

BHP Billiton

**Review of Environmental Factors for
Caroona Exploration Program
Reconnaissance Drilling and
Associated Activities 2007 to 2011**

September 2007



Review of Environmental Factors for Caroona Exploration Program Reconnaissance Drilling and Associated Activities 2007 to 2011

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

BHP Billiton

Project Director:	Barbara Crossley	
Project Manager:	John Merrell	
Report No.	2295/R08/FINAL	Date: September 2007



2/20 The Boulevard
PO Box 838
Toronto NSW 2283

Ph: 02 4950 5322
Fax: 02 4950 5737
Email: mail@umwelt.com.au
Website: www.umwelt.com.au

TABLE OF CONTENTS

1.0	Introduction	1
1.1	Locality.....	1
2.0	Proposed Caroona Exploration Program Activities	2
2.1	EL Requirements	2
2.2	Proposed Activities	3
2.2.1	Environmental Due Diligence Inspections.....	4
2.2.2	Exempt Areas within the Caroona EL	4
2.2.3	EECs within the EL Area	5
2.3	Proposed Groundwater Monitoring Boreholes.....	5
2.4	Justification of the Activity.....	6
2.5	Evaluation of Alternatives	6
3.0	Planning Context	7
3.1	Licences and Approvals Required.....	7
3.1.1	Roads Act 1993.....	7
3.1.2	Water Management Act 2000.....	7
3.2	Zoning	7
3.3	Stakeholder Consultation	8
4.0	Existing Environment.....	9
5.0	Environmental Impacts and Management.....	9
5.1	Ecology	9
5.1.1	Environmental Due Diligence Surveys	9
5.1.2	Regional Context and Significant Species and Communities	10
5.1.3	Impact Assessment	12
5.1.4	Management of Boreholes Located in EECs	13
5.2	Heritage	14
5.2.1	Aboriginal Archaeology.....	14
5.2.2	Historic Heritage	16
5.3	Amenity	16
5.3.1	Noise.....	16
5.3.2	Air Quality	17
5.4	Water, Hazardous Substances and Waste Management	17

5.4.1	Water	17
5.4.2	Hazardous Substances and Waste Management	18
5.5	Soils, Land Use and Natural Resources	18
5.6	Community	18
5.7	Cumulative Impacts	19
6.0	Rehabilitation	19
7.0	Summary of Impacts and Conclusions	19
8.0	References	20

FIGURES

1.1	Locality Plan Carroona EL 6505	1
2.1	Exempted Areas with EL	4
2.2	Potential Native Vegetation on Cracking Clay Soils EEC Areas	5
3.1	Carroona EL Area Land Zoning	7

APPENDICES

1	Seven Part Test of Significance
----------	--

1.0 Introduction

In March 2006 the NSW Government announced that a five year Exploration Licence (EL) had been granted to Coal Mines Australia Limited, a wholly owned subsidiary of BHP Billiton to carry out detailed exploration of the Carooona Exploration Licence Area (EL6505). The Carooona exploration area is located within the Liverpool Plains and Gunnedah Local Government Areas (LGAs). The Department of Primary Industries (DPI) has previously undertaken limited exploration of the coal resources within the EL area. BHP Billiton commenced Stage 1 of exploration activities within the Carooona EL in July 2006.

Approximately 40 exploration boreholes have been drilled by BHP Billiton during the first 12 months (Stage 1) of exploration activities. A Review of Environmental Factors (REF) was prepared (Umwelt, 2006) in October 2006 on behalf of BHP Billiton to assess the potential environmental impacts resulting from Stage 1 of the Carooona Exploration Program. The REF provided a borehole specific environmental assessment of Stage 1 exploration activities. The REF was approved by the DPI on 18 December 2006.

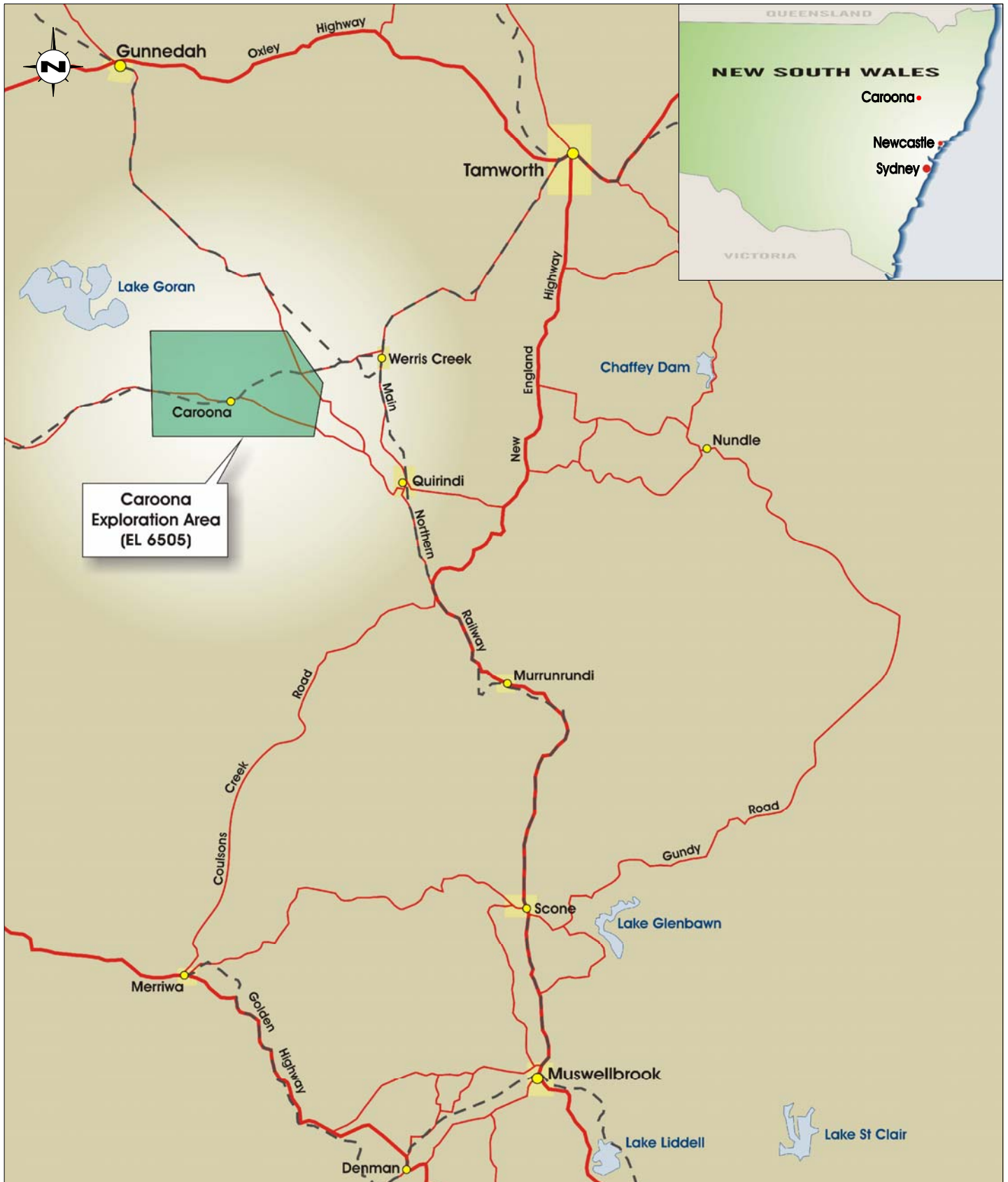
BHP Billiton propose to continue with exploration activities (reconnaissance drilling and associated activities) until 2011 which is for the duration of the current EL. This will consist of drilling of approximately 300 partially cored exploration boreholes. The majority of the exploration activities can be undertaken under the provisions of the Carooona EL 6505 without the need for further approvals from the DPI. However, some of the proposed exploration activities will require subsequent approval from the DPI due to the proposed location of activities being in an exempted area (e.g. State forest, road reserve). Other exploration activities may require further environmental assessment due to the potential for impacts on significant ecological (e.g. endangered ecological communities (EECs), threatened species) or other values (e.g. Aboriginal sites) (refer to **Section 5.1**).

