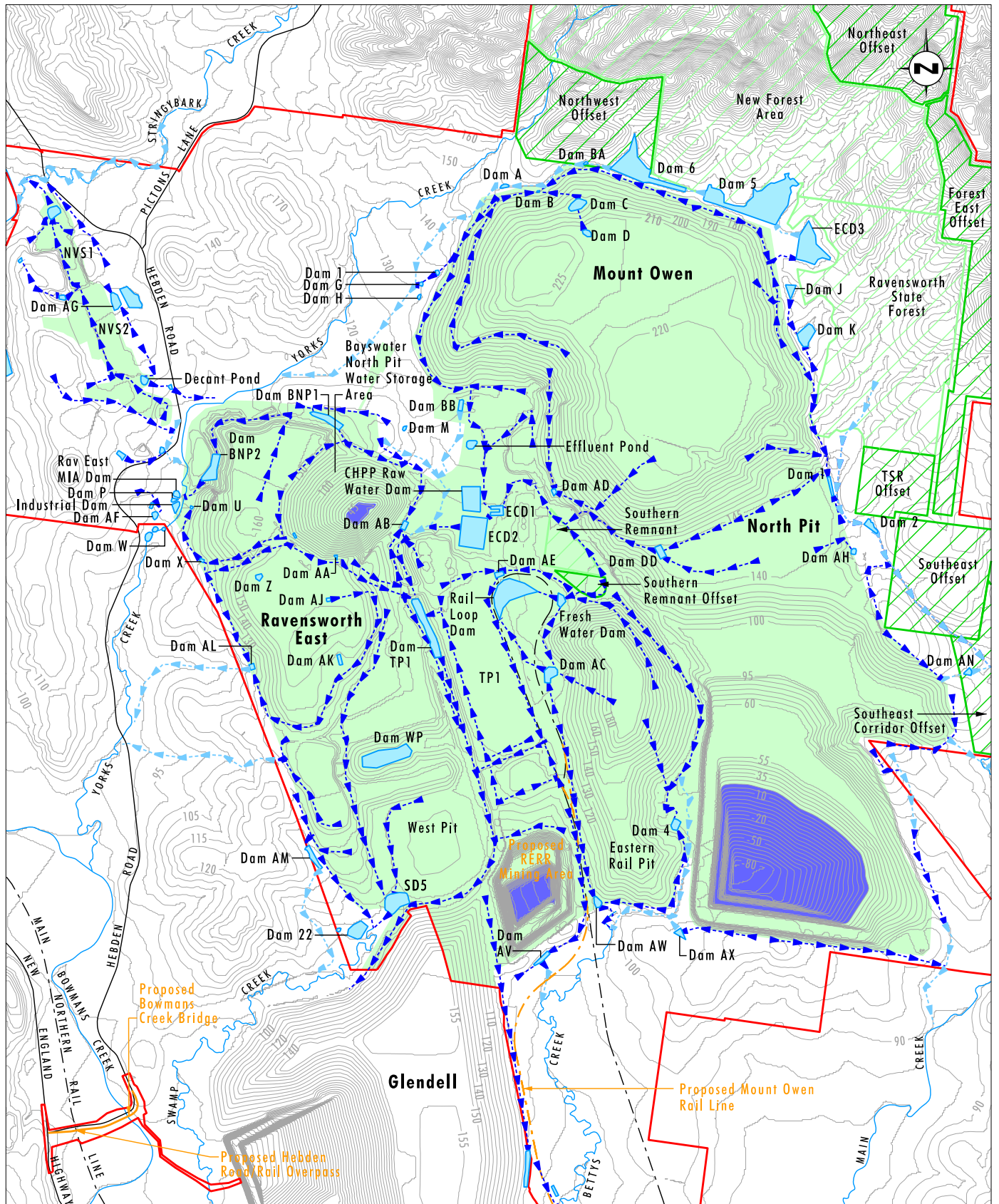
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1:40 000

FIGURE 5.5

Conceptual Surface  
Water Management  
Year 10





Data Source: Mount Owen (2014)  
Note: Contour Interval 5m(AHD). Subject to refinement as part of WMP process

0 0.5 1.0 2.0 km  
1:40 000

### Legend

- Project Area
- Existing Biodiversity Offset Areas
- Ravensworth State Forest
- Existing Railway
- Proposed Rail Upgrade Works
- Proposed Hebden Road Upgrade Works
- Clean Water Dam
- Existing Flow Path
- Clean Water Diversion Drain
- Drainage Line
- Rehabilitation - Complete
- Final Void Water Level

FIGURE 5.6

Conceptual Surface  
Water Management  
Final Landform



### 5.7.3 Surface Water Monitoring and Management Measures

Mt Owen will continue to manage its operations in accordance with the WMP, EPL and the HRSTS. Water monitoring at Mt Owen Mine is undertaken to assess compliance against licence conditions and consent conditions, and for operational purposes. This includes monitoring of erosion and sediment controls, the site water balance and water quality. Subject to the Proposed Action being approved, the WMP will be updated to reflect the changes to the surface water catchments and additional monitoring and management measures. A summary of the proposed water management measures is provided below, with further details of the ongoing approach to surface water monitoring and management provided in Appendix 9 of the EIS.

A substantial record of baseline data has been collected for Mt Owen Mine and will be used to inform the ongoing review of monitoring data, allowing any potential impacts of the Project to be identified and management measures implemented where appropriate.

Water monitoring currently conducted includes the following:

#### ***Water Balance Monitoring***

As part of the water balance monitoring for the Mt Owen WMS, water imported to site, water used on site and water discharged from site will be monitored in accordance with Water Reporting Requirements for Mines (NOW undated).

#### ***Watercourse Stability Monitoring and Management***

Mt Owen currently monitor the channel stability of Yorks Creek, Swamp Creek, Bettys Creek and Main Creek with results reported in the Annual Review. Monitoring points have been established along each of the creeks upstream and downstream of the Mt Owen Mine. Cross sections are also used to identify change in slope and depict creek bed profile. The creek bed profiles are compared with profiles in previous studies to determine if the creek banks have remained stable or declined in condition.

Mt Owen proposes to continue to monitor channel stability in watercourses as part of the Proposed Action.

Many local creek conditions are a result of historical farming and grazing practices which have contributed to the degradation of riparian areas. Erosion of watercourse bed and banks has been identified within local watercourses, including Swamp Creek and Bettys Creek. Monitoring and remediation of erosion within watercourses outside of the active mining and emplacement areas will continue to be managed as set out in the *Mt Owen Complex Landscape Management Plan*.

#### ***Surface Water Quality Monitoring***

Surface water quality monitoring is currently undertaken within the WMS and at various upstream and downstream locations on the creeks located near the Project Area. Water quality parameters monitored in watercourses upstream and downstream of the Project Area include monthly sampling of pH, electrical conductivity, total suspended solids and total dissolved solids. Surface water monitoring will be continued over the life of the Proposed Action. Mt Owen propose to:

- Continue to record and document the existing water quality upstream and downstream of the Project Area so as to highlight any areas of concern or impact. As part of the implementation of the Proposed Action, the WMP will be updated to reflect an additional surface water monitoring point on Main Creek, downstream of the North Pit Continuation

final extent. The water quality parameters and frequency of sampling for watercourses surrounding the Proposed Action will remain as for the existing approved operations.

- Continue to record and document water quality within the WMS as required for pH, electrical conductivity, total suspended solids, total dissolved solids, chlorine, nitrogen, sulphate, magnesium, calcium, phosphorous, oil and grease, chemical oxygen demand, biological oxygen demand, faecal coliform and nitrate.
- Monitor water quality during HRSTS discharge events as set out in the EPL.
- Review and monitor the performance of erosion and sediment controls.
- Continue the reporting of monitoring results in the Annual Review.

The existing and proposed surface water quality monitoring points are shown in **Figure 5.7**. A new monitoring point on Main Creek (MC3) is proposed to provide information on potential impacts from the North Pit Continuation. Monitoring at MC3 will commence upon Project approval. In addition, Mt Owen will continue to monitor water quality during HRSTS discharge events as set out in the EPL.

### **Flow Monitoring**

Flow monitoring on Yorks Creek, Swamp Creek, Bettys Creek and Main Creek will continue to be undertaken by visual observation of the flows during water quality sampling (flow, no-flow). The flow observations will be used to inform the assessment of water quality data.

### **Contingency Measures**

The process of detailed design, construction and monitoring/maintenance of the proposed WMS during the operational phase is intended to reduce the risks associated with unplanned spillages or other unforeseen circumstances with potential to result in unexpected environmental impacts. That is, the system has been designed considering the range of potentially relevant environmental factors and variables, reducing the risk of the implemented system not performing as planned.

In addition, Mt Owen has a *Pollution Incident Response Management Plan* (PIRMP) (2012), which sets out hazards to be managed, incident management, notification procedures, and other key information to address incidents.

As a further contingency measure, the following key components will be used as required to address potential surface water impacts:

- Water shortages: The water balance modelling has indicated that the Mount Owen Complex will typically operate with a water deficit in Year 1 and Year 5 of the Project and in surplus in Year 10. Mt Owen have planned to use water available from the GRWSS and existing Hunter Regulated River WALs to accommodate the predicted water deficit years. However, if water shortages develop in the GRWSS, Mt Owen will either source additional water from external sources or reduce production. This could include purchasing additional water allocations and may include sourcing water from other operations (e.g. other mining operations). These additional water sources would be obtained in accordance with any relevant licences and approvals.



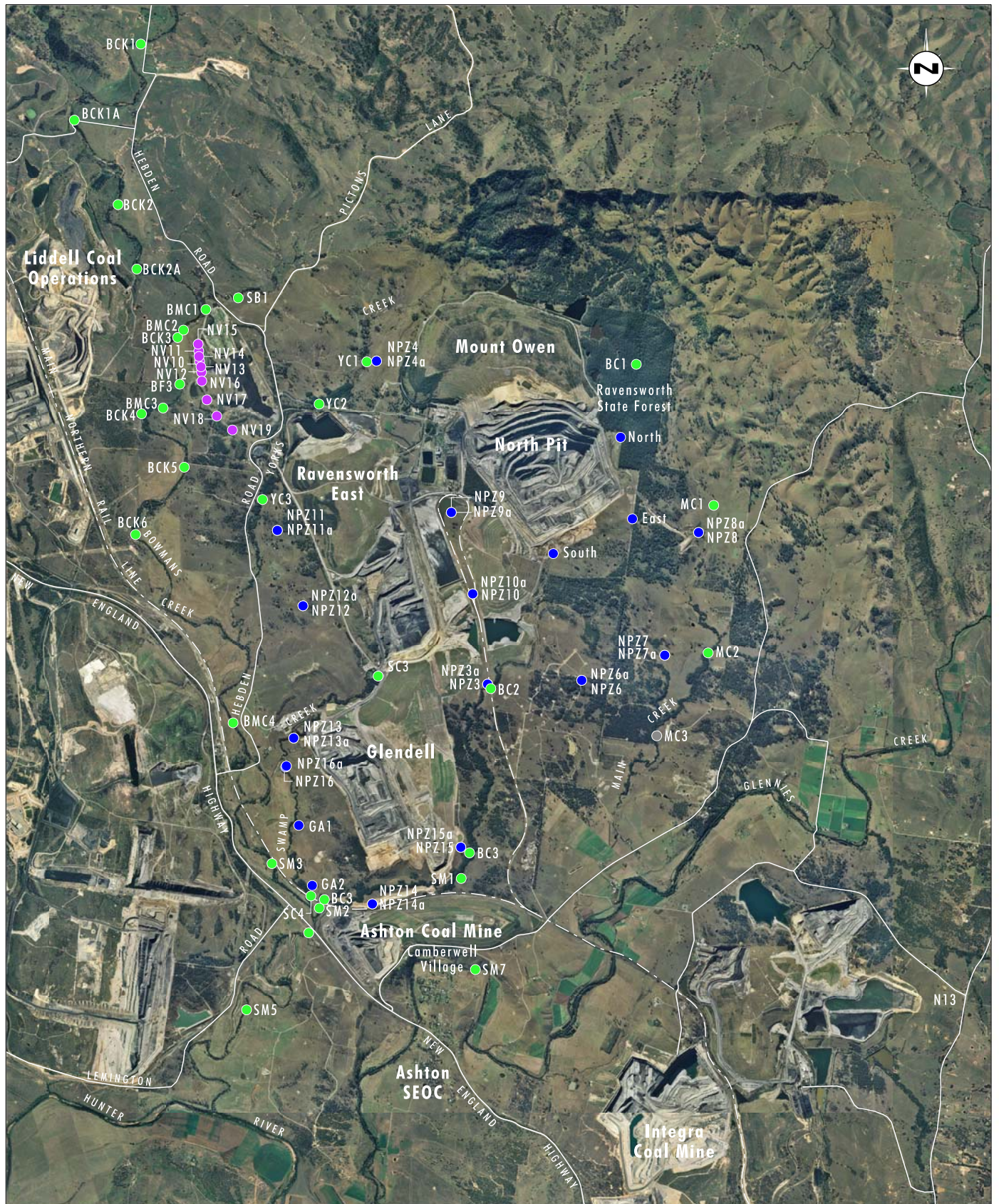


Image Source: Mount Owen (2012-2014)  
Data Source: Mount Owen (2014)

0 1 2 4 km  
1:80 000

#### Legend

- Groundwater Monitoring Location
- Surface Water Monitoring Location
- Proposed Future Water Monitoring Location
- Piezometer Groundwater Monitoring Location

FIGURE 5.7

Mount Owen Complex  
Water Monitoring Locations



- Water surplus: In the event of poorer water quality or if a greater risk of spilling than originally indicated is identified at any specific sediment dam, the contingency measures that will be implemented include:
  - increasing pumping rates to more quickly remove water from the dam where practical, or increasing the capacity of the dam if time constraints permit;
  - review and upgrading of rehabilitation of areas where runoff water quality is found to be poorer than expected post completion of rehabilitation works; and
  - if the water surplus relates to the overall water balance, transfer of water within the GRWSS and/or the number and use of HRSTS salt credits will be reviewed together with the overall water balance modelling.
- Unforeseen failure or catastrophic events: In the event of an unforeseen spillage associated with incidents such as accidental damage, operational failures or extreme catastrophic occurrences, the hazard notification protocols in the PIRMP will be followed.
- Possible impacts of climate change: Climate change poses an increased risk of both water shortages and extreme flood events. Given the predicted water surplus in the latter years of the Proposed Action, it is considered likely that the possible reduced availability of water will not significantly impact the Proposed Action.

Climate change may significantly impact on the final void water balances, particularly as the current prediction is that it will take several years for water levels to recover within the final voids. The impacts of climate change over such a long period are potentially significant, most likely decreasing the water level within the final voids and increasing the freeboard to spill levels.

While the impact on rainfall and evaporation are the most obvious possible impacts of climate change on surface water management, the potential impacts of climate change on rehabilitation in terms of the long term sustainability of vegetation will be re-assessed at least 5 years prior to closure. Changes that result in a deterioration in vegetation cover could result in increased surface water impacts, particularly in terms of TSS. The vegetation currently being established on rehabilitated areas and proposed to be used for the Proposed Action will be tolerant of anticipated future climatic changes.

### ***Erosion and Sediment Control Measures***

Erosion and sediment controls will be monitored during construction and operation in accordance with the *Blue Book* (Landcom 2004 and DECC 2008). Monitoring of the performance of the water management systems and associated erosion and sediment control measures will be set out in the revised *Mt Owen Complex WMP*, with monitoring typically undertaken monthly and after major storm events.

Further details of the ongoing approach to surface water monitoring and management are provided in Appendix 9 of the EIS.

### **5.7.4 Groundwater Management and Monitoring Commitments**

Mt Owen currently holds several different licenses to extract groundwater from water sources in the area to accommodate mining operations. These licenses include allocations to extract groundwater from the Glennies Creek alluvium, regulated by the Hunter Regulated River WSP (2004), and the Jerrys Water Source, which is regulated under the Hunter Unregulated and Alluvial WSP (2009), as well as licenses to extract water from the deeper regional hard rock aquifer under the *Water Act 1912*.



A review of current licenses held by Mt Owen against the licensing requirements identified for the Project confirms that the current licenses held by Mt Owen provide adequate allocation for groundwater extraction associated with the Project.

As discussed in **Section 3.3** (Section 2.5 of the EIS), the proposed conceptual mine plan for the North Pit Continuation was modified to include a setback of at least 200 metres from the high bank of Main Creek, to meet the minimal harm criteria outlined in the NSW Aquifer Interference Policy (2012).

The Mt Owen Complex WMP details the approach to water management, including groundwater management at Mt Owen. Mt Owen currently undertakes groundwater monitoring in accordance with the Mt Owen Complex Groundwater Monitoring Program as illustrated in **Figure 5.7**. This protocol currently includes the following groundwater monitoring:

- nested piezometer (NPZ) series bores, targeting the shallow bedrock overburden and underlying deeper bedrock or coal seams within the regional hard rock aquifer;
- standpipe piezometers targeting the alluvial aquifers of Swamps Creek, Yorks Creek and Bowmans Creek; and
- vibrating wire piezometers targeting the hard rock aquifer.

It is proposed to update the *Mt Owen Complex Groundwater Monitoring Program* to include the outcomes of the Groundwater Impact Assessment. Mt Owen will continue to monitor surface water and groundwater in accordance with the revised *Mt Owen Complex Water Management Plan* to provide data for on-going evaluation and incorporation into future updates of the numerical groundwater model.

The results of the monitoring will be subject to an annual review and reported in the *Mt Owen Complex Annual Review*. The groundwater model will be periodically updated and refined as additional data and monitoring results become available.

Should the Proposed Action be approved, the *Mt Owen Complex Water Management Plan*, *Groundwater Monitoring Program* and *Surface Water and Groundwater Response Plan* will be updated to reflect the Proposed Action.

## 6.0 Proposed Safeguards and Mitigation Measures

- 7. A description of feasible mitigation measures, changes to the action or procedures, which have been proposed by the proponent or suggested in public submissions, and which are intended to prevent or minimise relevant impacts on matters of national environmental significance. Information must include:**
- a) a description of the mitigation measures that will be undertaken to prevent or minimise the relevant impacts of the action. These mitigation measures should be justified and based on best available practices**
  - b) an assessment of the expected or predicted effectiveness of the mitigation measures including the effect on abundance and condition of species, suitable habitat and ecological communities**
  - c) any statutory or policy basis for the mitigation measures**
  - d) the cost of the mitigation measures**
  - e) an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs (including any relevant thresholds for corrective actions) for the relevant impacts of the action. Include the person or agency responsible for implementing these programs and the effectiveness of all mitigation measures, including any provisions for independent environmental auditing**
  - f) the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program**
  - g) identification of mitigation measures proposed to be undertaken by State governments, local governments or the proponent, and**
  - h) any changes to the action which prevent or minimise relevant impacts on listed threatened species and communities**

### 6.1 Ecological Impact Mitigation Measures

Mt Owen has sought to avoid and minimise potential impacts on the ecological values of the Referral Area throughout the project planning process. This has included avoidance and minimisation of disturbance of key vegetation communities and fauna habitats. These avoidance measures are described in detail in Section 5.1 of the Ecological Assessment (refer to Appendix 11 of the EIS).