This REF has been prepared by Umwelt (Australia) Pty Limited on behalf of BHP Billiton to assess the potential environmental impacts of exploration activities in exempt areas and areas identified as having vegetation that comprises (or potentially comprises) an EEC for the remaining duration of the existing EL (from 2007 to 2011). The REF will be used as a supporting document to Surface Disturbance Notices to be lodged with the Mining Titles branch of the DPI for individual borehole sites that fall under Condition 3, Section B, of the EL (i.e. exempted areas, refer to **Section 2.0**).

This REF assesses the potential environmental impacts of exploration activities in all identified exempt areas and areas of EEC within the EL, rather than providing a borehole specific assessment. Approval is sought to undertake exploration activities (reconnaissance level exploration drilling and associated activities) in these areas based on the environmental assessment provided in this REF.

1.1 Locality

The Carooona EL covers an area of approximately 344 km² and is located approximately 50 kilometres southeast of Gunnedah and 14 kilometres northwest of Quirindi (refer to **Figure 1.1**). The villages of Carooona and Walhallow are located within the EL area.



Source: New South Wales Road Directory

0 10 20 30km
1:750 000

FIGURE 1.1
Locality Plan
Caroona EL6505

2.0 Proposed Caroona Exploration Program Activities

2.1 EL Requirements

The exploration activities assessed in this REF for the period 2007 to 2011 are Category 1 prospecting operations as defined in the Caroona EL. Category 1 activities involve reconnaissance and low intensity activities including:

- a) geological mapping;
- b) airborne surveys;
- c) sampling and coring using hand held equipment;
- d) geophysical surveys and downhole logging, but not seismic surveys;
- e) drilling involving no more than minimal site preparation;
- f) minor clearing or cutting of native vegetation;
- g) minor excavations excluding costeaning or bulk sampling; and
- h) vehicle access that does not require construction of new access tracks.

Condition 1, Section A, of the Caroona EL outlines that Category 1 activities may be conducted within the EL area, without further approval, provided that:

- a) the operations do not cause more than minimal impact on the environment, taking into account the sensitivity of the local environment to disturbance;
- b) the operations do not cause harm to any threatened species, population or ecological community, or their habitats, including critical habitat;
- c) the operations do not cause damage to Aboriginal objects of Aboriginal places;
- d) the operations do not cause damage to the values and features listed in section 238 of the Act;
- e) the requirements of section 30 of the Act are met, if relevant; and
- f) the requirements of all State conservation, threatened species, environmental protection, heritage and related legislation are met.

Where the above requirements cannot be met, a Surface Disturbance Notice needs to be lodged with the DPI accompanied by relevant environmental assessment documentation to seek the DPIs approval to proceed prior to undertaking the activity.

There are two aspects of the proposed exploration activities that have been identified as requiring subsequent approval from the DPI. These are approvals for undertaking exploration activities in exempt areas (under section 30 of the *Mining Act 1992*), and to undertake activities that potentially impact on EECs recorded or predicted to potentially occur in the EL area. These two issues are addressed by this REF.

This REF identifies the locations in which EECs have been recorded or are predicted to potentially occur in the EL area and assesses the potential environmental impacts of Category 1 exploration activities in these areas. Exploration drilling is considered to be low intensity, as boreholes will generally be spaced greater than 500 metres apart.

Condition 3 of Section B of the EL specifies that where the requirements of section 30 of the Act cannot be met (i.e. exploration activities will be undertaken in an exempted area) the prior written consent of the Minister for Mineral Resources is required to undertake exploration activities. This includes exploration activities within road reserves, State Forests and other areas of Crown land. A Surface Disturbance Notice is required to be lodged with the DPI for approval prior to any exploration activity within exempted areas. This REF defines all identified exempt areas within the EL area that may be impacted by reconnaissance level exploration activity and assesses the potential environmental impacts of exploration activities in these areas. Exploration drilling in exempted areas will be of low intensity, with boreholes typically located greater than 500 metres apart.

2.2 Proposed Activities

The exploration activities proposed to occur within the EL area will involve the drilling of approximately 300 partially cored holes over the remainder of the Caroonia Exploration Program (2007 to 2011). In addition to borehole logging and extraction of cores from selected boreholes, in seam testing will be completed for the majority of boreholes including:

- *in situ* stress testing;
- permeability testing; and
- wireline logging.

It is also planned to undertake magnetic surveys and seismic surveys as part of the exploration program. A separate REF will be prepared and submitted to the DPI to assess the potential environmental impacts of undertaking seismic surveys.

The establishment of the drill sites will not generally require any earthworks, except for the excavation of sumps to contain drilling water. The soil excavated for the sumps will be stockpiled on site and the sumps filled in and the area rehabilitated once drilling has ceased. The only other ground disturbance associated with the operations will be the boreholes themselves. The remainder of operations at the drill sites including laydown areas for drilling equipment and temporary storage areas will not require any earthworks.

Existing access tracks to drilling sites may be improved (e.g. gravelled) at the request of the landholder. However, no new access tracks involving formed construction will be undertaken without prior approval from the DPI.

Drill sites will be temporarily fenced to prevent unauthorised access and ensure public safety, and the grass within the fenced areas may be slashed to minimise bushfire hazard around working machinery.

Drilling of each exploration borehole would typically take between two and four weeks depending on the depth of the hole, testing regime and geological conditions. Site preparation works (e.g. fencing and excavation of sumps) would typically commence one week prior to drilling. Site rehabilitation works will be undertaken following the completion of drilling.

2.2.1 Environmental Due Diligence Inspections

Prior to the commencement of exploration activities, the intended activity location is discussed with the relevant landholder and local community (where relevant) to ensure that potential land use impacts are minimised. In accordance with condition 13, Section C, of the Caroona EL, the proposed activity location is then subject to an environmental due-diligence inspection to determine its environmental values and to identify any potential site specific constraints or environmental management issues. If during environmental due diligence inspections potential impacts on threatened species, endangered populations, EECs or Heritage sites are identified, where possible, the proposed activity will be relocated to an area of reduced impact or appropriate management and mitigation measures implemented.

2.2.2 Exempt Areas within the Caroona EL

Undertaking exploration activities on private land within the Caroona EL area requires BHP Billiton to obtain access agreements with private landholders. BHP Billiton is committed to undertaking exploration activities in a manner that minimises impacts on private landowners and the local community and carries out detailed consultation with affected landowners. This includes, where possible, modifying proposed exploration activities and locations to reduce interactions with productive land uses. In some cases, obtaining landholder agreement to drill on private land may prove difficult.

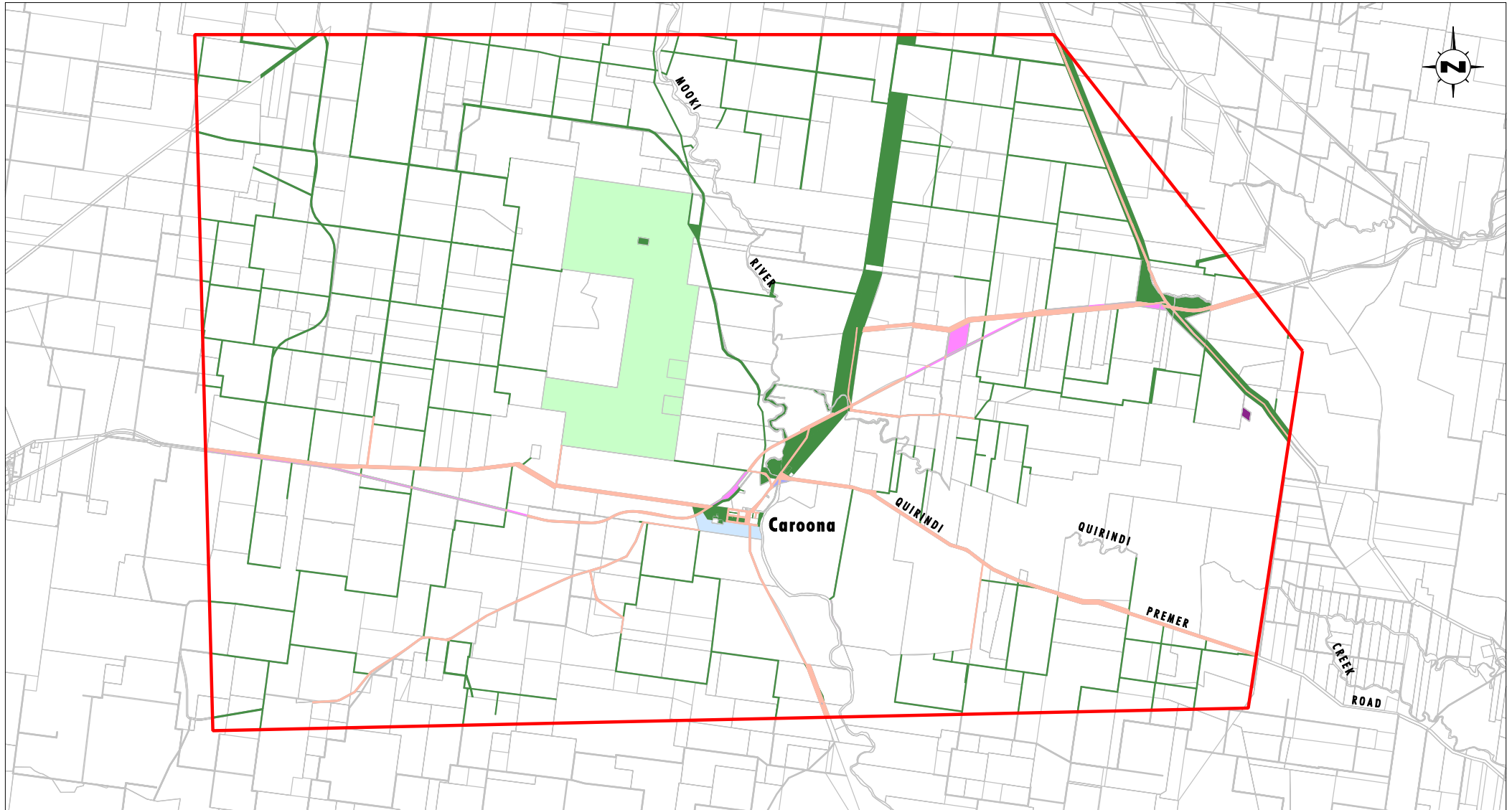
This REF assesses the potential impacts of exploration activities on all identified exempted areas in the EL area, rather than providing a borehole specific assessment, to aid in streamlining the approval process required for the remainder of the exploration program. The assessment is based on the proposed intensity of drilling activity.

The following exempted areas have been identified within the Caroona EL area:

- road and railway reserves;
- travelling stock reserves;
- State Forests;
- public reserves (including land owned by the State Rail Authority, Minister for Public Roads, Council of the Shire of Tarmang and Pell Cunningham County Council);
- crown land; and
- town commons.

The locations of exempted areas within the EL are shown on **Figure 2.1**. As shown on **Figure 2.1** the exempt areas predominantly consist of the Doona State Forest, Crown land and road reserves. Doona State Forest comprises the largest remnant of native woodland within the Caroona EL area, covering approximately 1330 hectares. The Crown land (including Crown road reserves) and road reserves within the EL area generally comprise small areas of moderately to highly disturbed native grasslands with scattered native trees and shrubs.

An assessment of the potential environmental impacts of exploration activities on the identified exempted areas within the Caroona EL area is provided in **Section 5.0**.