Mt Owen has committed to the design and implementation of a comprehensive strategy to mitigate the residual impacts of the Proposed Action. The impact mitigation measures proposed are based on best available practices and are widely used to mitigate the impact of coal mining developments in the Hunter Valley and elsewhere. Proposed ecological impact mitigation strategies include:

- strategies to guide mine rehabilitation with the aim of creating self sustaining communities characteristic of extant vegetation communities;
- fauna habitat augmentation;
- targeted passive and active regeneration of currently degraded vegetation communities;
- specific strategies to protect and increase the availability and quality of habitat for the spotted-tailed quoll (*Dasyurus maculatus maculatus*);

- strategies to protect threatened woodland dependent species and increase the availability of habitat over the medium to longer term; and
- general impact mitigation strategies such as sediment and erosion control, weed and feral animal control and bushfire management.

Section 6.0 of the Ecological Assessment (refer to Appendix 11 of the EIS) provides these strategies in detail.

## 6.2 Assessment of Mitigation Measures

### ***b. an assessment of the expected or predicted effectiveness of the mitigation measures including the effect on abundance and condition of species, suitable habitat and ecological communities***

As outlined in Section 6.0 of the Ecological Assessment, the mitigation measures proposed are expected to be effective in minimising the impact on the ecological features of the Project Area during construction and operation of the Proposed Action (refer to Appendix 11 of the EIS).

The impact mitigation and management measures proposed as part of the Proposed Action are expected to result in an increase in habitat quality at the proposed Biodiversity Offset Sites for the range of fauna species impacted by the Proposed Action. The increase in habitat quality is expected to result from the range of proposed management actions such as grazing management, weed management for African olive, regeneration and revegetation activities in Derived Native Grassland areas and the reinstatement of key fauna micro-habitats such as log piles for the spotted-tailed quoll. Following the implementation of the mitigation and management measures, the proposed Biodiversity Offset Sites have the potential to support an increased abundance of target species in higher quality habitat.

In order to determine the effectiveness of the proposed rehabilitation and regeneration activities, an assessment of the ecological value of rehabilitated vegetation communities at Mt Owen was undertaken (Umwelt 2013b), particularly in the context of vegetation community re-establishment and threatened species habitat. A targeted flora survey and condition assessment was undertaken in selected mine rehabilitation and revegetation areas across the Mt Owen North Pit rehabilitation area, the New Forest Area and existing Mt Owen Biodiversity Offset Areas, to provide context and certainty surrounding the inclusion of proposed mine rehabilitation and regeneration works in the proposed Biodiversity Offset Strategy. Following collection of the flora and condition assessment data, a thorough assessment of fauna monitoring results in relation to mine rehabilitation and habitat regeneration was undertaken, particularly focussing on the statistical analysis that is undertaken annually as part of the fauna monitoring. The key outcomes of the assessment (Umwelt 2013b) are provided below.

The assessment of similarity between rehabilitation, revegetation and regeneration areas and the NSW scientific committee determination for Central Hunter Ironbark – Spotted Gum – Grey Box Forest identified that areas of revegetation and regeneration in the New Forest Area and Biodiversity Offset Areas conform to the NSW Scientific Committee determination of Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC and therefore meet the rehabilitation objectives and site preliminary completion criteria detailed in the *Landscape Management Plan*. At this stage, the mine rehabilitation was assessed as trending towards the Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC.

Monitoring of the fauna habitat provided by the rehabilitation and regeneration sites at Mt Owen is clearly demonstrating that actively managed rehabilitation and regeneration can provide a high quality habitat for native fauna species from each of the main vertebrate fauna groups and including threatened species. Annual fauna monitoring has measured the diversity of threatened species utilising forest, regeneration and rehabilitation monitoring sites. A total of 29 species listed under either the TSC or EPBC Acts have been recorded at Mt Owen. Of the 29 threatened species recorded, 13 have been recorded in forest regeneration monitoring sites and 11 in post mining rehabilitation sites. Threatened species that have been recorded in mine rehabilitation include the spotted-tailed quoll and New Holland mouse and state listed threatened species such as the squirrel glider, masked owl and grey-crowned babbler have each been regularly recorded in regeneration monitoring sites. High quality potential habitat for the green and golden bell frog has also been created in mine rehabilitation areas.

Mt Owen has had considerable success in re-establishing vegetation communities on mine spoil. Mt Owen has worked closely with researchers from the University Of Newcastle with the initial goal of the Mt Owen mine research program to re-establish sustainable nutrient acquisition and cycling using natural root-microbe associations. This project soon expanded to include research into the use of available bulk materials and amelioration techniques for mine rehabilitation when forest topsoil would eventually run out. The rehabilitation strategy at Mt Owen has also benefited from the results of research such as a doctorate project through the University of Queensland titled 'Enhancing Eucalypt Forest Re-establishment on Coal Mined Land at Mount Owen'. Mt Owen has also participated in several Australian Coal Association Research Program (ACARP) projects on mine site rehabilitation. In collaboration with the University of Newcastle, Mt Owen has embarked on a research program that will lead to the most effective methods to establish dry sclerophyll and other native forest communities on rehabilitated overburden dumps.

Since commencement, research has continued to develop as part of the Ravensworth State Forest Complex Research Program, with over forty experiments and investigations currently established. Mt Owen is now listed as a 'Highly Commended' site on the Global Restoration Network of the Society for Ecosystem Restoration, International.

The assessment of the ecological values of rehabilitated formerly mined land and those areas that have been subject to vegetation community and fauna habitat reconstruction programs demonstrates that rehabilitated land can create quality vegetation communities and fauna habitats that includes threatened fauna species and EEC habitat and that there is a high degree of confidence in the predicted effectiveness of the proposed mitigation measures.

As outlined in **Section 5.7.3**, potential impacts associated with erosion and sediment will be managed during construction and operation in accordance with the *Blue Book* (Landcom 2004 and DECC 2008). Monitoring of the performance of the water management systems and associated erosion and sediment control measures will be set out in the revised *Water Management Plan*, with monitoring typically undertaken monthly and after major storm events.

Erosion and sediment control will be undertaken in accordance with the *Mount Owen Complex Erosion and Sediment Plan* (ESCP) (available on Mt Owen's website at [www.mtowencomplex.com.au](http://www.mtowencomplex.com.au)), which will be updated if the Project is approved. The ESCP provides a framework for the management of erosion and sedimentation at the Mount Owen Complex.



The objective of the ESCP is to ensure that appropriate structures and programs of work are in place to:

- identify activities that could cause erosion and generate sediment;
- describe the location, function and capacity of erosion and sediment control structures required to minimise soil erosion and the potential for transport of sediment downstream;
- ensure erosion and sediment control structures are appropriately maintained;
- fulfil the statutory conditions of the project approval; and
- meet the requirements of the Blue Book (Landcom 2004 and DECC 2008) and the *Draft Guidelines for the Design of Stable Drainage Lines on Rehabilitated Minesites in the Hunter Coalfields* (DIPNR undated).

### 6.3 Statutory or Policy Basis for Mitigation Measures

No specific State or Commonwealth policies are currently available to form the basis of the proposed mitigation strategy. The mitigation strategy has been developed specifically for the Proposed Action based on previous learning and experience at the Mt Owen Complex and utilising best practise guidelines in ecological impact minimisation. Consideration has also been given to State and Commonwealth Recovery Plans and Threat Abatement Plans, where relevant.

### 6.4 Cost of Mitigation Measures

**Table 6.1** presents all proposed mitigation actions and a conceptual cost estimate of each action. The conceptual cost estimate provides an indicative assessment of the capital requirements for the implementation of works at the Cross Creek and Esparanga Offset Sites and the Stringybark Creek Habitat Corridor. These costs are preliminary and based on broad assumptions of the management requirements for each offset area and typical management rates. Following approval of the Proposed Action, they will be further refined through the development of an updated *Landscape Management Plan* and as informed by a thorough site survey and ongoing monitoring. A contingency factor has been applied to the conceptual cost estimate for management actions. Glencore commits to the provisioning of adequate resources and budget for the implementation of management actions including rehabilitation at each of the proposed offset sites.

A summary of the costs of management actions is included in **Table 6.1** below.

**Table 6.1 – Summary of Management Action Costs**

Management Action	Proposed Works	Cost for 20 Years (\$)
Weed Management inc. African olive removal and management	Targeted weed removal using both spraying and manual removal. Weed management will be initiated in year 1, followed up in years 2 and 3. Then continued approximately every five years thereafter, undertaken on an as needed basis over 20 years (estimated to be up to six times over the 20 year period).	774,000
Pest Management	Targeted pest fauna control program to be undertaken on an annual basis for 20 years.	80,000

**Table 6.1 – Summary of Management Action Costs (cont.)**

Management Action	Proposed Works	Cost for 20 Years (\$)
Revegetation	Mix of natural and assisted revegetation works. Includes preparation of soil and re-planting areas of DNG with locally sourced tubestock.	98,500
Other general management	Includes the erection and upkeep of fencing and appropriate signage and maintaining fire trails around the perimeter of the property.	210,000
Monitoring and Reporting	Monitoring and reporting of the ecological values of the proposed Offset Sites including the effectiveness of mitigation and management actions. The scope of ecological monitoring program will be contingent upon approval of the associated <i>Landscape Management Plan</i> .	500, 000
	<b>Total</b>	<b>\$1,662,500</b>

## 6.5 Environmental Management Plan Framework

**Tables 6.2 to 6.10** set out the framework for continuing management and mitigation programs including thresholds for corrective actions. The framework sets out methodologies for implementation, expected effectiveness and responsibilities.

**Table 6.2 – Pre-clearing Surveys**

Mitigation Component	Mitigation Details
Objective	The purpose of pre-clearing surveys is to target particular threatened species known or potentially occurring in the area to be cleared and identify any critical habitat within the clearing area for these species. Pre-clearance surveys will also identify habitat resources, such as logs, hollows and rocks that can be salvaged and relocated to revegetation.
Phase	Prior to clearing of vegetation for construction of mine infrastructure or in disturbance areas.
Methodology for Implementation	A pre-clearing survey is to be undertaken by a relevantly trained person prior to the disturbance of vegetation. The survey will focus on threatened species known to occur or to be potentially occurring within the area to be cleared. The survey will also identify any critical habitat within the proposed clearing areas for these species.
Justification of Location and Design	To be undertaken in areas of vegetation to be cleared with high fauna habitat value in accordance with relevant approvals. The proposed measure is designed to provide a mechanism that protects threatened fauna species from direct impacts during vegetation clearing and minimise indirect impacts through relocation of suitable habitat as detailed in <b>Table 6.3</b> .
Expected Effectiveness	It is expected that pre-clearance surveys will be effective at identifying potential habitat for threatened species and trigger (where necessary) the appropriate actions outlined within the <i>Landscape Management Plan</i> .
Threshold for Corrective Actions	Identification of threatened species or habitat for threatened species during clearing activities.
Corrective Actions	Should any threatened species or habitat for threatened species be located during clearing, appropriate impact management measures will be undertaken in accordance with the <i>Landscape Management Plan</i> .
Responsibility for Implementation	Mt Owen Pty Limited.

**Table 6.3 – Clearing Supervision**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Objective	To ensure that vegetation removal is undertaken in an ecologically sound manner to minimise the impact to threatened species or ecological communities.
Phase	Prior to/during construction of mine infrastructure or disturbance areas.
Methodology for Implementation	Where practical, clearing within woodland communities should be timed to avoid more sensitive breeding, torpor and dispersal periods of the year (particularly winter and spring). Any fauna captured during clearing will be relocated to a suitable vegetation community in proximity to the cleared area in accordance with existing procedures in the <i>Landscape Management Plan</i> .
Justification of Location and Design	To be undertaken in areas of vegetation that have high fauna habitat value, as identified during the pre-clearance survey. The proposed measure is designed to provide a mechanism that protects threatened fauna species from direct impacts during vegetation clearing.
Expected Effectiveness	It is expected that clearing supervision is effective at minimising unexpected impacts on threatened species through identification and appropriate management.
Threshold for Corrective Actions	If suspected threatened habitats or flora or fauna species are encountered during clearing the actions outlined above will be implemented.  Where it is not practical to avoid clearance during sensitive breeding, torpor and dispersal periods, the pre-clearance survey would minimise potential impacts (refer to <b>Table 6.2</b> ).
Corrective Actions	In the event that high value fauna habitats are identified during clearing, the pre-clearance survey will be implemented prior to further vegetation clearing to identify the risks to threatened species or ecological communities during the proposed clearing process.
Responsibility for Implementation	Mt Owen Pty Limited.

**Table 6.4 – Habitat Augmentation Works**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Objective	To provide additional habitat resources in nearby woodland within Mt Owen landholdings for hollow-dependent species potentially displaced during the clearing of vegetation.
Phase	During and after construction, during operation, decommissioning and rehabilitation.

**Table 6.4 – Habitat Augmentation Works (cont.)**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Methodology for Implementation	<p>Habitat augmentation will involve the installation of nest boxes and salvaged hollows and logs, where practicable and reasonable.</p> <p><b><u>Nest Boxes</u></b></p> <ul style="list-style-type: none"> <li>• nest boxes will be appropriately designed for targeted threatened species and recorded non-threatened species;</li> <li>• all nest boxes will be constructed out of marine grade plywood or other similar suitably durable material;</li> <li>• a variety of nest box designs will be used;</li> <li>• nest boxes will be appropriately positioned within the landscape and within trees;</li> <li>• all nest boxes will be subject to appropriate, regular maintenance of their structural integrity and attachment; and</li> <li>• all nest boxes will be monitored for nest box condition and function, and every two to five years to assess nest box utilisation patterns (and cleared if feral species are present).</li> </ul> <p>Nest boxes will be placed in non-impacted woodland areas in the Mt Owen Complex and mine rehabilitation when such areas are of sufficient maturity. The number and types of nest boxes to be established will be based on the objective of replacing suitable hollows for the hollow-dependent threatened species removed during the clearing of vegetation. The number of nest boxes required will be determined during felling inspections.</p> <p><b><u>Salvaged Hollows</u></b></p> <p>Wherever suitable tree hollows (appropriate size, weight and condition) are encountered during tree felling inspections, and on the advice of a qualified person, reasonable efforts will be made to salvage the hollows for relocation. This approach will ensure the optimal re-use of existing habitat resources and, combined with nest box establishment, will address the loss of nesting and roosting habitat within the Referral Area.</p> <p>Salvaged and re-erected hollows will be subject to the same levels of maintenance and monitoring as nest boxes outlined above.</p> <p><b><u>Salvaged Logs</u></b></p> <p>The salvage and relocation of hollow logs, fallen timber and boulders will be undertaken wherever possible to provide additional denning resources for the spotted-tailed quoll. Such features can be selectively placed within the non-impacted remnant woodland areas in the Project Area where these resources may occur in low abundance.</p>
Justification of Location and Design	In general terms habitat augmentation will be undertaken in the Stringybark Creek Habitat Corridor. This proposed measure is designed to provide compensatory habitat in surrounding areas relative to that disturbed by the Proposed Action.
Expected Effectiveness	It is expected that the habitat augmentation will be effective in providing additional fauna habitat in nearby woodlands.
Threshold for Corrective Actions	The availability of the supplementary habitat is affected through loss of nest box functionality, as identified during monitoring program (refer to <b>Table 6.5</b> ).
Corrective Actions	Revision of habitat augmentation methods as informed by monitoring program, including replacement of nest boxes as required.
Responsibility for Implementation	Mt Owen Pty Limited.



**Table 6.5 – Vegetation and Habitat Enhancement Monitoring and Maintenance**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Objective	To monitor and maintain the vegetation and habitat enhancement areas within the proposed offset sites.
Phase	During and after construction, during operation, decommissioning and rehabilitation.
Methodology for Implementation	The vegetation and habitat enhancement areas will be monitored on a regular basis as part of the biodiversity monitoring program (contained within the revised <i>Landscape Management Plan</i> ). The monitoring will involve the collection of semi-quantitative, plot based, floristic data at fixed locations within the vegetation and habitat enhancement areas on an annual basis which will be compared to reference vegetation communities and fauna habitats.
Justification of Location and Design	The location and design of the vegetation and habitat enhancement monitoring and maintenance is such that it fulfils the objective listed above. This measure is proposed to provide ongoing information as to the effectiveness of the implementation of vegetation and habitat enhancement measures throughout the life of the Proposed Action.
Expected Effectiveness	It is expected that the vegetation and habitat enhancement monitoring and maintenance will provide information to measure and assess the effectiveness of providing additional fauna habitat in proposed offset sites over the life of the Proposed Action.
Threshold for Corrective Actions	Failure of vegetation and habitat enhancement areas to provide additional habitat areas as identified during monitoring as informed by regular ongoing monitoring.
Corrective Actions	A revision of vegetation and habitat augmentation monitoring frequency. Maintenance will be undertaken on an as needed basis as indicated by the monitoring process.
Responsibility for Implementation	Mt Owen Pty Limited.

**Table 6.6 – Weed Management**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Objective	Weed control is undertaken to limit the spread and colonisation of noxious weeds, while also reducing the density of current infestations, and also to minimise potential competition with areas of establishing native vegetation.
Phase	Before, during and after construction, during operation, decommissioning and rehabilitation.
Methodology for Implementation	<p>Weed control methods include:</p> <ul style="list-style-type: none"> <li>• management of topsoil stockpiles to limit weed proliferation and spread when stockpiled soil is used in rehabilitation areas;</li> <li>• limiting vehicle access to rehabilitated areas and offset sites;</li> <li>• washing down of all vehicles and equipment that have been operating in areas infested with noxious weeds;</li> <li>• use of established tracks;</li> <li>• chemical spraying and/or basal bark application with approved herbicides suitable for the target species; and</li> <li>• physical removal by manual chipping.</li> </ul> <p>Noxious weed species are controlled onsite, by either manual removal or by spraying.</p>

**Table 6.6 – Weed Management (cont.)**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Justification of Location and Design	Weed management measures are designed and implemented on an as needs basis and tailored to suit the species being managed and the extent of the outbreak.
Expected Effectiveness	It is expected that the weed management measures will keep weed densities at a level equivalent to the surrounding area to reduce the likelihood of invasive weed species colonising areas proposed for regeneration.
Threshold for Corrective Actions	Weed management actions are taken if declared noxious weed species occur and/or noxious weeds persistently occur at densities exceeding that observed in surrounding areas. In order to reduce the spread of invasive weeds, management of new infestations will be prioritised over existing dense infestations. Intervention prior to the long term establishment of a weed infestation is considered the most effective method for limiting the spread of weed species.
Corrective Actions	Weed management actions will be taken in accordance with the methods listed above as informed by regular monitoring and observations of site and surrounding areas.
Responsibility for Implementation	Mt Owen Pty Limited.