Base Source: LPI NSW
Source: BHP Billiton

0 2.0 4.0 6 km
1:120 000

Legend

- Carroona Exploration Area
- Doona State Forest
- Town Common
- Crown Land (Including Crown Road Reserve)
- Road and Rail Reserve
- The Council of the Shire of Tarmang
- The Minister for Public Roads
- The Peel Cunningham County Council
- State Rail Authority

File Name (A4): R08_V1/2295_104.dgn

FIGURE 2.1

Exempted Areas within EL

2.2.3 EECs within the EL Area

The Caroon EL area comprises floodplains and lower slopes that have been historically modified to form agricultural lands mostly clear of trees and shrubs. Areas in the EL that have not been subject to intensive agricultural land uses, including road reserves and grazed paddocks may comprise moderately to highly disturbed native grasslands with scattered eucalypts and shrubs. Areas that have been subject to less intensive land uses are more likely to contain remnant native vegetation which may be listed as an EEC. Due to the absence of detailed vegetation mapping information for the EL area, the potential presence of an EEC in a particular exploration activity area is determined during the environmental due diligence inspection.

One EEC is known to occur within the EL area. The EEC *Native Vegetation on Cracking Clay Soils of the Liverpool Plains* is known to occur within the EL area based on regional work and has been found by Umwelt during environmental due-diligence inspections of drilling locations. The occurrence of this EEC is limited by the presence of cracking clay soils, **Figure 2.2** indicates where the EEC could potentially occur within the EL area. Some of the exploration drilling work undertaken during Stage 1 was completed in areas identified as comprising this EEC and due to the potential wide distribution of the EEC within areas subject to less intensive agricultural land uses (refer to **Figure 2.2**), it is likely to interact with some future exploration activity locations.

In April 2007, *Inland Grey Box Woodland in the Riverina, NSW Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregions* was listed as an EEC. This EEC has not been recorded within the EL to date, but based on its regional distribution and habitat preferences could potentially occur within the EL area and interact with proposed exploration activities. If the EEC occurs within the EL area it is likely to be present in remnant woodland on slopes and rises dominated by Red Brown Earths. If this EEC occurs within the EL area, it may potentially interact with exploration activities.

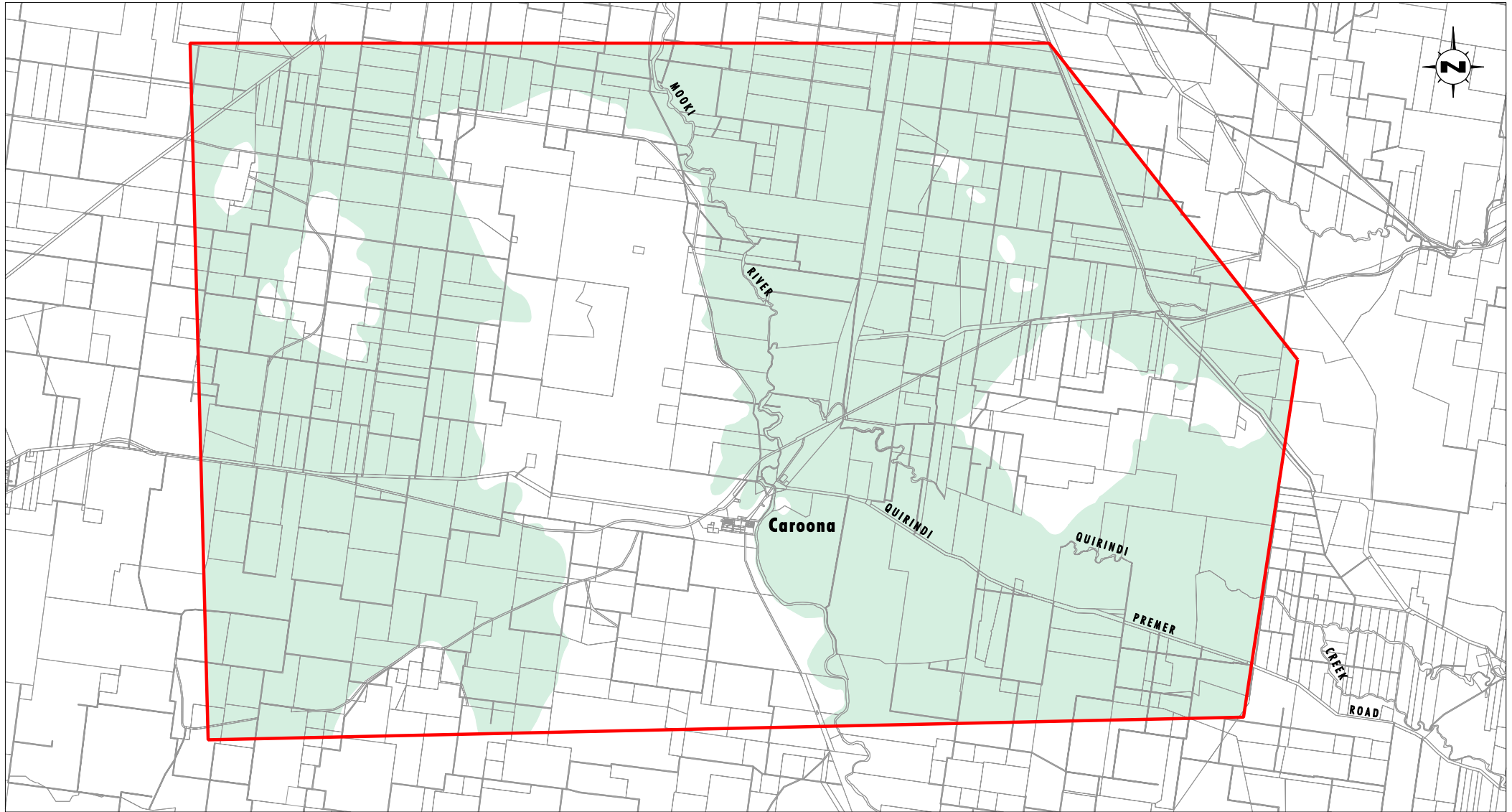
The *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions* EEC is also known to occur in the region. Weeping myall, the characteristic species of the community was observed within the EL area during environmental due-diligence inspections. If this community is present within the EL area it is likely to occur in small isolated stand. As a result, any proposed exploration activities found during due diligence inspections to be located within this EEC will be relocated to avoid impacts on the EEC.

An environmental assessment of the potential impacts of reconnaissance level exploration drilling in EECs is provided in **Section 5.0**.

2.3 Proposed Groundwater Monitoring Boreholes

Piezometers for ongoing groundwater monitoring will be installed in selected boreholes. Approximately 14 boreholes are planned to be converted to piezometers to monitor coal seam aquifers, some of which could potentially be located in exempted areas and/or interact with an EEC. The majority of the converted boreholes will have standpipe piezometers drilled to pair with the exploration boreholes to monitor groundwater in the alluvium.

Groundwater licences will be obtained for these piezometers from the Department of Water and Energy (DWE) prior to the installation of monitoring equipment.



Base Source: LPI NSW

0 2.0 4.0 6km
1:120 000

Legend

-  Carroona Exploration Area
-  Potential EEC Area (Based on Soil Mapping)

FIGURE 2.2

Potential Native Vegetation on Cracking Clay Soils EEC Areas

2.4 Justification of the Activity

The Caroona EL was granted to BHP Billiton by the NSW government in 2006. The initial phase of the exploration program requires holes to be drilled at regular grid spacings to provide suitable information for modelling of the resource. Although there is some flexibility around the exact location of the hole, maintenance of a suitable grid spacing is an important consideration.

BHP Billiton is seeking to conduct the exploration program in a manner that reduces impacts on landholders and the local community, and consultation about exploration activity locations is a key aspect of this consultation. Exploration activities are located to minimise environmental impacts and satisfy landholder preferences where possible. This is achieved through the completion of detailed consultation with affected landholders regarding suitable drilling locations and consideration of environmental factors, including completion of the environmental due-diligence inspections.

Due to the extent of exempted areas within the EL, drilling within exempted areas will be required to maintain acceptable borehole grid spacing. This will include drilling in Doona State Forest. In the absence of a suitable grid spacing, sufficient geological information will not be available to adequately assess the coal resource.

All exploration activities conducted during the Caroona Exploration Program are to be undertaken in accordance with the Exploration Environmental Management Plan for the Caroona Project (EEMP) (Umwelt, 2006) and as outlined in this REF. The EEMP provides the framework for environmental management of activities in the Caroona EL area and details the control measures to be implemented to ensure that exploration activities are conducted in an environmentally responsible manner. With these controls in place and as determined in this REF, the potential impacts of the exploration program on the environment are expected to be minimal.

2.5 Evaluation of Alternatives

As discussed in **Section 2.2**, exploration activity locations are selected to minimise potential impacts on environmental values, including those identified during the environmental due-diligence process, and to satisfy landholder preferences, where possible. This process has resulted in some of the exploration activities completed to date being relocated from their originally selected location, with this situation considered likely to continue for the remainder of the exploration program.

If exploration activities were not undertaken in exempt areas a suitable grid spacing of exploration drilling data would not be achievable. Without a suitable grid spacing, the geological information needed to adequately assess the resource within the EL area would not be obtained. As this REF identifies that exploration activities in exempted areas can be undertaken with minimal environmental impact, the preferred option is to undertake exploration activities in exempted areas to ensure that the required geological information is gathered.

Some areas within the EL may potentially comprise EECs as they have been subject to less intensive land uses. These areas are widely distributed across the EL and therefore it is likely that future exploration locations will interact with EECs. This REF identifies that exploration activities can be undertaken within EECs with minimal environmental impact. Undertaking exploration activities in EECs is essential for the exploration program to ensure sufficient geological data is gathered and will result in minimal impact.

Due to the widespread occurrence of both exempt areas and EECs within the EL, it is not possible to undertake the exploration program without drilling in these areas.

3.0 Planning Context

3.1 Licences and Approvals Required

The requirements of the Caroonia EL were described in **Section 2.1**. In addition to the requirements outlined in the EL, exploration activities within the EL area must be undertaken in accordance with the measures outlined in the Exploration Environmental Management Plan (EEMP) (Umwelt, 2006) approved by DPI.

Exploration activities in some areas within the EL may trigger the need for subsequent approval as discussed below.

3.1.1 Roads Act 1993

The *Roads Act 1993* is administered by the local Council in relation to Council roads and the Department of Lands in relation to Crown roads and Crown road reserves. Under Section 138, Part 9, Division 3 of the Act, a person must not:

- (a) erect a structure or carry out a work in, or over a public road, or
- (b) dig up or disturb the surface of a public road, or
- (c) remove or interfere with a structure, work or tree on a public road, or
- (d) pump water into a public road from any land adjoining the road, or
- (e) connect a road (whether public or private) to a classified road,

otherwise than with the consent of the appropriate roads authority.

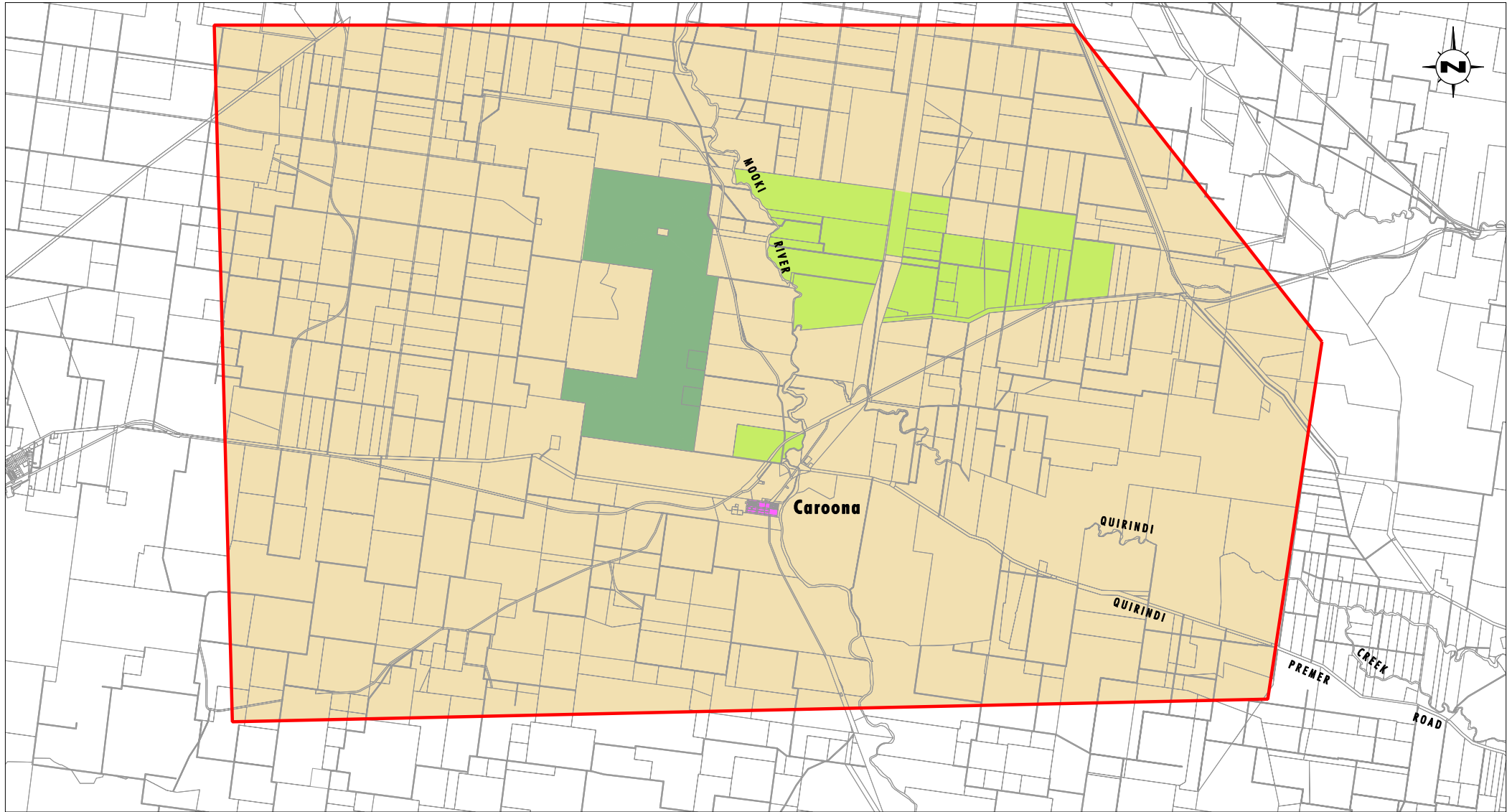
Approval under Section 138 of the Roads Act will be required from the relevant roads authority (Roads and Traffic Authority (RTA), council or Department of Lands) prior to any works in road reserves. BHP Billiton will obtain approval from the relevant authority prior to lodging an application for Ministers consent to drill in a road reserve.