**Table 6.7 – Feral Animal Management**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Objective	Feral animal control is undertaken to limit the spread and colonisation of feral animals. Control of feral animals is a legal obligation for all landholders under the <i>Rural Lands Protection Act 1989</i> . Their control is a necessary practice in the rehabilitation of disturbed areas and in proposed offset sites.
Phase	Before, during and after construction, during operation, decommissioning and rehabilitation. Control of feral animals is undertaken on an as needs basis.
Methodology for Implementation	Mt Owen Mine conducts control programs for feral cats, rabbits, hares, pigs and foxes onsite as needed.
Justification of Location and Design	The location and design of the action depends on the target species. Feral animal control is documented in consultation with relevant NSW Government Department associated with legal obligations for feral animal control.
Expected Effectiveness	It is expected that the feral animal control measures will keep pest species at a moderate level, in line with that reported in adjacent agricultural areas.
Threshold for Corrective Actions	Additional feral animal management actions will be undertaken if the above control measures result in feral animal species reaching moderate to high densities across the Mt Owen site and proposed offset areas.
Corrective Actions	Feral animal management actions will be undertaken in accordance with the methods described above. The specific actions to be implemented will be dependent on target feral animal species.
Responsibility for Implementation	Mt Owen Pty Limited.

**Table 6.8 – Rehabilitation Management**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Objective	To establish a self-sustaining ecosystem commensurate with the agreed rehabilitation objectives and post mining land use.
Phase	During and after construction, during operation, decommissioning and rehabilitation.
Methodology for Implementation	<p><u>Pre-closure</u></p> <ul style="list-style-type: none"> <li>Continue to implement the current management and operating procedures for the preservation and augmentation of native flora and fauna (refer to <b>Tables 6.2 to 6.4</b>).</li> <li>Continue with progressive rehabilitation (where appropriate) to ensure that the final landform and vegetation have the longest possible amount of time to stabilise and establish prior to mine closure.</li> <li>Establish methods for assessing rehabilitation success.</li> </ul> <p><u>Closure and Post closure</u></p> <ul style="list-style-type: none"> <li>Select rehabilitation sites suitable for monitoring against completion criteria approved in accordance with NSW government processes.</li> <li>Continue to implement the biodiversity monitoring and reporting program as needed.</li> <li>Based on the results of the monitoring program: <ul style="list-style-type: none"> <li>Identify weed/pest animal risk areas on newly rehabilitated sites; and</li> <li>Undertake ongoing weed/pest animal control as required.</li> </ul> </li> </ul>
Justification of Location and Design	The location and design of the rehabilitation is such that it fulfils the agreed rehabilitation objectives and post mining land use.
Expected Effectiveness	It is expected that the rehabilitation will be effective in establishing self-sustaining areas of native vegetation commensurate with the agreed rehabilitation objectives and post mining land use.
Threshold for Corrective Actions	Monitoring results indicate that rehabilitation has not or is unlikely to reach target thresholds as indicated by the rehabilitation criteria.
Corrective Actions	Based on the results of monitoring, additional rehabilitation activities undertaken to improve rehabilitation outcomes.
Responsibility for Implementation	Mt Owen Pty Limited.

**Table 6.9 – Biodiversity Monitoring and Reporting**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Objective	To identify and quantify ongoing environmental impacts that may occur both on and off site.
Phase	Before, during and after construction, during operation, decommissioning and rehabilitation.
Methodology for Implementation	The monitoring and reporting program is designed to measure the effectiveness of control measures and ensure compliance with consent, relevant standards and corporate requirements. Biodiversity monitoring will be conducted as part of the existing monitoring program, where fauna species and rehabilitation sites and reference sites are monitored annually. These results will be utilised as an indicator as to whether more extensive monitoring is required. Results of monitoring will be reviewed to identify where improvements are required in design works, annual rehabilitation plans or where maintenance is required to existing rehabilitation.

**Table 6.9 – Biodiversity Monitoring and Reporting (cont.)**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Justification of Location and Design	Undertaken in areas of remnant vegetation and native vegetation re-establishment within the proposed offset sites to build on existing monitoring requirements.
Expected Effectiveness	It is expected that the biodiversity monitoring and reporting is effective at documenting the ecological characteristics of the proposed offset sites and identifying areas where intervention (e.g. weed management, erosion controls) may be required.
Threshold for Corrective Actions	Based on the outcomes of the monitoring program.
Corrective Actions	The monitoring program is reviewed on an annual basis.
Responsibility for Implementation	Mt Owen Pty Limited.

**Table 6.10 – Threatened Species Adaptive Management**

<b>Mitigation Component</b>	<b>Mitigation Details</b>
Objective	To be able to adapt to unexpected occurrences of threatened species within the Referral Area.
Phase	During and after construction, during operation, decommissioning and rehabilitation.
Methodology for Implementation	Adaptive management will be initiated as required and will be initiated when any new species is encountered in the Referral Area. The adaptive management actions will be based on best practice procedures and undertaken in consultation with the DoE as required.
Justification of Location and Design	The location and design of the adaptive management action is such that it fulfils the objective listed above.
Expected Effectiveness	It is expected that adaptive management will be effective in providing management actions for any unexpected occurrences of threatened species.
Threshold for Corrective Actions	An unexpected threatened species occurs in the Referral Area and impacts occur to its habitat or to individuals of the species.
Corrective Actions	Revision of adaptive management methods as informed by regular monitoring (refer to <b>Table 6.9</b> ).
Responsibility for Implementation	Mt Owen Pty Limited.

The detailed approach to the continuing management and monitoring of the Biodiversity Offset Areas will be documented in the *Landscape Management Plan*. The *Landscape Management Plan* will be revised within 12 months of the Proposed Action approval and will be updated to incorporate the proposed additional impact mitigation and biodiversity management commitments as outlined above. The revised and consolidated *Landscape Management Plan* will be submitted for approval by DP&E and DoE and will include provisions for independent environmental auditing



## 6.6 Agency Responsible for Endorsement

The NSW DP&E and Commonwealth DoE will be responsible for endorsing the mitigation strategy and monitoring programs on approval of the Proposed Action. It is proposed that the mitigation measures will be included in an updated *Landscape Management Plan* which is expected to be provided to the DP&E and DoE within 12 months of approval for review and endorsement and will cover both state and Commonwealth requirements.

## 6.7 Mitigation Measures Proposed by State or local Government, or the Proponent

Key impact mitigation strategies are identified in **Section 6.5** above and will be detailed in the updated *Landscape Management Plan*. These will include strategies to guide mine rehabilitation with the aim of creating self sustaining communities characteristic of extant vegetation communities, fauna habitat augmentation, targeted passive and active regeneration of currently degraded vegetation communities, specific strategies to protect the spotted-tailed quoll (*Dasyurus maculatus maculatus*), strategies to protect threatened woodland dependent species, and general impact mitigation strategies such as sediment and erosion control, weed and feral animal control and bushfire management. These strategies are documented in Section 6.0 of the Ecological Assessment (refer to Appendix 11 of the EIS) and will be fully detailed in the amended *Landscape Management Plan*. The responsibility for the implementation of these management and mitigation strategies will be wholly Mt Owen's, and the implementation of these strategies do not rely on any other entity nor is it anticipated that any further mitigation measures would be implemented by any other entity.

## 6.8 Changes to the Proposed Action which Prevent/Minimise Impacts

Mt Owen has sought to avoid and minimise potential impacts on the ecological values of the Referral Area throughout the project design and planning process. This has included avoidance and minimisation of disturbance of key vegetation communities and fauna habitats. These avoidance measures are described in detail in Section 5.1 of the Ecological Assessment (refer to Appendix 11 of the EIS).

## 7.0 Offsets

**8. Where impacts cannot be avoided or mitigated, an offset package to compensate for any predicted or potential residual significant impacts on matters of national environmental significance. Offsets should demonstrate consistency with the Commonwealth EPBC Act Environmental Offsets Policy (October 2012, or subsequent versions), available at: [www.environment.gov.au/epbc/publications/environmental-offsets-policy.html](http://www.environment.gov.au/epbc/publications/environmental-offsets-policy.html). The department's information requirements in relation to EPBC Act offset proposals is provided at Appendix B. Information must include:**

**a) the description of any offset package should include how the offset compensates for the residual impacts, when the offset will be delivered and how the offset will be managed**

Appendix B of the Supplementary DGRs outlines additional requirements in relation to the Biodiversity Offset Strategy, as listed below.

- **Details in relation to the proposed offsets package, including:**
  - **the location and size, in hectares, of any offset site(s)**
  - **maps clearly showing for each offset site:**
    - **the relevant ecological features**
    - **the landscape context, and**
    - **the cadastre boundary**
  - **the current tenure arrangements (including zoning and ownership) of any proposed offset sites**
  - **confirmed records of presence (or otherwise) of relevant protected matter(s) on the offset site(s), and**
  - **detailed information regarding the presence and quality of habitat for relevant protected matter(s) on the offset site. The quality of habitat should be assessed in a manner consistent with the approach outlined in the document titled *How to use the offset assessment guide* available at: [www.environment.gov.au/epbc/publications/environmental-offsets-policy.html](http://www.environment.gov.au/epbc/publications/environmental-offsets-policy.html).**

### 7.1 Description of the Offset

A Biodiversity Offset Strategy is proposed to compensate for residual impacts on those species, vegetation communities and ecological features that are likely to be, or could potentially be, significantly impacted by the Proposed Action at both the State and Commonwealth level. The Biodiversity Offset Strategy compensates for these residual impacts by using direct land-based offset sites with the inclusion of vegetation regeneration and on-site rehabilitation.

The objectives of the Biodiversity Offset Strategy are to:

- maintain or improve the terrestrial and aquatic biodiversity values of the region in the medium to long term;
- identify land-based offsets that contain as many as possible of the threatened species impacted by the Proposed Action;

- identify land-based offsets that are strategically located;
- identify land-based offsets in which an environmental gain can be made via appropriate management strategies;
- provide for the long term conservation of offsets;
- to develop a management strategy for the proactive environmental management of the proposed offset sites, but with appropriate consideration of the existing rural nature of the area;
- as a minimum provide a suite of offsets (land-based) that have ecological value similar to the residual impacts of the Proposed Action on threatened flora species and threatened fauna species; and
- demonstrate how the strategy would be integrated with the Upper Hunter Strategic Assessment process.

The key components of the Biodiversity Offset Strategy include the following land-based components:

- Cross Creek Offset Site;
- Esparanga Offset Site;
- Stringybark Creek Habitat Corridor; and
- on-site mine rehabilitation.

Sections 7.3 and 7.4 of the Ecological Assessment (refer to Appendix 11 of the EIS) provide a detailed description of each of the proposed land-based offset sites including the vegetation communities and fauna habitats mapped in each offset area and the range of threatened species and TECs recorded or considered likely to occur. A summary of the ecological and strategic biodiversity values of each land-based offset is provided below.

Two general areas provide the focus of the strategic offset approach being undertaken by Glencore, being the Manobalai Offset Cluster and Mt Owen Offset Cluster. Of key importance is the location of these offset clusters in relation to key landscape features such as adjoining vegetation remnants, National Parks, Crown Land, Government Initiatives (such as the Great Eastern Ranges Initiative), and other Glencore managed offset areas.

The existing offset areas are private freehold land owned by Glencore. It is proposed that these offsets would be secured in perpetuity. Mt Owen will continue to consult with DP&E to identify appropriate mechanisms for the security of the offsets.

### **Cross Creek Offset Site**

Cross Creek Offset Site is a long-term conservation area located adjacent to existing Mt Owen Biodiversity Offset Areas (refer to **Figure 7.1**). The Cross Creek Offset Site contains a total area of 367 hectares, of which 51.7 hectares comprises Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC listed under the TSC Act. The remaining area of the property, approximately 315.3 hectares, comprises native grassland, which is likely to have once supported Central Hunter Ironbark – Spotted Gum – Grey Box Forest. Most of the grassland areas are likely to naturally regenerate into a functional woodland ecosystem over time, with the strategic management of stock on the property. Some active management is likely to be required to regenerate the Cross Creek Offset Site into a woodland community



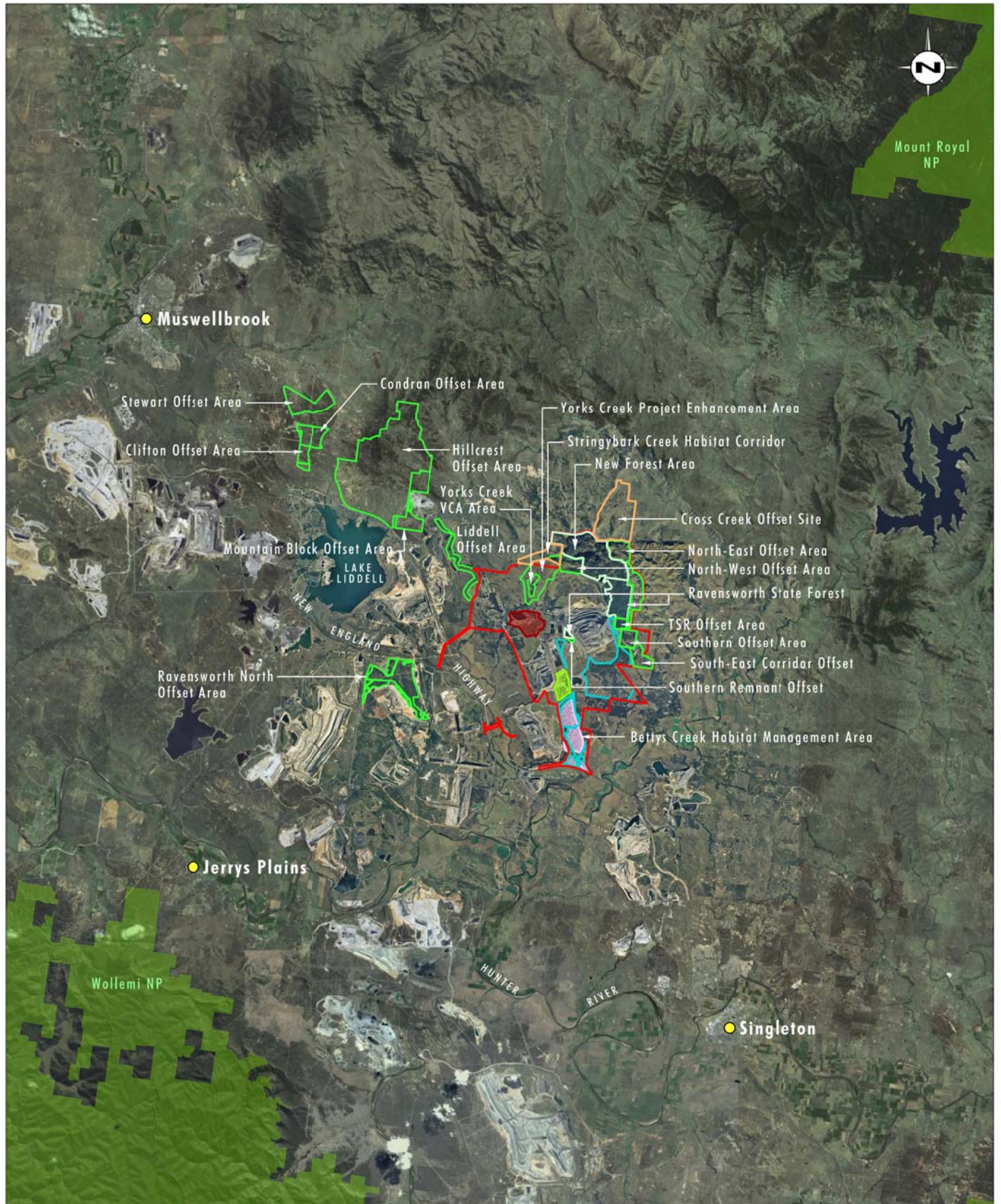


Image Source: AAM (2013), Mount Owen (2012-2013), Google Earth (2008)  
Data Source: Mount Owen (2014), Department of Lands (2013)

0 2.5 5.0 10. km  
1:250 000

### Legend

- ▬ Project Area
- ▬ Referral Area
- ▬ Proposed RERR Mining Area
- ▬ Bayswater North Pit
- ▬ Approved Glencore Offsets
- ▬ Proposed Mount Owen Offsets
- ▬ Bettys Creek Habitat Management Area
- ▬ Ravensworth State Forest
- ▬ National Park

FIGURE 7.1

Strategic Location of Cross Creek Offset Site  
in the Mount Owen Offset Cluster



due to the high level of clearing for agricultural purposes the property has been subject to. The regeneration of the woodland community would provide a significant environmental gain as an outcome of offsetting for the Proposed Action, balanced with the immediate outcome of protecting 51.7 hectares of Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC, a community that will be potentially significantly impacted by the Project at the State level. The provision of a ‘like for like’ offset, i.e. offsetting the vegetation type impacted with the same vegetation type, is a key outcome of the inclusion of the Cross Creek Offset Site in the Biodiversity Offset Strategy.

Although much of the vegetation is relatively young and hollow-bearing trees are present only in low abundance, the general health of the vegetation is good and the diversity and abundance of introduced flora species is generally low. The grassland community contains a relatively high diversity of native flora species and these areas are considered likely to regenerate into Central Hunter Ironbark – Spotted Gum – Grey Box Forest, provided grazing and other pressures, are minimised. The ongoing regeneration of the Cross Creek Offset Site will allow hollow-dependent fauna species to colonise from adjacent Biodiversity Offset Areas once the vegetation is mature enough for populations of these species. This will result in a substantial gain for hollow-dependent fauna species in the central Hunter Valley, especially as hollow-bearing trees are a limiting resource in the local area due to the long history of vegetation clearance for agriculture and the time required for mature trees to develop tree hollows.

The Cross Creek Offset Site also provides a direct, ‘like for like’ land-based offset for three threatened species that are potentially significantly impacted by the Project and for an additional cave-roosting threatened bat that will also be impacted through the loss of foraging habitat (although not significantly) as a result of the Project.

The site is strategically located in the vicinity of a number of existing and proposed Glencore biodiversity offset areas.

### Esparanga Offset Site

The Esparanga Offset Site is a 303 hectare property located in the Manobalai region (refer to **Figure 7.2**). This Esparanga Offset Site adjoins Manobalai Nature Reserve in a priority conservation area located in the Great Eastern Ranges Initiative corridor and the Upper Hunter Strategic Assessment priority areas and provides high conservation value vegetation communities and ‘like for like’ threatened fauna habitat.

The inclusion of the Esparanga Offset Site as part of the Biodiversity Offset Strategy is of strategic benefit as securing privately owned land in this corridor for conservation purposes is a major conservation priority for the NSW Government.