3.1.2 Water Management Act 2000

The *Water Management Act 2000* (WMA Act) repeals a number of legislative instruments including the licensing provisions of the *Water Act 1912* and the *Rivers and Foreshores Improvement Act 1948*. The provisions of the WMA Act repeal the *Water Act 1912* once a Water Sharing Plan for the water source has been gazetted. The Upper and Lower Namoi Groundwater Sources Water Sharing Plan applies to the alluvial groundwater zones within the EL area. Piezometers installed for groundwater monitoring in the alluvial zones will require an approval under the WMA Act. The majority of required approvals have already been obtained.

3.2 Zoning

The majority of exploration activities to be undertaken will be located on land zoned as 1(a) - Rural "A" under the Quirindi Local Environmental Plan (LEP) or 1(a) - Rural (Agricultural Protection) under the Gunnedah LEP (refer to **Figure 3.1**). The Doona State Forest is zoned 1(f) - Forests under the Gunnedah LEP. The proposed exploration activities are generally



Base Source: LPI NSW, 2000
Source: Gunnedah Shire Council 1998, Liverpool Plains Shire Council 2006

0 2 4 6 km
1:120 000

Legend

- Carroona Exploration Area
- Rural Zone 1(a)
- Village Zone 2(v)
- Open Space Zone 6(a)
- Forests Zone 1(f)

FIGURE 3.1
Carroona EL Area
Land Zoning

consistent with the objectives of the above zones. Smaller areas of the EL are zoned 2(v) Village Zone (around the Caroonia township) and 6(a) Open Space Zone (refer to **Figure 3.1**).

The Doona State Forest which is zoned 1(f) - Forests under the Gunnedah LEP comprises the largest exempt area within the Caroonia EL . The remaining exempt areas are generally within land zoned as 1(a) - Rural "A" under the Quirindi LEP or 1(a) - Rural (Agricultural Protection) under the Gunnedah LEP.

3.3 Stakeholder Consultation

BHP Billiton is committed to an open and transparent consultation process as part of the Caroonia exploration program. Key stakeholders relevant to the program include the DPI, local community and interest groups, local Aboriginal community, local Council's and relevant government agencies. Detailed consultation regarding the exploration program has been undertaken with the DPI and will be ongoing for the duration of the project, with an extensive community consultation program currently underway as discussed below.

In accordance with Condition 54 of the Exploration Licence, BHP Billiton has established the Caroonia Coal Project - Community Consultative Committee (CCC). The committee includes the following representatives:

- Chairperson;
- BHP Billiton – two representatives;
- Department of Primary Industries;
- Liverpool Plains Shire Council – two representatives;
- Gunnedah Shire Council – two representatives; and
- Community – eight representatives.

The Caroonia CCC meets every two months or at other intervals determined by the Chairperson in consultation with committee members.

BHP Billiton has also appointed a community contact for all community and other stakeholder enquiries regarding the Caroonia exploration project. A free call phone number and e-mail address for community members to access has been established. Project information sheets have also been distributed by BHP Billiton regarding the exploration program, with regular updates to be distributed throughout the program.

Consultation has also been undertaken with landholders during the due diligence process to determine preferred locations for boreholes to be drilled.

BHP Billiton is consulting as required, with the relevant authorities regarding current and proposed exploration activities in exempted areas.

4.0 Existing Environment

The Carroona EL area is predominantly flat with hilly areas associated with the Doona State Forest, Nicholas Ridge and Georges Island. The soil types occurring in the EL area are dominated by very deep Clays and Earths, and shallow to moderately deep Earths, Sands, Podzolic and Solodic Soils. The dominant surrounding land uses are a mixture of cropping, grazing, feed lots and the State Forest. The major crops grown in the area include oats, wheat, barley, canola and grain sorghum as well as some irrigated cotton. Other land uses in the broader area include extractive industries, mines, industrial uses and tourism (Liverpool Plains Shire Council 2005).

The Carroona EL lies within the Namoi Valley catchment, which forms part of the Murray Darling Basin. The Mooki River bisects the EL and flows into the Namoi River upstream of Gunnedah. A section of Quirindi Creek, a tributary of the Mooki River, flows east to west through the EL area. Yarraman Creek also flows through the south-west portion of the EL area. These water sources have variable river flows throughout the year and are ephemeral systems (DIPNR 2005).

The groundwater system of the EL area consists of three types of aquifers:

- a Quaternary alluvial aquifer system which covers approximately 70 per cent of the EL area;
- Triassic fractured rock aquifers; and
- underlying Permian coal seam aquifers.

The lower section of the alluvium contains high yielding sands and gravels in the Gunnedah Formation and is used extensively for irrigation for agriculture. The upper section of the alluvium, the Narrabri Formation, predominantly consists of silts and clays with shoe-string sand beds used locally for stock and domestic supply. Groundwater in the alluvium is generally potable, with a median electrical conductivity of approximately 1000 μ S/cm.