The Esparanga Offset Site provides a direct, ‘like-for-like’ offset for the vast majority of the fauna species that are expected to be impacted by the Proposed Action, including the squirrel glider and the spotted-tailed quoll. The Esparanga Offset Site also provides substantial high quality habitat for woodland dependent bird and bat species and provides a range of additional high conservation value attributes such as potential roost sites for cave roosting bats and a known record of the tiger orchid (*Cymbidium canaliculatum*) endangered population (EP) in the Hunter Valley.

High quality vegetation communities have been recorded in the Esparanga Offset Site that will result in the conservation of high conservation priority communities as a result of the Proposed Action.

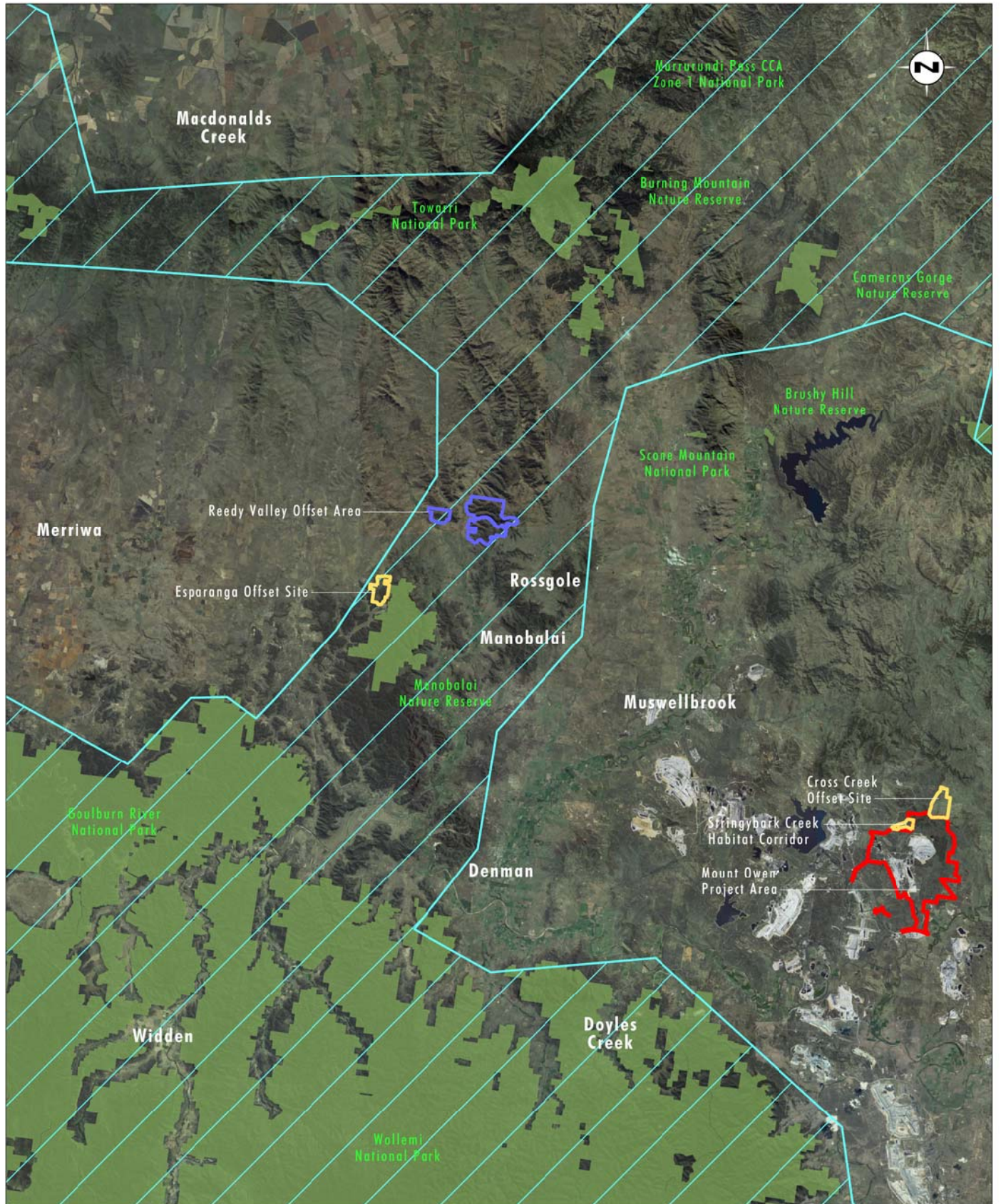


Image Source: Google Earth (2004)  
Data Source: Mount Owen (2014), DECC (2008), Department of Lands (2009)

0 5.0 15.0 30.0 km  
1:500 000

### Legend

- Project Area
- Proposed Mount Owen Offsets
- Bulga Offset Area
- National Parks and Reserves
- Great Eastern Ranges Conservation Corridor Initiative

File Name (A4): R12/3109\_958.dgn  
20140822 13.46

FIGURE 7.2

Strategic Location of the Esperanga Offset Site  
in the Glencore Manabalai Offset Cluster



Opportunity also exists at the Esparanga Offset Site for environmental gain initiatives, including the regeneration of approximately 90 hectares of Derived Native Grassland habitat, 137 hectares of which conforms to the very high conservation value White Box Woodland and Derived Native Grassland EEC and CEEC (refer to Sections 7.3.5.3 and 7.5.3.4 of the Ecological Assessment, Appendix 11 of the EIS).

### **Stringybark Creek Habitat Corridor Establishment**

Stringybark Creek Habitat Corridor regeneration strategy will provide a 97.5 hectare corridor that strategically increases linkages with existing high quality habitat associated with the existing Mt Owen Biodiversity Offset areas and Ravensworth State Forest with adjacent corridors and proposed conservation areas at Glencore's Liddell Operations to the west of the Referral Area (refer to **Figure 7.1**). The Stringybark Creek Habitat Corridor includes key commitments relating to the establishment of spotted-tailed quoll habitat.

Stringybark Creek was identified as a priority restoration area for the Proposed Action due to the presence of a degraded riparian corridor that could provide a linkage for the spotted-tailed quoll between areas of known habitat along Bowmans Creek proposed for in-perpetuity conservation as part of the Liddell Biodiversity Offset Strategy (Umwelt 2013) and existing Mt Owen Biodiversity Offset Areas. It is proposed to reinstate woodland communities within the Derived Native Grassland communities of the Habitat Corridor with the proposed restoration/regeneration works expected to facilitate the movement of spotted-tailed quoll individuals within the local population of the species across the broader landscape and aid in dispersal of juveniles.

The Stringybark Creek Habitat Corridor currently provides approximately 35.8 hectares of moderate quality spotted-tailed quoll woodland/forest habitat that generally occurs on slopes adjacent to the existing Mt Owen Biodiversity Offset Areas, along with 58.8 hectares of derived native grassland habitat that the species may use as it moves across the landscape. In accordance with the known habitat preferences of the species, it is expected to utilise the woodland/forest and Derived Native Grassland communities along Stringybark Creek. The in-perpetuity conservation of the Stringybark Creek Habitat Corridor will ensure that an additional area (58.8 hectares) of preferred movement habitat (that is riparian corridors) for the species are regenerated/restored and managed for the species in the long term.

In addition to the stated objective of spotted-tail quoll habitat restoration, the proposed regeneration of Derived Native Grassland communities within the Corridor to woodland commensurate with the state listed Central Hunter Ironbark - Spotted Gum – Grey Box Forest EEC will also positively benefit many of the state listed threatened species and vegetation communities that are likely to be impacted as a result of the Proposed Action, including Central Hunter Ironbark - Spotted Gum – Grey Box Forest EEC, threatened woodland birds and micro-bats, threatened arboreal fauna including the squirrel glider (*Petaurus norfolcensis*) and the brush-tailed phascogale (*Phascogale tapoatafa*) and the masked owl (*Tyto novaehollandiae*).

### **On-site Mine Rehabilitation**

Mount Owen has committed to undertaking a final landform rehabilitation strategy to mitigate the impacts that would occur as a result of the Proposed Action. On-site mine rehabilitation comprises key commitments to native vegetation community re-establishment and fauna habitat augmentation. Section 7.6 of the Ecological Assessment (refer to Appendix 11 of the EIS) provides further details on the contribution of on-site rehabilitation across the Referral Area to mitigate the impacts that would occur as a result of the Proposed Action. The rehabilitation of post-mining areas is predicted to provide a long-term benefit to the ecological values of the Referral Area and wider locality.

The Biodiversity Offset Strategy has been prepared with consideration of the EPBC Act Environmental Offsets Policy. The Biodiversity Offset sites will be secured for long-term conservation and Mt Owen envisages that all three land-based offset sites will be managed in a manner consistent with the existing Mt Owen Biodiversity Offset Areas. The proposed offsets will be provided immediately at the commencement of the Proposed Action and the measures proposed to improve the quality of the offsets will be conducted over a 20 year period. This is further detailed in Section 7.0 of the Ecological Assessment (refer to Appendix 11 of the EIS).

As part of the Ecological Assessment (Section 7.8.2 of Appendix 11 of the EIS) a detailed analysis of the adequacy of the proposed Biodiversity Offset Strategy in accordance with the Environmental Offsets Policy (DSEWPC 2012a) was undertaken.

The analysis, presented below, demonstrates that the proposed Biodiversity Offset Strategy provides an adequate and appropriate strategy to offset the residual impacts of the Proposed Action on listed threatened and migratory species. Mt Owen proposes to manage the proposed offsets in a manner consistent with the management strategy for its existing biodiversity offset sites as specified in the approved *Mt Owen Flora and Fauna Management Plan* (2006). Mt Owen proposes to update the existing Flora and Fauna Management Plan and revise and consolidate the current *Landscape Management Plan* that will include commitments proposed as part of the current Proposed Action and also those commitments made in previous approvals.

**1. Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter.**

The Biodiversity Offset Strategy has been developed with the aim to maintain or improve the biodiversity values of the surrounding region in the medium to long term. With the various impact mitigation and offset strategies to be employed as part of the Proposed Action, it is likely that such an improvement will occur, particularly given that the three land-based offset components are strategically located adjacent to or close to existing conservation reserves and biodiversity offset areas. The Biodiversity Offset Strategy also includes substantial commitments to habitat restoration and regeneration resulting in an increase in woodland and forest habitats and key threatened species habitats in the long term.

The Biodiversity Offset Sites will be secured for long-term conservation. The mechanism for securing this conservation will be determined in consultation with the relevant government agencies. Currently Mt Owen envisages that all three sites would be managed in accordance with the requirements for existing Mt Owen Biodiversity Offset Areas.

**2. Suitable offsets must be built around direct offsets but may include other compensatory measures.**

The Biodiversity Offset Strategy is based on the use of direct land-based offsets that occur within the Hunter Region. The Biodiversity Offset Strategy will result in the long-term conservation of 768 hectares. The Biodiversity Offset Strategy does not propose any additional compensatory measures.

**3. Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter.**

The level of statutory protection that applies to the significantly, or potentially significantly impacted MNES was considered during project planning to ensure that adequate offsets were obtained, commensurate with the status of the threatened or migratory species. The result is a suitable biodiversity offset for impacted species.



#### **4. Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter.**

Section 5.6 and Tables 7.2, 7.13, 7.14 and 7.15 of the Ecological Assessment (Appendix 11 of the EIS) concisely document the area of impact on MNES, together with the relevant ecological features within each offset that is proposed for each MNES. These show that the Biodiversity Offset Strategy is at least commensurate with the magnitude of impacts and delivers a 'like for like' outcome. Additionally, the results of the EPBC Act Offsets Calculator show that the proposed Biodiversity Offset Strategy exceeds the 100 percent direct offset requirement for significantly impacted species listed under the EPBC Act. As stated previously, it is envisaged that the Biodiversity Offset Strategy will deliver net biodiversity gains in the medium and long term.

#### **5. Suitable offsets must effectively account for and manage the risks of the offset not succeeding.**

The Biodiversity Offset Strategy is based on the use of direct land-based offsets that occur within the Hunter Region. The land-based offset sites have been determined to provide known habitat for those species that are affected by the Proposed Action, rather than potential habitat, thereby reducing the risk that habitat utilisation of the offset sites will be limited by unmeasured factors.

Additionally, a positive feedback loop between monitoring and adaptive management of the land-based offset sites will be established. Thresholds for key monitoring parameters will be proposed, together with trigger points or threshold exceedance levels to ensure that there are clear points at which a review of the monitoring and management approach is enacted. The management of the ecological components of the Proposed Action will be responsive to any new ecological data that may arise through the ecological monitoring of the Biodiversity Offset Sites, or any other studies completed.

#### **6. Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs.**

As discussed above, the land-based offsets proposed as part of the Proposed Action do not overlap with any other government funded protection or habitat restoration program. All offset sites are located on currently non-reserved land and will add a significant area into the reserve system.

#### **7. Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable.**

The Biodiversity Offset Strategy allows for the up-front protection and pro-active conservation management of the Biodiversity Offset Areas, to provide immediate compensation for loss of habitat from the Referral Area. Each of the land-based offset components of the Biodiversity Offset Strategy has been secured on land wholly owned by Glencore as offset sites prior to the approval. It is anticipated that for all three land-based components, a single *Landscape Management Plan* will be prepared following approval, restoration would be undertaken, and the offset sites would be conserved under an appropriate conservation mechanism that will be determined in consultation with relevant authorities.

The area of impact has been derived from detailed GIS mapping of project boundaries and impact areas, and the ecological survey, mapping, impact assessments and design of the Biodiversity Offset Strategy have been completed by qualified ecologists with considerable experience in the region ensuring that the Biodiversity Offset Strategy is scientifically robust, transparent and reasonable.

## **8. Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced**

As the Biodiversity Offset Strategy is being proposed as an integral component of the Proposed Action, it is expected that the commitments in this strategy will be included within the project approval conditions, and any other legally binding consents. Section 8.0 of the Ecological Assessment (Appendix 11 of the EIS) documents the elements that will be included in detailed monitoring programs for each offset component, and it is anticipated that regular auditing of offset sites will be undertaken.

## **7.2 Impact of Offsets**

### ***b) an assessment of the impact of the offsets on other matters of environmental, economic, or social significance and***

The land proposed for biodiversity offsets is owned by Glencore and is currently used for low intensity agricultural purposes. The provision of this land as biodiversity offsets will require the development and implementation of a controlled grazing program, which will provide for controlled grazing where considered practicable and where it will not compromise desired ecological outcomes. This will assist with management of fuel loads and reduce competition from pasture grasses.

The potential impact of the Proposed Action on existing agricultural enterprises and potential agricultural productivity of the proposed offset areas was investigated as part of the Proposed Action. The agricultural resources (landforms, land and soil capability, access to water, etc) of the three biodiversity offset sites included as part of the Proposed Action will not be substantially impacted as the potential land use change involves passive regeneration of native vegetation with no change to soils, landform or water resources.

Land in the proposed offset areas is recognised to have high biodiversity value and high potential to enhance biodiversity value. On the basis of current government policy to protect remaining areas of EECs and other high biodiversity value aspects of the landscape, the biodiversity value of these properties is considered greater than the agricultural value. Use of the land for biodiversity conservation does not change its underlying agricultural resource value. Terrain, soil, water and water access will remain the same as now.

As Glencore currently already owns each of the three proposed offset areas, the establishment of the offset areas would not result in the relocation of any existing private landholders and accordingly no adverse social impacts are anticipated. The establishment of the Biodiversity Offset Strategy is not expected to result in adverse impacts on other matters of environmental, economic or social significance.

***Provide information regarding how the proposed offsets package is additional to what is already required, as determined by law or planning regulations, agreed to under other schemes or programs or required under an existing duty-of-care***

There are no existing laws, conservation management requirements, planning regulations or existing duty-of-care that applies across the Esparanga Offset Site, Cross Creek Offset Site or the Stringybark Creek Habitat Corridor.

**The overall cost of the proposed offsets package; including costs associated with, but not limited to:**

- **acquisition and transfer of lands/property**

All of the proposed Biodiversity Offset Sites were purchased as they became available on the property market and are owned by Glencore and property acquisition and transfer is therefore not required.

- **Implementation of all related management actions, and**

**Table 6.1** presents all management actions and a conceptual cost estimate of each management action. The conceptual cost estimate provides an indicative assessment of the capital requirements for the implementation of works at the Cross Creek and Esparanga Offset Sites and the Stringybark Creek Habitat Corridor, which will be further refined through the development of detailed management actions (within the revised *Landscape Management Plan*) and as informed by ongoing monitoring. As outlined in **Table 6.1**, a contingency factor has been applied to the conceptual cost estimate for management actions. Glencore commit to the provisioning of adequate resources and budget for the implementation of management actions at the proposed offset sites.

In addition to the costs for the management actions outlined in **Table 6.1**, Mt Owen's commitment to rehabilitation of mine areas to native woodland communities and habitat augmentation costs in these areas represents a substantial cost above conventional mine rehabilitation practices.

- **Monitoring, reporting and auditing of offset performance**

**Table 6.1** presents all expected monitoring, reporting and auditing requirements and presents a cost for each. The cost to develop a rehabilitation and ecological monitoring plan and undertake annual surveys and reporting is estimated to be approximately \$500,000 over a 20 year period.

## 7.3 EPBC Offset Assessment Guide

Appendix B of the Supplementary DGRs provides a guide to the information required by the DoE to assess offset proposals. The information requirement relates to the assessment of offset proposals using the EPBC Offset Assessment Guide, including the offset calculator.

An assessment of the offsetting value of the proposed Biodiversity Offset Sites for the MNES identified in the Supplementary DGRs has been undertaken as part of the Ecological Assessment (refer to Appendix 11 of the EIS). This was completed using the Offsets Assessment Guide in the form of a function-embedded excel spreadsheet. The MNES assessed include:

- spotted-tailed quoll (*Dasyurus maculatus maculatus*);
- swift parrot (*Lathamus discolor*);
- regent honeyeater (*Anthochaera phrygia*);
- koala (*Phascolarctos cinereus*);
- green and golden bell frog (*Litoria aurea*);
- large-eared pied bat (*Chalinolobus dwyeri*);

- New Holland mouse (*Pseudomys novaehollandiae*); and
- grey-headed flying-fox (*Pteropus poliocephalus*).

Appendix I of the Ecological Assessment provides a detailed description of the impacts of the Proposed Action and the contribution of each of the proposed biodiversity offset sites to meeting the minimum 90 percent land-based offset, in accordance with the Environmental Offsets Policy (DSEWPC 2012a).

A summary of the presence and quality of habitat for the relevant MNES assessed in a manner consistent with the approach in *How to Use the Offset Assessment Guide* (DSEWPC 2012b) is also provided in Appendix I of the Ecological Assessment (refer to Appendix 11 of the EIS).

### 7.3.1 Summary of Outcomes of EPBC Calculator Assessment

As described in Appendix H, the EPBC Offset Assessment Guide indicates that the Biodiversity Offset Strategy for the Proposed Action provides in excess of 100 percent of the land based offsetting requirements for the predicted impacts of the Proposed Action on the spotted-tailed quoll, swift parrot, regent honeyeater, koala and large-eared pied bat. This exceeds the minimum 90 percent direct offset requirement for these species as specified by the EPBC Offsets Assessment Guide.