The Triassic and Permian aquifers which outcrop over approximately 30% of the EL area are low yielding and generally contain poor quality water. Some of the bedrock outcrop areas provide stock and domestic water.

Further details of the existing environment in the EL area are discussed where relevant in **Section 5.0**.

5.0 Environmental Impacts and Management

5.1 Ecology

5.1.1 Environmental Due Diligence Surveys

Condition 13, Section C, of the Carroona EL specifies that prior to carrying out any prospecting operations the licence holder must consider potential impacts on threatened species, populations and ecological communities and their habitats. To achieve this aim, environmental due diligence surveys are undertaken to assess the proposed borehole locations for potential impacts on threatened species, endangered populations and EECs listed under the *Threatened Species Conservation Act 1995* (TSC Act) or the Commonwealth

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). If potential impacts on threatened species, endangered populations or EECs are identified during the inspections, where possible, the proposed boreholes will be relocated to an area of reduced impact or appropriate management and mitigation measures implemented.

The inspections target potentially occurring threatened flora species, endangered populations and EECs. The inspections also target any significant fauna habitat features that could be utilised by threatened fauna, such as hollow-bearing trees, feed trees and hollow logs. An area within an approximately 15 metre radius of the centre point is surveyed at each proposed drilling site, to adequately cover the area of potential impact. Proposed access tracks for the drilling sites are also inspected where required.

The proposed management strategy for minimising the potential environmental impacts of exploration boreholes potentially interacting with EECs is discussed in **Section 5.1.4**.

5.1.2 Regional Context and Significant Species and Communities

The Caroonia EL area comprises floodplains and lower slopes that have been historically modified to form agricultural lands mostly clear of trees and shrubs, however, some scattered mature trees are present. Doona State Forest comprises the largest remnant of native woodland within the Caroonia EL area, covering an area of approximately 1330 hectares. Other areas in the EL that are not subject to intensive agricultural land uses, including road reserves, may also comprise moderately to highly disturbed native grasslands with scattered eucalypts and shrubs.

A number of threatened flora and fauna species are considered to potentially occur within the Caroonia EL area. No records of threatened flora species from the NSW Department of Environment and Climate Change (DECC) Atlas of NSW Wildlife occur within the EL area, however, three fauna species from the atlas have been previously recorded within the EL area: the koala (*Phascolarctos cinereus*), diamond firetail (*Stagonopleura guttata*) and hooded robin (*Melanodryas cucullata*). A fourth threatened species, the grey-crowned babbler (*Pomatostomus temporalis temporalis*), was recorded by Umwelt during site inspections, as were additional locations for the koala.

No threatened flora or fauna species have been identified at the sites of the proposed exploration activities inspected to date. Similarly, no endangered populations are considered likely to occur at the proposed exploration activity locations. However, the endangered ecological community (EEC) *Native Vegetation on Cracking Clay Soils of the Liverpool Plains* (refer to **Section 5.1.2.1**) has been identified during due diligence inspections as potentially occurring at a number of exploration activity locations.

The EEC *Inland Grey Box Woodland in the Riverina, NSW Western Slopes, Cobar Penplain, Nandewar and Brigalow Belt South Bioregions* could potentially occur within the EL area and interact with proposed exploration activity locations. If the EEC occurs within the EL area it is likely to be present in remnant woodland on slopes and rises dominated by Red Brown Earths.

The EEC *Weeping Myall Woodland in the Brigalow Belt South Bioregion* (refer to **Section 5.1.2.3**), is also thought to occur in the EL area and is considered to have potential to occur at some of the proposed exploration activity locations yet to be assessed. However, as discussed in **Section 5.1.2.3**, exploration activities will be relocated to avoid potential impacts on this EEC, which generally occurs in small areas.

5.1.2.1 Native Vegetation on Cracking Clay Soils of the Liverpool Plains EEC

This community occurs on cracking clay soils (vertisols – including soils referred to as Black Earths) within the Liverpool Plains catchment. It generally comprises grasslands which are dominated by plains grass (*Austrostipa aristiglumis*), Queensland blue grass (*Dichanthium sericeum*) or coolibah grass (*Panicum queenslandicum*). Shrubs and trees can occur within this community, and are generally sparse but may be locally common (NSW Scientific Committee 2004).

Locations of exploration activities that are on clay soils within the EL area have the potential to interact with this EEC. The final determination for this EEC (NSW Scientific Committee 2004) does not provide any specific guidance in determining how disturbances, such as cultivation history and level of weed infestation, affect the likely presence or persistence of this EEC.

To assist in delineating whether the vegetation within the EL conforms to the EEC, two regional experts were contacted for advice: Mr Dennis Boschma, Catchment Manager with the Tamworth office of the Namoi Catchment Management Authority, and Mr Todd Soderquist, Threatened Species Officer with the Armidale Office of the Department of Environment and Conservation.

The outcome of consultation with these experts were as follows:

- the definition of the EEC is very broad, and essentially captures all native vegetation that occurs on cracking clay soils on the Liverpool Plains;
- there are no specific exclusions in relation to weed density, cropping (or other disturbance) history;
- routine agricultural activities were exempt from permit to clear the EEC;
- regrowth since 1990 was exempt from permit under the *Native Vegetation Act 2003*; and
- if a seed-bank was present, or likely to be present, and there was a chance of unassisted or slightly assisted recovery of the community, even where absent above ground, then the EEC was regarded as being present.

The advice supports the assessment approach undertaken by Umwelt, that areas that have been regularly cultivated over a reasonable period of time are unlikely to support viable seed-banks and therefore not likely to support the EEC. All other areas that occur on cracking clay soils and support a reasonable abundance of native vegetation, or likely viable seed-banks, are regarded as being part of the EEC.

A nomination to list the *Austrostipa aristiglumis* Grasslands of the Liverpool Plains in NSW under the Commonwealth EPBC Act has also been made. This nominated community conforms to the Native Vegetation on Cracking Clay Soils of the Liverpool Plains listed under the TSC Act. Assessments under the EPBC Act are not required at this stage, however, considerations under the TSC Act effectively assess the impact on the nominated community.

5.1.2.2 Inland Grey Box Woodland in the Riverina, NSW Western Slopes, Cobar Penplain, Nandewar and Brigalow Belt South Bioregions EEC

This EEC is found on the relatively fertile soils of the western slopes and plains of NSW in which *Eucalyptus microcarpa* (inland grey box) is the most characteristic species (NSW Scientific Committee 2007). Inland grey box is often found in association with *Eucalyptus*

populnea subsp. *bimbil* (bimbil box), *Callitris glaucophylla* (white cypress-pine), *Brachychiton populneus* (Kurrajong), *Allocasuarina luehmannii* (buloke) or *Eucalyptus melliodora* (yellow box), and sometimes with *Eucalyptus albens* (white box) in this community (NSW Scientific Committee 2007). Shrubs are typically sparse or absent, however a variable ground layer of grass and herbaceous species is present at most sites (NSW Scientific Committee 2007). The community generally occurs as an open woodland 15 to 25 metres tall but in some locations the overstorey may be absent as a result of disturbance (NSW Scientific Committee 2007).