The results of the EPBC Offsets Calculator assessment are summarised in **Table 7.1** below and indicate that the proposed land-based offset sites provide a more than adequate offset for the EPBC Act-listed species considered likely to be impacted by the Proposed Action. Refer to Appendix H of the Ecological Assessment for the full assessment.

**Table 7.1 – EPBC Offset Calculator Outcomes for MNES**

Species Assessed by Offset Calculator	Calculated Proportion of Impact Addressed by Offsets			
	Cross Creek Offset Site	Stringybark Creek Habitat Corridor	Esparanga Offset Site	Total Value of Offset Sites
spotted-tailed quoll <i>Dasyurus maculatus maculatus</i> (woodland impacts)	73%	12%	22%	<b>107%</b>
spotted-tailed quoll <i>Dasyurus maculatus maculatus</i> (grassland impacts)	42%	33%	31%	<b>106%</b>
swift parrot <i>Lathamus discolor</i>	130%	31%	69%	<b>230%</b>
regent honeyeater <i>Anthochaera phrygia</i>	129%	30%	59%	<b>218%</b>
koala <i>Phascolarctos cinereus</i>	196%	46%	93%	<b>335%</b>



**Table 7.1 – EPBC Offset Calculator Outcomes for MNES (cont.)**

Species Assessed by Offset Calculator	Calculated Proportion of Impact Addressed by Offsets			
	Cross Creek Offset Site	Stringybark Creek Habitat Corridor	Esparanga Offset Site	Total Value of Offset Sites
large-eared pied bat <i>Chalinolobus dwyeri</i>	155%	40%	110%	<b>305%</b>
New Holland mouse <i>Pseudomys novaehollandiae</i>	733%	159%	437%	<b>1,329%</b>
grey-headed flying-fox <i>Pteropus poliocephalus</i>	86%	23%	46%	<b>155%</b>

Note: Percentage numbers combine woodland and regenerated grassland offsets unless otherwise noted and are rounded to the nearest whole number. Exact calculations are provided in **Appendix H**.

The Offset Calculator generated high values for the grassland areas to be regenerated into eucalypt woodland which is a function of a large increase in habitat quality as Derived Native Grassland areas are managed back to woodland form over a 20 year period. For the swift parrot, regent honeyeater, koala and large-eared pied bat, the return of Derived Native Grassland areas to woodland areas would provide approximately 476 hectares of additional eucalypt-dominated woodland habitat capable of providing suitable foraging habitat in areas within the species' distributions.

The exception for high offset percentages is the spotted-tailed quoll, which is known to also utilise the Derived Native Grassland habitats of the Referral Area. This additional impact substantially increased the impact numbers applicable in the calculator. Two hundred and six percent of the grassland impacts for the species are offset by regenerating grassland to high quality woodland habitats at the offset sites. The residual offset percentages for grassland beyond the required 100 percent were then applied to the shortfall for offsetting woodland impacts, which increased woodland offsets from 49 percent to 107 percent.

The improvement of the habitat quality scores across all sites depends on the active regeneration of eucalypt-dominated woodland vegetation, including targeted revegetation works and replanting of key flora species, which will substantially increase the area of suitable habitat available for these species, as well as improving connectivity between the offset sites and surrounding habitat. It is considered likely that the proposed regeneration and revegetation works will be successful in restoring habitat for target MNES. Mount Owen has successfully restored Central Hunter Ironbark – Spotted Gum – Grey Box Forest EEC within the Project Area through the targeted planting of canopy species within areas of derived native grassland, including within the 430 hectare New Forest Area which has been transferred into State Forest ownership under a conservation zoning. The likely reduction of future habitat quality of the Cross Creek Offset Site and Stringybark Creek Habitat Corridor, without the provision of the offset, is derived from the likely ongoing threats at the sites such as the invasion and establishment of African olive (*Olea europaea* subsp. *cuspidata*) which can result in the suppression of native species growth and regeneration which limits biodiversity and resources for target fauna species. Active management of this species will be a key management factor in maintaining and improving the habitat on these sites as part of the Biodiversity Offset Strategy.

## 8.0 Other Approvals and Conditions

**9. Any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the Proposed Action.**

**Information must include:**

- a. details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the Proposed Action, including:**
  - i. what environmental assessment of the Proposed Action has been, or is being, carried out under the scheme, plan or policy, and**
  - ii. how the scheme provides for the prevention, minimisation and management of any relevant impacts**

### 8.1 Local and State Planning Schemes/Policies

Details of local and State legislation applicable to the Proposed Action has been provided in Section 3.2 of the EIS, and includes discussion regarding the application of these planning provisions to the Proposed Action. Environmental Planning Instruments (EPIs) and Plans considered as part of the assessment process for the Proposed Action are discussed in Section 3.2.2 and 3.2.3 of the EIS and are summarised below in **Table 8.1**. This summary clearly states the environmental assessments carried out to meet the requirement of each EPI and/or Plan, and the purpose of each EPI and Plan with respect to its intent and how each provides for the prevention, minimisation and management of any relevant impacts.

**Table 8.1 – Environmental Planning Instruments and Plans Applicable to the Proposed Action**

<b>Act/Policy/Plan</b>	<b>Purpose</b>	<b>Applicability</b>	<b>Relevant EIS Section</b>	<b>Further Assessment Undertaken?</b>
Singleton Local Environmental Plan (LEP) 2013)	The aim of the Singleton LEP 2013 is to guide planning decisions in Singleton local government area (LGA) through zoning and development controls; thereby managing the ways in which land is used.	Under the Singleton LEP 2013, the Mt Owen Complex is located within an area classified as RU1 Primary Production.  Open cut mining is identified as a development permitted with consent within the RU1 Primary Production zone and the Proposed Action is considered to be consistent with the objectives of the zone.	Section 3.2.2.1	No further assessment required
State Environmental Planning Policy (SEPP) (Mining, Petroleum Production and Extractive Industries) Amendment (Resource Significance) 2013	Part 3 of the Mining SEPP requires specific matters to be considered in relation to development applications for mining development or applications that will affect existing or proposed mining operations. These requirements are detailed in Section 3.2.2.2 of the EIS.	The aims of the Mining SEPP have been a consideration throughout the development of the Proposed Action. Mt Owen's ability to meet these aims is demonstrated in the information presented in Section 5.0 of the EIS.	Section 3.2.2.2	Yes, refer to Section 5.0 of the EIS
SEPP No 33 – Hazardous and Offensive Development	SEPP No. 33 requires the consent authority to consider whether an industrial proposal is a potentially hazardous industry or a potentially offensive industry. A hazard assessment is completed for potentially hazardous development to assist the consent authority to determine acceptability.	The Proposed Action will not result in any changes to the existing Mt Owen Mine which would alter this classification. Therefore no further consideration of SEPP 33 is required.	Refer to Section 3.2.2.3	Yes, refer to Section 5.15 of the EIS
SEPP No 44 – Koala Habitat Protection	SEPP 44 restricts a Council from granting development consent for proposals on land identified as core koala habitat without preparation of a plan of management. Singleton LGA is listed in Schedule 1 of SEPP 44 and therefore the SEPP 44 is relevant to the Action.	An extensive ecological assessment (refer to Section 5.7 and Appendix 11 of the EIS) has been conducted for the Proposed Action and included a koala habitat assessment. The Project Area does not provide core koala habitat. Consequently, the requirement for preparation of a koala plan of management does not apply.	Refer to Section 3.2.2.4	Yes, refer to Section 5.7 and Appendix 9 of the EIS

Table 8.1 – Environmental Planning Instruments and Plans Applicable to the Proposed Action (cont.)

Act/Policy/Plan	Purpose	Applicability	Relevant EIS Section	Further Assessment Undertaken?
SEPP No 55 – Remediation of Land	SEPP 55 aims to provide a state-wide planning approach to the remediation of contaminated land and to reduce the risk of harm to human health and the environment by consideration of contaminated land as part of the planning process. Under SEPP 55, a consent authority must not consent to the carrying out of development on land unless it has considered any potential contamination issues.	There are no contaminated sites currently recorded within the Referral Area, however activities carried out at Mt Owen Complex have the potential to cause contamination if not properly managed. The management of contamination risks is discussed further in Section 5.14 of the EIS. A closure and decommissioning strategy, including a contaminated land management strategy, will be developed as part of decommissioning and closure. This management strategy will incorporate the investigation and remediation of any contaminated land and will be included in any <i>Mining Operations Plan</i> (MOP)/ <i>Rehabilitation and Environmental Management Plan</i> (REMP) submitted to DRE for approval, should the Proposed Action be approved.	Refer to Section 3.2.2.5	Yes, refer to Section 5.14 of the EIS
Upper Hunter Strategic Regional Land Use Plan (SRLUP) 2012	Key to the implementation of the Upper Hunter SRLUP is the assessment of impacts from mining and coal seam gas development on land identified as being strategic agricultural land. There are two types of strategic agricultural land identified in the Upper Hunter SRLUP, Biophysical Strategic Agricultural Land (BSAL) and Critical Industry Clusters.  The Upper Hunter SRLUP also requires all development applications for mining development that is State Significant Development and which would potentially impact on agricultural resources and industries to be accompanied by an Agricultural Impact Statement (AIS).	As discussed in Section 2.1.3 of the EIS, the Proposed Action is located wholly within existing Glencore MLs and therefore the Gateway Process does not apply to the Proposed Action.  An AIS was prepared for the Proposed Action in accordance with the Agricultural Impact Statement Technical Notes (DPI 2013b) and included as Appendix 12 of the EIS.  Each of the issues was considered in the assessment of the Proposed Action's potential environmental impacts and mitigation measures (refer to Sections 5.0 and 6.0 of the EIS). Further, the site verification process determined that there was no BSAL within the Referral Area.	Refer to Section 3.2.3 and Appendix 12 of the EIS	Refer to Section 5.0 and Appendices 5 to 1



## 8.2 State and Commonwealth Approvals

- b. a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the EPBC Act), including any conditions that apply to the action**
- c. a statement identifying any additional approval that is required, and**

If development consent for the Project is granted under Part 4 of the EP&A Act, the approvals which are required for the Project which must not be refused by the relevant authority, and must be substantially consistent with the terms of the development consent, are listed below in **Table 8.2**.

**Table 8.2 – Approvals Legislation to be Applied Consistently with Development Consent**

<b>Act</b>	<b>Approval</b>	<b>Authority</b>
<i>Mine Subsidence Compensation Act 1961</i> (MSC Act)	An approval under section 15 for development within a mine subsidence district.	NSW Mine Subsidence Board (MSB)
<i>Mining Act 1992</i> (Mining Act)	No new mining leases are required for the Project. The <i>Mining Act 1992</i> requires all mining operations to be subject to a <i>Mining Operations Plan</i> (MOP) approved by the Director-General of NSW Trade & Investment, Division of Resources and Energy (DRE). The existing Mining Operations Plan (MOP) will be revised to include the North Pit Continuation area, and associated operations.	DRE
<i>Protection of the Environment Operations Act 1997</i> (POEO Act)	The POEO Act regulates pollution to the environment and requires licences for environmental protection including waste, air, water and noise pollution control. Coal mining and coal works are scheduled activities which require licensing under the POEO Act. The existing EPL4460 will require a variation to cover changes associated with the Project.	OEH
<i>Roads Act 1993</i> (Roads Act) Section 138	Consent is required under section 138 to work on or above a road or to connect a road to a classified road. Consent under section 138 will be required for: <ul style="list-style-type: none"> <li>the road works associated with the rail overpass on Hebden Road (near the intersection with the New England Highway); and</li> <li>the proposed Bowmans Creek Bridge.</li> </ul>	Singleton Council – Local Roads

A summary of other State environmental and planning legislation potentially relevant to the Proposed Action is provided in **Table 8.3** below.

**Table 8.3 – Other State Legislation of Potential Relevance to the Proposed Action**

Planning Provision	Comments	Further Approval Required?
<i>Aboriginal Land Rights Act 1983</i>	<p>Under Sections 34 and 35 of the <i>Aboriginal Land Rights Act 1983</i> Land Rights claims can be lodged by the New South Wales Local Aboriginal Land Council (LALC) over any Crown Lands.</p> <p>There is one crown road (subject to closure application) in the Referral Area. It should also be noted that a Native Title Extinguishment Assessment has been completed by Mt Owen's legal advisors for landholdings within the Mt Owen Complex, including the Referral Area, which has determined that Native Title has been extinguished.</p>	No
<i>Coal Mine Health and Safety Act 2002</i> (CMHS Act)	<p>The principal aim of the CMHS Act is to secure the objectives of the <i>Work Health and Safety Act 2011</i> in relation to coal operations. It achieves this by imposing certain specific safety requirements on coal mines. This includes the requirement to obtain consent from the Minister for Mineral Resources (DRE) for the establishment of emplacement areas. There are no new emplacement areas associated with the Proposed Action with all spoil being dumped either in-pit or on previously disturbed areas. The proposed emplacement of tailings is conducted in a manner consistent with currently approved operations. Proposed additional tailings emplacement area in the North Pit Continuation will require an approval under Section 100 of the Act.</p>	<p>Yes</p> <p>Section 100 approval will be required for the North Pit Continuation tailings area.</p> <p>Section 101 approval will also be required for decommissioning and rehabilitation of all emplacement areas.</p>
<i>Crown Lands Act 1989</i> (Crown Lands Act)	<p>The Crown Lands Act provides for the administration and management of Crown land in the eastern and central divisions of NSW. Crown land may not be occupied, used, sold, leased, dedicated, reserved or otherwise dealt with unless authorised by this Act or the <i>Crown Land (Continued Tenures) Act 1989</i>.</p> <p>There are is one crown road (subject to closure application) in the Referral Area for the Proposed Action.</p>	Yes

**Table 8.3 – Other State Legislation of Potential Relevance to the Proposed Action (cont).**

<b>Planning Provision</b>	<b>Comments</b>	<b>Further Approval Required?</b>
<i>Dams Safety Act 1978</i> (Dams Safety Act)	<p>This Act requires that the NSW Dams Safety Committee (DSC) periodically review large dams that may constitute a hazard to human life and property. These dams are known as prescribed dams and are listed in Schedule 1 of the Dams Safety Act. Any new prescribed dams are to be designed to the satisfaction of the DSC.</p> <p>Although no significant dams are proposed for water storage, the proposed use of the Ravensworth East voids for tailings emplacement will be subject to assessment in accordance with the DSC requirements to determine if the tailings emplacement areas will be prescribed dams.</p>	Yes
<i>Explosives Act 2003</i> (Explosives Act)	A licence is required for the storage of explosives on site. This Act is administered by WorkCover NSW. Mt Owen's explosives contractor holds the relevant licence to possess and store explosives on the Mt Owen site. There will be no change in the quantities of explosive materials as a result of the Proposed Action.	Yes
<i>Environmentally Hazardous Chemicals Act 1985</i> (EHC Act)	Under the EHC Act, a licence is required for any storage, transport or use of prescribed chemicals. Should such a licence be required under this Act during the life of the Proposed Action, Mt Owen, or the relevant contractor, will obtain a licence prior to the storage, transport or use of prescribed chemicals.	If required
<i>Threatened Species Conservation Act 1995</i> (TSC Act)	<p>Under the EP&amp;A Act, impacts on threatened species listed under the TSC Act are required to be assessed.</p> <p>All threatened species listed in the TSC Act potentially located within the Project Area have been assessed by the Ecological Assessment (refer to Section 5.7 and Appendix 11 of the EIS). No further approvals are required under the TSC Act.</p>	No

**Table 8.3 – Other State Legislation of Potential Relevance to the Proposed Action (cont).**

<b>Planning Provision</b>	<b>Comments</b>	<b>Further Approval Required?</b>
<i>Water Management Act 2000 (WM Act)</i>	<p>The Hunter Unregulated and Alluvial Water Sources WSP (in force under the WM Act) applies to the surface waters and alluvial groundwaters of Bowmans Creek (Jerrys Water Source) and Main Creek (Glennies Water Source) and their catchments.</p> <p>The Hunter Regulated River WSP applies to extractions from the Hunter River and Glennies Creek under the WM Act.</p> <p>Relevant consideration is required for impacts on surface water in particular Bowmans Creek, Yorks Creek, Swamp Creek, Bettys Creek and Main Creek, which, as outlined above, are all regulated within the framework of the WM Act.</p> <p>A WSP indicates that water extraction and interference licensing is required to account for any water loss over the life of the mine and until such time as those losses are negated.</p> <p>The Proposed Action will not require approval under sections 89, 90 or 91 (other than an aquifer interference approval) of the WM Act due to the exemptions outlined under section 89J of the EP&amp;A Act; however, an approval may be required for aquifer interference under the WM Act (refer to Table 3.6 of the EIS).</p>	Yes
<i>Water Act 1912 (Water Act)</i>	<p>The licensing provisions of the Water Act apply to water sources that are not subject to a water sharing plan gazetted under the WM Act. The Water Act is administered by NOW. A permit and/or licence must be obtained to extract groundwater (Part 5 of the Act) not covered by a WSP.</p> <p>Extraction of groundwater that flows into the open cut pits (from hard rock aquifers) will require licensing under Part 5 of the Water Act.</p> <p>It is not anticipated that any additional water licences will be required for the Proposed Action.</p>	No

### 8.3 Monitoring, Enforcement and Review Procedures

***d. description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action***

The existing Mt Owen development consent (DA 14-1-2004) includes requirements for an environmental management strategy, an environmental monitoring program, annual reporting, a community consultative committee, and independent environmental auditing; with the additional requirement to make this information publicly available on the Applicant's website.



All current approved operations are undertaken in accordance with the approved Environmental Management Plans (EMPs) and monitoring programs as detailed in Section 2.1.6 of the EIS. In addition, Mt Owen continually monitors environmental performance and legislative compliance of the existing operations within the Mt Owen Mine to minimise impacts on the surrounding community through the existing Environmental Management System (EMS). The EMS has been developed to be in accordance with the principles of the environmental management standard ISO14001.

The EMS provides for the environmental monitoring of all aspects of the current operations. In addition, Mt Owen Mine undertake monitoring in accordance with the EPL.

The outcomes of monitoring programs are reported annually to the community and regulators through the Annual Review and monthly Monitoring Reports available on the Mt Owen website.

Should the Proposed Action be approved, the development consent is expected to include similar conditions to the existing approval, and as such the EMS and related documents would be updated to maintain compliance with the new approval and any commitments outlined in the EIS or as part of any Commonwealth approval requirements. Additional EIS commitments relating to ecological and water resource matters are summarised in Section 6.0 of the EIS and include:

## Ecology

Mt Owen will incorporate the relevant strategies from the existing *Mt Owen Complex Flora and Fauna Management Plan* in the revised and consolidated Landscape Management Plan within 12 months of Approval. These strategies will include:

- feral animal and weed control;
- rehabilitation of disturbed areas with species characteristic of extant vegetation communities;
- use of native species in revegetation, and the linkage and integration of rehabilitation areas with existing vegetated areas to improve ecological function and provide appropriate fauna habitat, except in areas identified for improved pasture;
- management of erosion and sedimentation to minimise impacts on adjoining vegetation communities and aquatic systems;
- adaptive management, as required, if a previously unrecorded or assessed threatened species is identified in the Referral Area during operations;
- ongoing monitoring and maintenance of revegetation works and habitat enhancement activities; and
- an adaptive approach to ongoing monitoring of native flora and fauna.

The following fauna re-instatement strategies will be implemented:

- the re-establishment of ground fauna habitat through the relocation of cleared vegetation and rocks in targeted rehabilitation areas, where practicable;
- installation of supplementary arboreal habitat, such as nest boxes, once rehabilitated vegetation communities are of sufficient maturity; and

- the retention or augmentation of dams in the post-mining landform to facilitate the re-colonisation of woodland fauna communities.

Mt Owen will incorporate the existing tree felling procedure into the consolidated *Landscape Management Plan*, within 12 months of Approval, to minimise the potential for impacts on native fauna species (including threatened species) as a result of the clearing of hollow-bearing trees.

To assist with the persistence of the Spotted-tailed quoll, Mt Owen will implement the following habitat enhancement measures within the proposed Stringybark Creek Habitat Corridor:

- salvage of trees felled during construction works and emplacement within the Stringybark Creek Habitat Corridor as log piles; and
- salvage and placement of large rocks and boulders into piles as further potential denning habitat.

#### Biodiversity Offset Strategy

Mt Owen will implement a comprehensive Biodiversity Offset Strategy for the Proposed Action which includes the long-term conservation of the following land-based offset areas:

- Cross Creek Biodiversity Offset Area approximately 367 hectares (located adjacent to the existing Mt Owen Biodiversity Offset Areas); and
- Esparanga Biodiversity Offset Area approximately 303 hectares (located in a priority conservation area within the Great Eastern Ranges in the Manobalai Region).

Mt Owen will implement the Stringybark Creek Habitat Corridor regeneration strategy to provide a link from the existing high quality habitat associated with the Mt Owen Biodiversity Offset Areas and the Ravensworth State Forest with adjacent corridors and proposed conservation areas.

Mt Owen will implement mine rehabilitation which will provide native vegetation communities and fauna habitat augmentation.

#### Monitoring

As part of the preparation of the consolidated *Landscape Management Plan*, Mt Owen will review the existing monitoring program to include the proposed Biodiversity Offset Areas. The review of the monitoring program and the preparation of the *Landscape Management Plan* will be completed within 12 months of Approval.

#### **Surface Water**

Mt Owen will continue to manage the continuation of operations in accordance with the WMP, the EPL and the HRSTS. Within 12 months of Project Approval, Mt Owen will revise the WMP to reflect the changes to the surface water catchments and the additional monitoring and management measures required including:

- Additional off-line detention capacity to the Ravensworth East MIA, and flow conveyance at Hebden Road, will be provided by modifying the existing Industrial Dam to provide off line detention storage for flood events above the 10% AEP event.

- Implementation of construction environmental management plans detailing the specific inspection, maintenance and revegetation requirement prior to construction activities within each work area.
- Erosion and sediment controls will be monitored during construction and operation in accordance with the Blue Book (Landcom 2004 and DECC 2008).
- As part of the water balance monitoring for the Mt Owen water management system, water imported to site, water used on site and water discharged from site will be monitored in accordance with Water Reporting Requirements for Mines (NOW undated).
- Monitoring and remediation of erosion within watercourses outside of the active mining and emplacement areas will continue to be managed as set out in the *Mt Owen Complex Landscape Management Plan*.
- Mt Owen will install a new monitoring point on Main Creek (MC3). Monitoring at MC3 will commence upon Approval. In addition, Mt Owen will continue to monitor water quality during HRSTS discharge events as set out in the EPL.
- If required, controlled discharges to Swamp Creek will occur in accordance with EPLs and the HRSTS.
- Mt Owen will operate the Proposed Action and Project as a whole in accordance with the *Hunter Regulated River Water Sharing Plan 2004* for extractions from Glennies Creek.
- Mt Owen will continue to provide a summary of the surface water monitoring results as part of the Annual Review.
- Mt Owen proposes to, within 3 years of Approval, review the Mt Owen Complex water balance and interactions with the GRWSS including options for storage and transfer of water.

## Groundwater

- Mt Owen will continue to undertake groundwater monitoring in accordance with the Mt Owen Complex surface water and groundwater monitoring protocol. The *Mt Owen Complex Groundwater Monitoring Program* and *Surface Water and Groundwater Response Plan* will be updated within 12 months of Project Approval.
- Mt Owen will continue to extract groundwater from hard rock aquifers that flow into the Mt Owen and Ravensworth East Mines under the existing Part 5 licenses under the *Water Act 1912*.
- The results of the monitoring will be subject to an annual review and reported in the Mt Owen Complex Annual Review. The groundwater model will be periodically updated and refined as additional data and monitoring results become available.

## 9.0 Economic and Social Matters

### 9.1 Short and Long Term Social and Economic Implications/Impacts

#### ***10. A description of the short-term and long-term social and economic implications and/or impacts of the project.***

A Social Impact and Opportunities Assessment (SIOA) and Cost Benefit Analysis and Economic Impact Analysis have been prepared as part of the EIS. Both short and long term social and economic implications and/or impacts have been assessed as part of these assessments.

#### **9.1.1 Social**

The SIOA involved a number of phases of consultation to develop an understanding of the positive and negative social impacts of the Project which includes the Proposed Action. The SIOA has also considered cumulative issues relating to mining within the Singleton area.

An assessment of the potential impact on the key service areas of health, accommodation and education has identified that the health sector was the over-riding area of concern for residents and community groups in terms of community need.

As there are no proposed changes to operational staffing levels for the Proposed Action, impacts to community infrastructure, such as health, education, childcare, aged care, youth services, recreational facilities or other community services and facilities, due to permanent population increase, are considered negligible. Taking the assessments of community sensitivity at the local government area and township level into consideration, there is not anticipated to be any significant negative consequences regarding community sustainability.

Positive impacts include significant direct economic and community contributions associated with the ongoing retention of existing staff who share strong socio-economic linkages to Singleton and the wider Hunter Region, as well as opportunities related to local social investment, proactive approaches regarding cumulative impacts, and collaborative involvement of community members in local land management.

The existing Mt Owen Social Involvement Plan will be revised to incorporate management strategies to include a framework to monitor the effectiveness of the proposed mitigation strategies in mitigating negative social impacts and/or enhancing positive social impacts over time.

The SIOA was prepared by Coakes Consulting / Umwelt and is provided in Appendix 3 of the EIS, and summarised in Section 5.17.4, of the EIS.



### 9.1.2 Economic

The Project's Cost Benefit Analysis and Economic Impact Analysis was undertaken in order to develop an understanding of the positive and negative economic impacts of the Project. The analysis concluded that overall, the Project is expected to generate net benefits, and is also expected to generate increased economic activity and employment within the NSW community. The continuation of operations of the Mt Owen Mine will have a significant positive economic impact, for the Hunter Valley and the State of NSW. In total, the Project is anticipated to have the following positive impacts:

- deliver net benefit of around \$758 million over its life and generates a benefit cost ratio of approximately 1.30;
- generate royalties of an estimated \$258 million in NPV terms to the NSW Government;
- generate a net benefit to the Singleton community of around \$306 million (in NPV terms) over the life of the Project;
- the Hunter Region's Gross Regional Product (GRP) is projected to increase by just under \$1.3 billion in NPV terms, over the life of the Project;
- increase the NSW GSP (including the Hunter) by approximately \$1.9 billion (NPV terms);
- capital expenditure of approximately \$152.9 million; and
- directly and indirectly employ a peak of almost 1,200 FTEs workers. Of this, about 1,091 are estimated to be employed in the Hunter region.

The Cost Benefit Analysis and Economic Impact Analysis were undertaken by Deloitte Access Economics and are provided in Appendix 15, and summarised in Section 5.18, of the EIS.

## 10.0 Environmental Record of Person Proposing to Take the Action

### ***11. Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:***

- a. the proponent, and***
- b. for an action for which a person has applied for a permit, the person making the application.***

As outlined in the Referral, the proponent (Mt Owen) has not been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources.

## 10.1 Environmental Policy and Planning Framework

### ***12. Details of the proponent's environmental policy and planning framework.***

The Glencore Values and Code of Conduct represent the commitment to the environment and community and upholding good business practices which includes meeting or exceeding applicable laws and other external requirements. The Glencore environmental planning and policy framework hinges off these commitments, with each of the Glencore sites required to develop and implement a site specific framework of environmental plans and management systems in accordance with relevant legislation, approvals, guidelines and standards. Mt Owen's framework is detailed below.

### **10.1.1 Environmental Management Plans and Monitoring Systems**

All current approved operations are undertaken in accordance with the approved Environmental Management Plans (EMPs)<sup>3</sup> listed below:

- *Water Management Plan (including Erosion and Sediment Control Plan, Surface Water and Groundwater Response Plan, Groundwater Monitoring Program, Surface Water Monitoring Program).*
- *Landscape Management Plan (including Rehabilitation and Offset Management Plan, Mine Closure Plan and Final Void Management Plan).*
- *Noise Monitoring Program.*
- *Air Quality and Greenhouse Gas Management Plan (AQGG Management Plan).*
- *Flora and Fauna Management Plan (including Biodiversity Offset Strategy).*
- *Bushfire Management Plan.*
- *Blast Management Plan.*
- *Pollution Reduction Program.*

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<sup>3</sup> EMPs cover the entire Mount Owen Complex, i.e. Mount Owen Mine, Glendell Mine and Ravensworth East Mine. The Glendell Mine does not form part of the proposed Project nor the Proposed Action.

- *Pollution Incident Response Management Plan.*

The current EMPs and monitoring programs for the Mt Owen Complex are available on the Mt Owen website (<http://www.mtowencomplex.com.au>).

Mt Owen continually monitors environmental performance and legislative compliance of the existing operations within Mt Owen to minimise impacts on the surrounding community through the existing Environmental Management System (EMS). The EMS has been developed to be in accordance with the principles of the environmental management standard ISO14001.

The EMS provides for the environmental monitoring of all key aspects of the current operations.

As outlined above, an integral aspect of the current EMS is the continued implementation of environmental performance monitoring. The existing environmental monitoring locations are listed below and are illustrated on **Figure 10.1**:

- air quality monitoring network including 25 dust deposition gauges, five High Volume Air Samplers (HVAS) and five continuous dust monitors (Tapered Element Oscillating Microbalance instruments (TEOM));
- water quality monitoring network including 23 surface water monitoring locations and 41 groundwater monitoring locations;
- blast monitoring network comprising 12 blast monitoring locations near potentially impacted heritage items, public services, residences and TP1 (a prescribed dam);
- attended noise monitoring undertaken at nine receivers on a three-monthly basis over a 72 hour period;
- unattended monitoring at continuous noise monitoring locations; and
- two meteorological monitoring stations.

The outcomes of monitoring programs are reported annually to the community and regulators through the Annual Review and monthly Monitoring Reports available on the Mt Owen website.



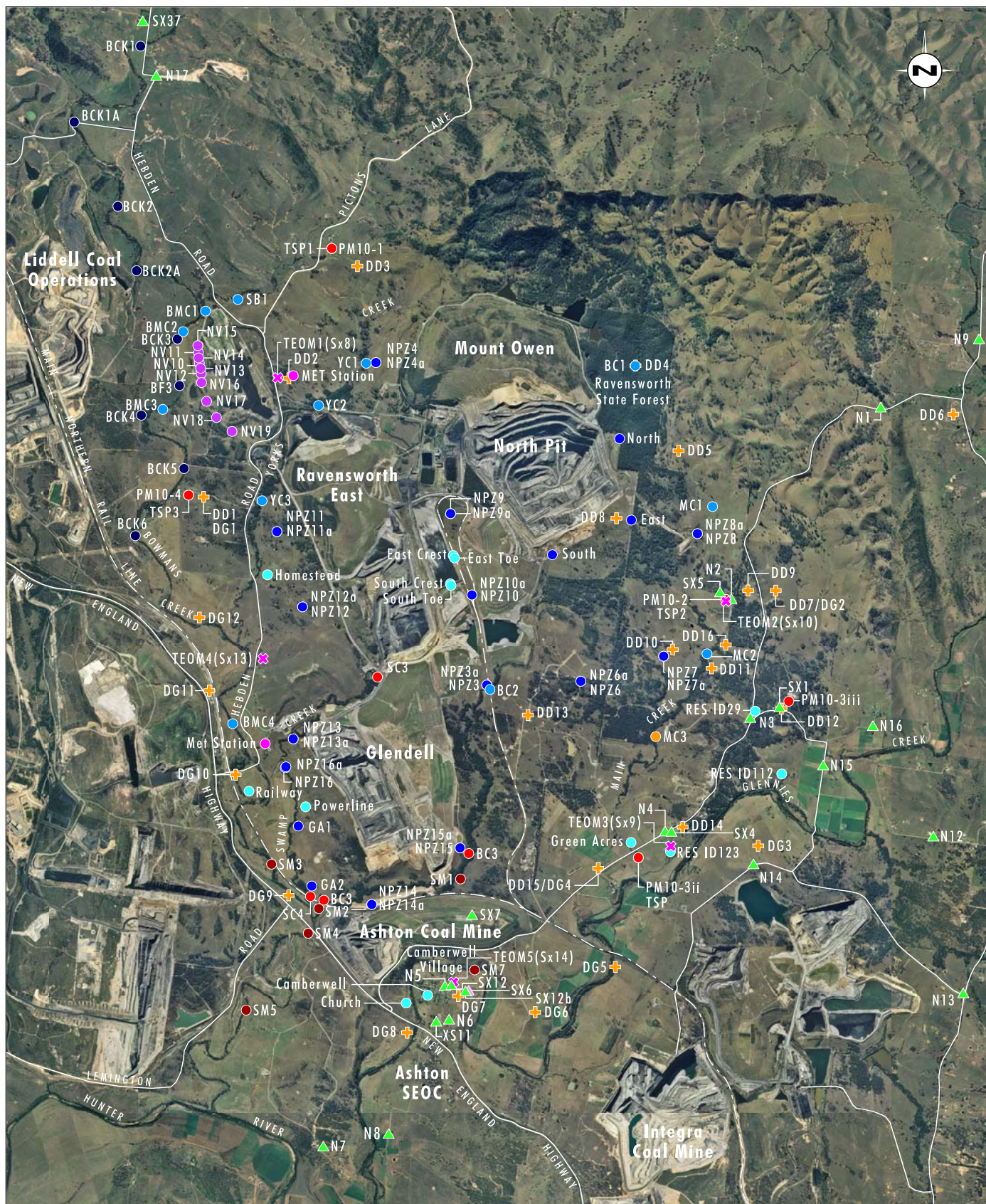


Image Source: Mount Owen (2012-2014)  
Data Source: Mount Owen (2014)

0 1 2 4 km  
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## Legend

- Depositional Dust Monitoring
- HVAS Location (dust)
- TEOM Monitoring Location
- Blast Monitoring Location
- Noise Monitoring Location
- MET Station Location
- Groundwater Monitoring Location
- Surface Water Monitoring Location
- Continuous Noise Monitoring Location
- Proposed Future Water Monitoring Location
- Piezometer Groundwater Monitoring Location

FIGURE 10.1

Mount Owen Complex  
Monitoring Locations



## 11.0 Information Sources

***13. For information given in an environment assessment, the draft must state:***

- a. the source of the information***
- b. how recent the information is***
- c. how the reliability of the information was tested, and***
- d. what uncertainties (if any) are in the information.***

The EIS and associated appendices include appropriate referencing of source information. The most recently available information is used and where available information was considered to be out of date, additional surveys, monitoring and investigations were undertaken in order to update information.

The reliability of information was tested during the assessment based on the experience of relevant professionals and experts preparing studies, calibration and verification processes, technical peer reviews and consultation with relevant government agencies during EIS preparation. The EIS and relevant studies provide transparent reporting of uncertainties, where relevant.



## 12.0 Consultation

### **14. Any consultation about the action, including:**

- a. any consultation that has already taken place**
- b. proposed consultation about relevant impacts of the action, and**
- c. If there has been consultation about the Proposed Action - any documented response to, or result of, the consultation**

The stakeholder engagement program as part of the environmental impact assessment and approval process consisted of four main phases aligning with the phase of project development and the statutory approval schedule. The phases of engagement are presented in Section 4.2.2 of the EIS. A summary of the phases is provided below:

- Phase 1 provided stakeholders with an introduction to the Project/Proposed Action, and allowed opportunity to provide their initial views and issues for consideration in project planning and impact assessment (completed between September and November 2012).
- Phase 2 involved discussions on further details of the proposed Project/Proposed Action, including the proposed approach to mining the resource and the consideration of impact mitigation measures, providing further opportunities for stakeholder input to the design and assessment process (completed between February to September 2013).
- Phase 3 was conducted upon completion of key technical studies as part of the environmental assessment process. The main focus of this phase of the engagement program was to present Project details and the results of the environmental, social and cultural heritage impact studies to the community and other stakeholders, in addition to seeking feedback on proposed management and mitigation measures. This phase included feedback on how key issues identified in earlier phases were addressed in the Project (completed between October and December 2013).
- Phase 4 involved communication of the proposed Project changes to key stakeholders during this Phase. Additionally, the outcomes of the updated environmental studies were also presented to the community and other key stakeholders. Activities undertaken in this phase included provision of Community Information Sheets 4 and 5 to stakeholders, face to face meetings, a third community information day, ongoing briefings to the workforce and the Mount Owen Community Consultative Committee (CCC).

Comprehensive documentation of the consultation undertaken with stakeholders (i.e. the community, Government agencies and Registered Aboriginal Parties (RAPs)) throughout the stakeholder engagement program is provided in Section 4.0 and Appendix 5 of the EIS. Specific consultation in relation to ecological and water resource matters is summarised in **Table 12.1** below.

**Table 12.1 – Consultation in Relation to the MNES**

<b>Stakeholder</b>	<b>Description</b>
NSW Office of Environment and Heritage (OEHS)/Environment Protection Authority	Five meetings – Project/Proposed Action briefings including discussion regarding approach for assessments, outcomes of technical assessments including proposed mitigation and management measures in addition to proposed offsets. Technical studies specifically discussed included historic heritage, Aboriginal Archaeology and Cultural Heritage, biodiversity, air quality and noise.
NSW Department of Primary Industries (NOW)	Two meetings – Project briefings including discussion regarding approach for assessments, outcomes of technical assessments including proposed mitigation and management measures. A site meeting was also held which included a tour of the Project Area/Proposed Action / Referral Area.
Forestry Corporation NSW	Three meetings – Project briefings including discussion regarding outcomes of technical assessments including proposed mitigation and management measures. One of these meetings included a site visit. Additionally a site visit for the Institute of Retired Foresters to inspect Ravensworth State Forest and rehabilitation areas was also undertaken.
NSW Department of Primary Industries (Fisheries)	One meeting – Project briefing.
NSW Department of Primary Industries (Catchments and Lands Division)	Two meetings – Project briefing and discussions regarding crown road closures and other land tenure issues.
DoE	A meeting was held with the DoE to discuss the Proposed Action, with specific reference to MNES.
DoE	Email submission of the electronic copy of the referral documentation for the Proposed Action. Letter submission of one hard copy of the referral documentation for the Proposed Action.
DoE	Provision of updated EPBC Referral documentation, including updated coordinates data.
DoE	The EPBC Referral for the Proposed Action (2013/6978) placed on public exhibition.
DoE	Receipt of letter from the DoE (dated 29 August 2013) acknowledging receipt of the referral documentation for the Proposed Action, indicating a period of consultation extending for 10 business days.
DoE	Receipt of letter from the DoE indicating the Proposed Action as having been determined a controlled action, therefore requiring assessment and approval under the EPBC Act.
DoE	Application and meeting for variation to a Proposed Action under Section 156A of EPBC. Variation approved by DoE on 25 August 2014. DoE confirmed that supplementary DGRs remain applicable to the varied action on 18 September 2014.

## 12.1 Identification of Affected Parties

### ***15. Identification of affected parties, including a statement mentioning any communities that may be affected and a description of their views.***

Engagement with the community has been a key component of the assessment process. Community consultation was a key component of the SIOA in order to obtain a comprehensive understanding of the issues and perspectives of neighbouring landholders in proximity to the Mt Owen Complex. An extensive program of consultation was ongoing throughout the assessment to inform the SIOA and the broader environmental assessment studies.

Affected parties were identified through consideration of Burdge's (2004) identification of stakeholders as individuals and groups that:

- live nearby the resource/operation/project;
- have an interest in the Project/Proposed Action or change;
- use or value a resource; and
- are interested in its use and/or are forced to relocate.

Further details are provided in **Section 4.0** and **Appendix 5** of the EIS.

## 12.2 Consultation and Communication Methods

Discussions have been held with over 395 stakeholders, with a variety of consultation and communication methods used, summarised in **Table 12.2** below. Further details regarding consultation are provided in Appendix 3 of the EIS.

**Table 12.2 – Consultation and Communication Methods**

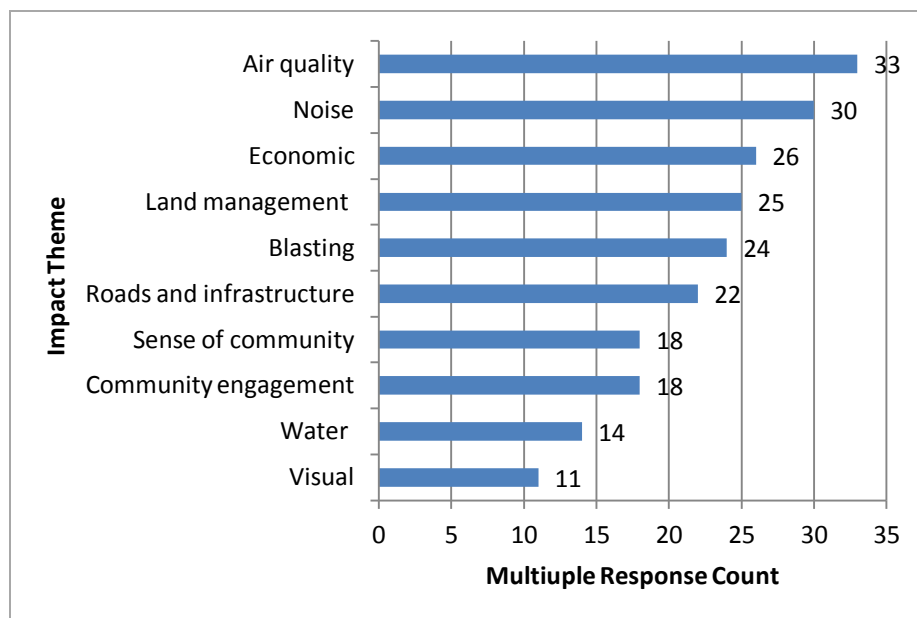
<b>Neighbour interviews and meetings</b>	Personal meetings with near neighbours to outline Project/Proposed Action aspects and obtain feedback on perceived issues and opportunities.
<b>Local stakeholder consultations</b>	Personal meetings with key local stakeholders drawn from community sectors such as local government, education, health, transport, housing and emergency services.
<b>Community Consultative Committee (CCC)</b>	Regular briefings and presentation of EIS material at CCC meetings.
<b>Regional stakeholder meetings</b>	Personal meetings with regional stakeholders in local communities (including council representatives, environmental NGO's).
<b>Community information sheets</b>	Project information sheets summarising key aspects and progress/outcomes of the environmental and social assessment program, distributed to neighbouring community and relevant stakeholders.
<b>Site open days and site visits</b>	Engagement events hosted on site, including exhibition of Project material, tours of the Mt Owen site, and discussions with the team.
<b>Community information sessions</b>	Briefings for the wider community and stakeholders to view key EIS findings and ask questions from the team.
<b>Workforce survey</b>	Surveys with Mt Owen employees, contractors and suppliers to identify associations between Mt Owen and the wider community.

**Table 12.2 – Consultation and Communication Methods (cont.)**

<b>Government briefings and consultation</b>	Meetings with relevant local and state government organisations to provide updates on Project status and discuss approval and other relevant matters.
<b>Website</b>	Publication of relevant Project information on the Mt Owen Complex website.

## 12.3 Identified Community Issues

Detailed constructive feedback on the existing operations, the Project/Proposed Action and the environmental assessment process was received from the community through the stakeholder engagement process. The most common perceived impact themes identified by landholders associated with the current Mt Owen operation and other mining operations in the local area, related to cumulative air quality and noise, with approximately 70 percent of landholders (N=43<sup>4</sup>) identifying one or both as a current issue. These issues were followed by economics (60 percent); land management (58 percent), blasting (55 percent) and road infrastructure (51 percent) (refer to **Figure 12.1**).

**Figure 12.1 – Perceived Impact Themes identified by Neighbouring Landholders**

*Note: Includes both positive and negative issues/impacts. Multiple responses permitted.*

*Source: Coakes Consulting (2013)*

Whilst some of the perceived impacts were raised in terms of direct attribution to the existing Mt Owen operation, the majority were discussed in cumulative terms with residents reporting difficulties in fully distinguishing issues and impacts associated with individual mining operations, given their proximity to multiple mines.

Less prominent issues related to other environmental impacts, such as water and visual amenity, as well as more socially oriented concerns such as sense of community, community contribution and community engagement. The latter were discussed mainly in terms of positive impacts or opportunities.

<sup>4</sup> Number of individuals consulted.



Issues raised by landholders are consistent with findings from Glencore's (formerly Xstrata Coal) 2012 Community Survey undertaken by the Hunter Valley Research Foundation (HVRF 2012) (refer to **Section 4.2.1** of the EIS), which included interviews with 37 residents from the localities of Hebden, Camberwell and Glennies Creek. This survey identified air quality (46 percent of respondents) and noise (30 percent) as the top perceived issues relating to Mount Owen's operations in the area. Some differences emerge, however, when analysing historical patterns of landholder complaints to the Mount Owen Complex operations, which exhibit a focus on blasting and noise, with very little comparative attention to air quality. Further detailed discussions of the issues raised by the community are provided in **Section 5.17** and **Appendix 5** of the EIS.

In relation to the Proposed Action specifically, some landholders expressed concerns regarding the progression of the Proposed Action towards their properties and the potential for acquisition of property depending upon the outcomes of noise and air quality studies. Notwithstanding these concerns, some landholders acknowledged the rail overpass and dual lane bridge over Bowmans Creek as a positive outcome.

The Project team considered this community feedback in refining the project design to address these issues. **Table 12.3** contains a summary of the aspects of the Proposed Action that address the top five issues raised by stakeholders in the consultation process.

**Table 12.3 - Top 5 Stakeholder Issues and Key Project Aspects**

Issue	Key Project Aspects
<b>Air Quality</b>	<ul style="list-style-type: none"> <li>• Mine Planning and Design: <ul style="list-style-type: none"> <li>▪ Mine design was subject to an optimisation process to reduce the potential impacts on local landholders. Mine plan refinements included minimisation of haul road length, design of select haul roads below natural surface, and identification of areas that would be temporarily treated to reduce potential for air quality impacts.</li> <li>▪ A review of Best Practice Management procedures was completed to enable the adoption of management options to reduce potential impacts.</li> </ul> </li> <li>• Air Quality Monitoring and Management: <ul style="list-style-type: none"> <li>▪ A range of air quality controls and monitoring exist, and are proposed, for the Proposed Action. This includes an extensive real time monitoring network which collects data that is fed back into existing operations.</li> </ul> </li> </ul>

Table 12.3 - Top 5 Stakeholder Issues and Key Project Aspects (cont.)

Issue	Key Project Aspects
<b>Noise</b>	<ul style="list-style-type: none"> <li>• Mine Planning and Design: <ul style="list-style-type: none"> <li>▪ Mine design was subject to an optimisation process to reduce the potential impacts of noise to local landholders. Mine plan refinements included design of selected haul roads below natural surface, and inclusion of bunds on well established and exposed long term haul roads.</li> <li>▪ The location and scheduling of equipment within the proposed North Pit Continuation during certain times of the year was reviewed with the objective of designing the mine such that when the likelihood of noise propagation increased (winter nights), equipment would be operating where maximum shielding could be achieved.</li> </ul> </li> <li>• Noise Monitoring and Management: <ul style="list-style-type: none"> <li>▪ A range of noise controls and monitoring exist and are proposed, for the Proposed Action. This includes the maintenance of the existing performance based management and monitoring system. Mt Owen has an extensive noise monitoring network that collects real time noise data which feeds back to operations. Mt Owen also monitors the predicted weather conditions daily to understand and plan operations to reduce likely noise impacts on a daily basis.</li> </ul> </li> </ul>
<b>Economic</b>	<ul style="list-style-type: none"> <li>• The economic impact of the Proposed Action is positive. Mine planning and design has been undertaken to enable efficient extraction of coal to ensure the Proposed Action is an economically viable operation which will allow for continued employment for an additional 12 years.</li> </ul>
<b>Land Management</b>	<ul style="list-style-type: none"> <li>• Mine Planning and Design: <ul style="list-style-type: none"> <li>▪ The Proposed Action has been designed to be progressively rehabilitated and will seek to optimise the final landform design to achieve an undulating and more natural looking landform.</li> </ul> </li> <li>• Mine Closure Planning and Rehabilitation: <ul style="list-style-type: none"> <li>▪ As outlined in <b>Section 5.19</b> of the EIS, mine closure and rehabilitation considerations: <ul style="list-style-type: none"> <li>– include the development of a safe and sustainable landform with provision of ecological habitat and connectivity;</li> <li>– do not discount other future land uses that may be viable; and</li> <li>– identify that closure planning will continue over the life of the development.</li> </ul> </li> </ul> </li> <li>• Consultation: <ul style="list-style-type: none"> <li>▪ During the development of the Proposed Action, Mt Owen consulted with Singleton Council and DRE in relation to final landform, land use and mine closure.</li> <li>▪ Community consultation, social impact and cultural heritage assessments considered stakeholder interests in mine closure and final land use (refer to <b>Section 4.2.2</b>, <b>Section 5.17</b>, and <b>Appendix 5</b> of the EIS).</li> </ul> </li> <li>• Other Land Management Measures <ul style="list-style-type: none"> <li>▪ A range of other land management measures are in place, and are proposed, for the Project, such as feral animal and noxious weed management and bushfire management (refer to <b>Sections 5.7</b> and <b>5.16</b> of the EIS respectively).</li> </ul> </li> </ul>

**Table 12.3 - Top 5 Stakeholder Issues and Key Project Aspects (cont.)**

Issue	Key Project Aspects
<b>Blasting</b>	<ul style="list-style-type: none"><li>• Blast Design<ul style="list-style-type: none"><li>▪ Mt Owen has well established blast design and blast practices as part of current operations that will be continued as part of the Proposed Action.</li></ul></li><li>• Blast Monitoring and Management:<ul style="list-style-type: none"><li>▪ A range of blasting controls and monitoring exist and are proposed. This includes a range of blast monitors, review of local meteorological conditions prior to blasting, appropriate design of each blast including the size of blasts and the use of blast techniques such as electric detonation.</li></ul></li></ul>

As noted, the issues raised by the community also played an important role in informing the detailed studies undertaken as part of the environmental assessment process. This is discussed further in **Section 5.0** of the EIS.

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## APPENDIX 1

Supplementary DGRs



## Planning & Infrastructure

### Development Assessment Systems & Approvals Mining Projects

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Fax: (02) 9228 6466

Email: [matthew.sprott@planning.nsw.gov.au](mailto:matthew.sprott@planning.nsw.gov.au)

Ms Vicki McBride  
Approvals Manager  
Mount Owen Pty Limited  
PO Box 320  
SINGLETON NSW 2330

Our Ref: 10/14081

Dear Ms McBride

### **State Significant Development – Supplement to Director-General's Requirements Mount Owen Continued Operations Project (SSD-5850)**

I refer to the Director-General's requirements issued for the Mount Owen Continued Operations Project on 13 March 2013.

As you are aware, this project has been declared a controlled action under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Commonwealth Department of the Environment has accredited the NSW Part 4 State Significant Development assessment process for the Project.

To ensure that sufficient information is provided to enable an appropriate level of assessment of relevant matters of National Environmental Significance, the Director-General has issued supplementary requirements for the Environmental Impact Statement (EIS) under section 78A(8A) of the *Environmental Planning and Assessment Act 1979*. A copy of the supplementary requirements is attached.

You must ensure that the EIS adequately addresses the Director-General's requirements issued on 13 March 2013, as well as the attached supplementary requirements.

To facilitate the accredited assessment process, the EIS must provide a clear assessment of all State and Commonwealth matters. While these matters may be assessed in an integrated manner in the main EIS report, this document must be accompanied by a separate appendix that deals with all relevant Commonwealth matters of National Environmental Significance in a single discrete location.

If you have any enquiries about these requirements, please contact Matthew Sprott on the details above.

Yours sincerely

 8/11/13

David Kitto  
**Director**  
**Mining Projects**  
as delegate for the Director-General

# Supplementary Director General's Requirements

## Section 78A (8A) of the *Environmental Planning and Assessment Act 1979*

A delegate for the Commonwealth Minister for the Environment has determined the Mt Owen Continued Coal Mining Operation Project, NSW (EPBC 2013/6978), involving the continuation of the existing Mt Owen Mine, approximately 20 kilometres north-west of Singleton in the Upper Hunter Valley, NSW, to be a controlled action under section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The action is likely to have a significant impact on the EPBC Act listed endangered Spotted-tailed Quoll, Swift Parrot and Regent Honeyeater. Significant impacts are also considered possible for a number of other species protected by the EPBC Act including, but not limited to, those listed in Appendix A. The action is also likely to have a significant impact on a water resource, as defined under the EPBC Act.

In accordance with the one-off accredited assessment process for this project, the environmental assessment of the impacts of the controlled action must be assessed under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The assessment should include enough information about the action and its relevant impacts to allow the Minister for the Environment to make an informed decision on whether or not to approve the action under the EPBC Act.

The following assessment requirements concerning matters in the EPBC Act and schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000* should be integrated into the assessment requirements of the EP&A Act.

### General information

1. The background of the action, including:

- a. the title of the action
- b. the full name and postal address of the designated proponent
- c. a clear outline of the objective of the action
- d. the location of the action
- e. the background to the development of the action
- f. how the action relates to any other actions (of which the proponent should reasonably be aware) that have been, or are being, taken or that have been approved in the region affected by the action
- g. the current status of the action, and
- h. the consequences of not proceeding with the action

### Description of the controlled action

2. A description of the action, including:

- a. all the components of the action
- b. the precise location of any works to be undertaken, structures to be built or elements of the action that may have relevant impacts
- c. how the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts
- d. the timing and duration of the works to be undertaken, and
- e. to the extent reasonably practicable, a description of any feasible alternatives to the controlled action that have been identified through the assessment, and their likely impact, including:

- i. if relevant, the alternative of taking no action
- ii. a comparative description of the impacts of each alternative on the matters protected by the controlling provisions for the action, and
- iii. sufficient detail to clarify why any alternative is preferred to another

### Description of the existing environment

3. A description of the existing environment of the proposal location and the surrounding areas that may be affected by the action, including but not limited to:
  - a. surveys using accepted methodology for targeting listed threatened species, ecological communities and their respective habitat, including but not limited to OEH's *Survey and assessment guidelines* (2009), available at: <http://www.environment.nsw.gov.au/threatenedspecies/surveymethodsfauna.htm> and the Department of the Environment's species-specific survey guidelines for nationally threatened species, available at: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>
  - b. a description of the distribution and abundance of threatened species and ecological communities, as well as suitable habitat (including breeding, foraging, roosting habitat, habitat critical to the survival of threatened species) within the site and in surrounding areas that may be impacted by the proposal. Specifically, this must include but not be limited to the species at Appendix A.
  - c. the regional distribution and abundance of suitable and potential habitat for threatened species and ecological communities surrounding the site
  - d. a description of the important water resources within the site and in surrounding areas, including detailed information addressing the department's Water Resources Terms of Reference, currently in preparation, and
  - e. a description of water related assets that are dependent on any important water resources, including an estimation of the water requirements of those assets (i.e. regional water use).

### Description of the relevant impacts of the controlled action

4. An assessment of all relevant impacts<sup>1</sup> with reference to the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines Matters of National Environmental Significance* (2009), *Draft significant impact guidelines: Coal seam gas and large coal mining developments – impacts on water resources* and species specific guidelines as relevant (available at: [www.environment.gov.au/epbc/guidelines-policies.html](http://www.environment.gov.au/epbc/guidelines-policies.html)) that the controlled action has, will have or is likely to have. Information must include:
  - a. a description of the relevant impacts of the action on matters of national environmental significance:
    - listed species and communities (including, but not limited to, those listed in Appendix A), and
    - water resources (...)
  - b. a detailed assessment of the nature and extent of the likely short term and long term relevant impacts

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<sup>1</sup> The term "relevant impact" is defined in section 82 of the EPBC Act. Note that the action has been found to be likely to have a significant impact on listed species and communities, under sections 18 and 18A of the EPBC Act, and water resources, under sections 24D and 24E of the Act.

- c. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible
  - d. analysis of the significance of the relevant impacts, and
  - e. any technical data and other information used or needed to make a detailed assessment of the relevant impacts
5. Where there is a potential habitat for EPBC Act listed species (Appendix A), surveys must be undertaken. These surveys must be timed appropriately and undertaken for a suitable period of time by a qualified person<sup>2</sup>. A subsequent description of the relevant impacts on such EPBC Act listed species should include, inter alia, direct, indirect, cumulative and facilitative impacts on the:
- a. population of the species at the site
  - b. area of occupancy of the species
  - c. habitat critical to the survival of the species
  - d. breeding cycle of the population, and
  - e. availability or quality of habitat for the species

If an endangered ecological community or threatened species listed at Appendix A is not believed to be present on the proposed site, detailed information must be included in the Environmental Impact Assessment to demonstrate that this community will not be impacted.

6. Under sections 24D and 24E of the EPBC Act, a water resource in relation to coal seam gas and large coal mining development has been determined a controlling provision in relation to this project. The documentation provided must include information addressing all relevant impacts on water resources and water related values. The information must be consistent with the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development's *Information Guidelines for Proposals Relating to the Development of Coal Seam Gas and Large Coal Mines where there is a Significant Impact on Water Resources*. The Guidelines are available at: <http://www.environment.gov.au/coal-seam-gas-mining/pubs/iesc-information-guidelines.pdf>. The information must include:
- a detailed assessment of potential impacts (including cumulative impacts) on the quality and quantity of existing surface and ground water resources, including:
    - a. detailed modelling of potential groundwater impacts, including any potential impacts on alluvial aquifers
    - b. impacts on affected licensed water users and basic landholder rights
    - c. impacts on riparian, ecological, geo-morphological and hydrological values of watercourses, including environmental flows, and
    - d. a flood assessment including identification of any necessary flood impact mitigation measures
  - a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume, salinity and frequency of any water discharges), water supply infrastructure and water storage structures
  - an assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives
  - assessment of impacts of salinity from mining operations, including disposal and management of coal rejects and modified hydrogeology, a salinity budget and the evaluation of salt migration to surface and groundwater sources

<sup>2</sup> Where available, species-specific survey guidelines can be obtained on the department's *Species Profile and Threats Database*: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>



- assessment of groundwater impacts against the minimal impact considerations in the *NSW Aquifer Interference Policy*
- identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000*
- demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP)
- a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo
- a detailed description of the proposed water management system (including sewage), water monitoring program and measures to mitigate surface and groundwater impacts, and
- information on how the project will comply with the Hunter River Salinity Trading Scheme

### **Proposed safeguards and mitigation measures**

7. A description of feasible mitigation measures, changes to the action or procedures, which have been proposed by the proponent or suggested in public submissions, and which are intended to prevent or minimise relevant impacts on matters of national environmental significance. Information must include:
  - a. a description of the mitigation measures that will be undertaken to prevent or minimise the relevant impacts of the action. These mitigation measures should be justified and based on best available practices
  - b. an assessment of the expected or predicted effectiveness of the mitigation measures including the effect on abundance and condition of species, suitable habitat and ecological communities
  - c. any statutory or policy basis for the mitigation measures
  - d. the cost of the mitigation measures
  - e. an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs (including any relevant thresholds for corrective actions) for the relevant impacts of the action. Include the person or agency responsible for implementing these programs and the effectiveness of all mitigation measures, including any provisions for independent environmental auditing
  - f. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program
  - g. identification of mitigation measures proposed to be undertaken by State governments, local governments or the proponent, and
  - h. any changes to the action which prevent or minimise relevant impacts on listed threatened species and communities

### **Offsets**

8. Where impacts cannot be avoided or mitigated, an offset package to compensate for any predicted or potential residual significant impacts on matters of national environmental significance. Offsets should demonstrate consistency with the Commonwealth EPBC Act Environmental Offsets Policy (October 2012, or subsequent versions), available at: [www.environment.gov.au/epbc/publications/environmental-offsets-policy.html](http://www.environment.gov.au/epbc/publications/environmental-offsets-policy.html). The department's information requirements in relation to EPBC Act offset proposals is provided at Appendix B. Information must include:

- a. the description of any offset package should include how the offset compensates for the residual impacts, when the offset will be delivered and how the offset will be managed
- b. an assessment of the impact of the offsets on other matters of environmental, economic, or social significance and
- c. analysis of cost, both financial and other, related to offsets.

### **Other approvals and conditions**

9. Any other requirements for approval or conditions that apply, or that the proponent reasonably believes are likely to apply, to the proposed action. Information must include:
  - a. details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including:
    - i. what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy, and
    - ii. how the scheme provides for the prevention, minimisation and management of any relevant impacts
  - b. a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the EPBC Act), including any conditions that apply to the action
  - c. a statement identifying any additional approval that is required, and
  - d. a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action

### **Economic and social matters**

10. A description of the short-term and long-term social and economic implications and/or impacts of the project.

### **Environmental record of person proposing to take the action**

11. Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against:
  - a. the proponent, and
  - b. for an action for which a person has applied for a permit, the person making the application.
12. Details of the proponent's environmental policy and planning framework.

### **Information sources**

13. For information given in an environment assessment, the draft must state:
  - a. the source of the information
  - b. how recent the information is
  - c. how the reliability of the information was tested, and
  - d. what uncertainties (if any) are in the information.

### **Consultation**

14. Any consultation about the action, including:
  - a. any consultation that has already taken place
  - b. proposed consultation about relevant impacts of the action, and

- c. if there has been consultation about the proposed action — any documented response to, or result of, the consultation
- 15. Identification of affected parties, including a statement mentioning any communities that may be affected and a description of their views.

## **Appendix A**

### **Threatened Fauna**

- *Dasyurus maculatus maculatus* (Spotted-tailed Quoll, endangered)
- *Lathamus discolor* (Swift Parrot, endangered, migratory)
- *Anthochaera phrygia* (Regent Honeyeater, endangered, migratory)
- *Phascolarctos cinereus* (Koala, vulnerable)
- *Litoria aurea* (Green and Golden Bell Frog, vulnerable)
- *Chalinolobus dwyeri* (Large-eared Pied Bat, vulnerable)

## **Appendix B**

### **Information requirements for EPBC Act offset proposals**

- Details in relation to the proposed offsets package, including:
  - the location and size, in hectares, of any offset site(s)
  - maps clearly showing for each offset site:
    - the relevant ecological features
    - the landscape context, and
    - the cadastre boundary
  - the current tenure arrangements (including zoning and ownership) of any proposed offset sites
  - confirmed records of presence (or otherwise) of relevant protected matter(s) on the offset site(s), and
  - detailed information regarding the presence and quality of habitat for relevant protected matter(s) on the offset site. The quality of habitat should be assessed in a manner consistent with the approach outlined in the document titled *How to use the offset assessment guide* available at:  
[www.environment.gov.au/epbc/publications/environmental-offsets-policy.html](http://www.environment.gov.au/epbc/publications/environmental-offsets-policy.html).
- Provide information and justification regarding how the offsets package will deliver a conservation outcome that will maintain or improve the viability of the protected matter(s) consistent with the *EPBC Act environmental offsets policy* (October 2012) including:
  - management actions that will be undertaken that improve or maintain the quality of the proposed offset site(s) for the relevant protected matter(s). Management actions must be clearly described, planned and resourced as to justify any proposed improvements in quality for the protected matter(s) over time
  - the time over which management actions will deliver any proposed improvement or maintenance of habitat quality for the relevant protected matter(s)
  - the risk of damage, degradation or destruction to any proposed offset site(s) in the absence of any formal protection and/or management over a foreseeable time period (20 years). Such risk assessments may be based on:
    - presence of pending development applications, mining leases or other activities on or near the proposed offset site(s) that indicate development intent
    - average risk of loss for similar sites, and
    - presence and strength of formal protection mechanisms currently in place, and
  - the legal mechanism(s) that are proposed to protect offset site(s) into the future and avert any risk of damage, degradation or destruction
- Provide information regarding how the proposed offsets package is additional to what is already required, as determined by law or planning regulations, agreed to under other schemes or programs or required under an existing duty-of-care
- The overall cost of the proposed offsets package; including costs associated with, but not limited to:
  - acquisition and transfer of lands/property



- implementation of all related management actions, and
- monitoring, reporting and auditing of offset performance



## APPENDIX 2

Risk Assessment

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## Water Resources Risk Assessment

The objective of the risk assessment was to identify the risk of significant impacts relating to key aspects associated with water resources resulting from the Proposed Action. The risk assessment detailed below has been developed with reference to the information gained as part of the water resources impact assessments for the Project and includes consideration of the proposed impact mitigation and management measures. The risk assessment has been developed in consideration of the requirement of Australian Standard Risk Management (AS/NZS ISO 31000: 2009).

The water resources that are immediately downstream and adjacent to the Proposed Action include ephemeral watercourses, low yield alluvial aquifers and poor quality coal seam aquifers. The potential for significant impacts on water resources is considered to be limited to the watercourses located further downstream, that being Bowmans Creek and Glennies Creek and their associated alluvial aquifers and as such these are the focus of the risk assessment.

The level of risk for significant water resource impacts has been identified from a matrix that considers the likelihood that a significant impact could occur and the consequences of the significant impact.

The likelihood of impact criteria used in the water resources risk assessment are set out in **Table A.1**, with the consequence criteria set out in **Table A.2**.

The likelihood of impact rating and consequence rating are then used to identify the level of risk for potential significant impacts on water resources as set out in **Table A.3**.

The assessment of risk for potential water resource impacts is set out in **Table A.4**. The likelihood and consequence ratings as detailed in **Table A.4** have been ranked assuming that existing and proposed controls have been implemented. In the assessment of potential significant impacts to water resources, the identified criteria are applied to the consequence of a significant impact, rather than the most likely consequence of the impact.

**Table A.1 - Risk Rating Matrix for Likelihood of Impact**

Rating	CRITERIA
<b>E</b>	99% Probability or impact is occurring now or could occur within months
<b>D</b>	>50% and <99% probability, or balance of probability will occur, or could occur annually
<b>C</b>	>20% and <50% probability, or may occur shortly but a distinct probability it won't, or could occur in 2 to 5 years
<b>B</b>	>1% and <20% probability, or may occur but not anticipated, or could occur within 5 to 20 years
<b>A</b>	<1% probability occurrence requires exceptional circumstances exceptionally unlikely, even in the long term future occurs less than once every 20 years

**Table A.2 Risk Rating Matrix for Consequences**

Rating	Environment
5	5 – an incident that has caused disastrous environmental impact term effect requiring major remediation
4	Category 4 – an incident that has caused serious environmental impact with medium term effect requiring significant remediation
3	Category 3 – an incident that has caused moderate reversible environmental impact with short term effect requiring moderate remediation
2	Category 2 – an incident that has caused minor reversible environmental impact requiring minor remediation
1	Category 1 – an incident that has caused negligible reversible environmental impact requiring very minor or no remediation

**Table A.3 Risk Matrix for Risk Level**

LIKELIHOOD RATING	E	11	16	20	23	25
	D	7	12	17	21	24
	C	4	8	13	18	22
	B	2	5	9	14	19
	A	1	3	6	10	15
		1	2	3	4	5
		CONSEQUENCE RATING				

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**Table A.4 Risk Assessment of Potential Significant Impacts on Water Resources**

Aspect	Impact	Existing and proposed controls	Likelihood	Consequences	Risk Level	Comments
Flow Regimes	Loss of significant available water to downstream third parties and the environment. Increases in flood flows.	Water Management System (WMS) controls to minimise clean water catchments and manage flood flows in downstream watercourses (refer to <b>Section 5.5.1</b> ).	B	2	5	The Proposed Action is a continuation of the existing open cut operations at the same rate and scale of production. The footprint of the mine will increase with the Proposed Action and water from this increased area will be captured, treated and reused within the water management system. As outlined in <b>Section 5.3.1.1</b> , the changes to catchment areas as a result of the Proposed Action will result in negligible to minor changes to downstream flow regimes. As outlined in <b>Section 5.3.1</b> , the Proposed Action will also result in negligible to minor changes in flood flow velocities and depths, and will not adversely impact downstream landholders and watercourse stability with the proposed management methods.



Recharge Rates; Aquifer pressure or pressure relationships between aquifers; Groundwater table levels	Drawdown of >2 metres in the alluvial aquifers of Bowmans Creek or Glennies Creek.	Proposed Action located a substantial distance from Bowmans Creek and Glennies Creek (refer to <b>Section 5.3.2</b> ).	A	2	3	<p>A detailed groundwater impact assessment has been completed for the Proposed Action (refer to Appendix 10 of the EIS). The proposed mining limit has been specifically designed such that it is located a minimum of 200 metres off the high bank of Main Creek in order to minimise impacts on the Main Creek alluvium.</p> <p>The groundwater modelling and impact assessment indicates that the Project will cause negligible impacts to the alluvial aquifers associated with Glennies Creek and Bowmans Creek. Minimal drawdown is predicted within the alluvial aquifers of Bettys Creek and Main Creek. Drawdown in alluvial aquifers associated with Main Creek and Bettys Creek, minor tributaries to Glennies Creek and Bowmans Creek respectively, is predicted to exceed the minimal impact criteria (greater than 2 m drawdown) for aquifer interference activities as specified in the Aquifer Interference Policy (NSW, 2012) (AIP). Further assessment identified that the significance of these alluvial aquifers is limited, with both creeks having low volume, ephemeral surface water flow, and they largely act as drainage courses for local runoff. The assessment indicates no groundwater-dependent assets (i.e. groundwater users or environmental requirements) are impacted by the predicted drawdown. Both Bettys Creek and Main Creek are ephemeral surface water features that largely act as drainage lines for the local area and only generate incidental baseflow following sustained rain. Peak incremental groundwater losses from the Bettys Creek alluvium (representing maximum potential baseflow loss to the creek, assuming groundwater intercepts and flow within the creek) are predicted to be less than 6 ML/year and correlate to mining of the RERR Mining Area. Mining in the BNP is not predicted to impact on the alluvial aquifers. Peak incremental groundwater losses from the Main Creek alluvium (representing maximum potential baseflow loss to the creek, assuming groundwater intercepts and flow within the creek) are predicted to be less than 15 ML/year and correlate to continuation of the North Pit. As stated, these creek systems are ephemeral and as such it is considered that the modelled baseflow impacts in the Bettys Creek and Main Creek systems are overestimated in the modelling and are in reality negligible.</p>
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Groundwater/surface water interactions	Significant removal of baseflows within Bowmans Creek or Glennies Creek.	Proposed Action located a substantial distance from Bowmans Creek and Glennies Creek (refer to <b>Section 5.3.2</b> ).	B	2	5	As discussed above, the Proposed Action is predicted to result in negligible changes to the groundwater contribution to baseflows in these surface drainage systems.
River/floodplain connectivity	Removal of channel/floodplain connectivity for Bowmans Creek or Glennies Creek.	Proposed Action located a substantial distance from Bowmans Creek and Glennies Creek (refer to <b>Section 5.3.1</b> ).	A	2	3	No changes to river/floodplain connectivity are predicted as a result of the revised Proposed Action.
Inter-aquifer connectivity	Connectivity of lower quality coal seam aquifers to higher quality alluvial aquifers in Bowmans Creek or Glennies Creek.	Proposed Action located a substantial distance from Bowmans Creek and Glennies Creek (refer to <b>Section 5.3.2</b> ).	A	3	6	As discussed above, a detailed Groundwater Impact Assessment identified that the Proposed Action will result in minimal harm to aquifers. No material impacts on inter-aquifer connectivity are predicted as a result of the Proposed Action.
Coastal Processes	No impact.	Proposed Action not located on the coast and is not assessed to have any indirect impacts.	Not Applicable	Not Applicable	Not Applicable	No impact.
Impact on water users	Changes to water flows that cannot be managed within the framework of the NSW Government Water Sharing Plans.	NSW Government Water Sharing Plans, WMS and existing water licences (refer to <b>Section 5.2.1</b> ).	B	2	5	No private groundwater users have been identified as being affected or potentially affected by the Proposed Action. There are no private landholders located immediately downstream of the Project Area on Yorks Creek, Bettys Creek or Swamp Creek. There are two private landholders with access to Main Creek located downstream of the Mt Owen WMS. There are known licensed water users on Bowmans Creek and Glennies Creek downstream of the Project Area. There are private landholders downstream of the Project Area on Main Creek, Glennies Creek and Bowmans Creek that retain basic landholder rights for domestic and stock use. All water take associated with the Proposed Action will be licensed in accordance with the <i>Water Management Act 2000</i> (WM Act) and <i>Water Act 1912</i> . The Proposed Action will not significantly change water availability for surface water users.

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State Water Resource Plans	Changes to water flows that cannot be managed within the framework of the NSW Government Water Sharing Plans.	NSW Government Water Sharing Plans WMS and existing water licences (refer to <b>Section 5.2.1</b> ).	B	2	5	The surface water and alluvial water sources within the Project Area are managed under the <i>Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009</i> . In addition, water extraction from Glennies Creek is managed under the <i>Water Sharing Plan for the Hunter Regulated River Water Source 2003</i> . Both the <i>Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009</i> and the <i>Water Sharing Plan for the Hunter Regulated River Water Source 2003</i> are State Water Resource Plans and are governed under the WM Act. The NSW Government Water Sharing Plans provide a regional water balance for these water sources and consider cumulative water use. The coal measure aquifers in the Project Area are not covered by a water sharing plan and as such are governed under the <i>Water Act 1912</i> . Water take for the Proposed Action will comply with the above listed water sharing plans and Acts which are designed to provide for the sustainable use of NSW's water resources.
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Water Quality	Significant deterioration of water quality within Bowmans Creek or Glennies Creek to outside the bounds of the NSW Water Quality Objectives.	WMS to manage water that has the potential to cause environmental harm. In conjunction with the proposed WMS, a series of erosion and sediment control measures will be utilised during construction, operation and rehabilitation phases of the Proposed Action to manage water quality (refer to <b>Section 5.3.1.4</b> ).	B	2	5	<p>Mt Owen has a WMS in place to manage the potential impacts of its mining operations on water resources. The WMS for the Proposed Action has been designed in accordance with relevant government standards to limit potential impacts on downstream water qualities by managing water that has the potential to cause environmental harm. To manage water quality during construction, operation and rehabilitation phases of the Proposed Action, Mt Owen will implement erosion and sediment control measures, and other water quality control measures in accordance with the relevant government standards to minimise any potential impact on water quality. Monitoring results are assessed against the relevant site specific and default ANZECC trigger values.</p> <p>Mt Owen proposes to continue to discharge surplus water from its water management system in accordance with relevant approvals. The quality of such discharges will be in accordance with relevant Environment Protection Licences (EPL's) and consistent with the provisions of the Hunter River Salinity Trading Scheme (HRSTS). As part of the development of the HRSTS, the NSW Government has determined the sustainable salt load for the Hunter River, considering the impacts on the environment. The HRSTS is managed such that discharges from industrial operations can only occur in suitable conditions. Discharges from the Proposed Action will be monitored prior to release to ensure compliance with the requirements of the HRSTS; discharges are also therefore not considered likely to result in significant cumulative impacts.</p> <p>The Proposed Action is not predicted to affect groundwater quality in any identified aquifers.</p>
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