An assessment by Prober and Thiele (2004) found Inland grey box to be associated with soils of Tertiary and Quaternary alluvial (or occasionally colluvial or eluvial) origin, largely corresponding with Red Brown Earths (NSW Scientific Committee 2007). Doona State forest comprises the largest woodland remnant remaining within the EL area. A substantial proportion of the Doona State Forest has been inspected to date and this EEC has not been recorded. There are, however, smaller areas of remnant woodland within the EL which have not been surveyed to date and could potentially comprise this EEC.

If the EEC occurs within the EL area it may be present in any areas of remnant woodland on slopes and rises dominated by Red Brown Earths.

5.1.2.3 Weeping Myall Woodland in the Brigalow Belt South Bioregion EEC

Weeping Myall Woodland in the Brigalow Belt South Bioregion is situated on alluvial plains with red-brown earths and heavy textured grey and brown alluvial soils. The tree layer, typically up to 10 metres in height, is dominated by weeping myall (*Acacia pendula*). The understorey comprises an open layer of chenopod shrubs and other woody plant species and an open to continuous groundcover of grasses and herbs (NSW Scientific Committee 2005).

Weeping myall, the characteristic species in this community has been observed on the floodplains within the Caroonia EL area. Although the weeping myall remnants have not yet been investigated, they are highly likely to comprise this EEC. If this community is present at any of the proposed exploration activity locations yet to be assessed, it is likely to occur in small, isolated stands. If proposed exploration activity locations coincide with the presence of this EEC, they will be relocated to minimise the impact on this community.

A nomination to list Weeping Myall Open Woodlands under the EPBC Act has also been made. This nominated community conforms to the Myall Woodland in the Brigalow Belt South bioregion listed under the TSC Act. Assessments under the EPBC Act are not required at this stage, however, considerations under the TSC Act effectively assess the impact on the nominated community.

5.1.3 Impact Assessment

5.1.3.1 Boreholes in Native Vegetation on Cracking Clay Soils of the Liverpool Plains EEC

Figure 2.2 provides an indicative area of where the EEC *Native Vegetation on Cracking Clay Soils of the Liverpool Plains* may occur within the EL area, based on soil landscape mapping by Banks (1995), position in the landscape and environmental due-diligence inspections completed to date. The EEC may, however, potentially occur outside of the area shown on **Figure 2.2**, and the environmental assessment provided below assesses the potential environmental impacts of exploration activities with the EEC throughout the EL area. Exploration activities located in reserves (e.g. road and travelling stock reserves) are considered most likely to impact on vegetation that comprises the EEC due to the low level of

disturbance that is likely to have occurred, and potential presence of a native vegetation seed bank at these sites. Seed banks of native vegetation are also considered likely to be present in grazed paddock sites due to the presence of native grass species that are considered to have undergone relatively low levels of disturbance, when compared to other agricultural areas in the local area.

The proposed exploration activities involve reconnaissance drilling and associated activities with a borehole grid spacing that varies between 500 metres and 4000 metres. The impact of reconnaissance drilling will be limited to a compound of approximately 20 metres by 20 metres, with ground disturbing works limited to the drilling of the borehole and excavation of two water sumps. The improvement of existing access tracks will not result in additional ground disturbance. Therefore, the extent of impact of exploration activities will be minimal.

In accordance with Section 5A of the *Environmental Planning and Assessment Act 1979*, a Seven-Part Test of Significance was undertaken for exploration activities assessed in this REF (refer to **Appendix 1**). The Seven-Part Tests of Significance determined that exploration activities are unlikely to have a significant impact on the EEC due to the very small area of disturbance and the expected recovery of vegetation at the sites after drilling. A species impact statement is therefore not required.

5.1.3.2 Boreholes in Inland Grey Box Woodland in the Riverina, NSW Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregions EEC

If this EEC is present within the EL area it is most likely to occur in remnant woodland on slopes and rises dominated by Red Brown Earths. As described above, the reconnaissance drilling will impact on an area approximately 20 metres by 20 metres, generally at a minimum 500 metre grid spacing, with ground disturbance limited to the drilling of the borehole and excavation of two water sumps. The improvement of existing access tracks will not result in additional ground disturbance. Therefore, the extent of impact of exploration activities will be minimal.

In accordance with Section 5A of the *Environmental Planning and Assessment Act 1979*, a Seven-Part Test of Significance was undertaken for exploration activities (for the remainder of the exploration program) that could potentially interact with this EEC (refer to **Appendix 1**). The Seven-Part Tests of Significance determined that the exploration activities are unlikely to have a significant impact on the EEC due to the very small area of disturbance and the expected recovery of vegetation at the sites after drilling. A species impact statement is therefore not required.

5.1.3.3 Boreholes in Weeping Myall Woodland in the Brigalow Belt South Bioregion EEC

As discussed in **Section 5.1.2.3**, any proposed exploration activities found during due diligence inspections to be located within vegetation comprising the *Weeping Myall Woodland in the Brigalow Belt South bioregion* EEC will be relocated to avoid impacts on the EEC.

5.1.4 Management of Boreholes Located in EECs

For exploration activities located in the *Native Vegetation on Cracking Clay Soils of the Liverpool Plains or Inland Grey Box Woodland in the Riverina, NSW Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregions* EECs, the following controls will be implemented to reduce the potential impact of the exploration program on the EECs:

- the area of disturbance will be kept to the minimum required to undertake drilling of the borehole;
- each site will be fenced to visually define the area of disturbance;
- vehicle movements to and from each site will be restricted to defined tracks;
- contractors undertaking work at these sites will be informed of the ecological significance of these sites;
- machinery will be cleaned of mud and seed prior to relocation to each site; and
- rehabilitation of each site will be undertaken in accordance with the process outlined in **Section 6.0**.

5.2 Heritage

5.2.1 Aboriginal Archaeology

A search of the DECC/AHIMS site was undertaken on 5 June 2006 to identify any registered Aboriginal sites within the EL. Thirty-three sites were identified (refer to **Table 5.1**). Some of these sites are site complexes and incorporate two site types (e.g. burials and stone arrangement, burial and mission, axe grinding groove and stone arrangement). The most common Aboriginal site type within the Caroon EL is scarred trees (23), followed by axe grinding grooves (5), burials (3), stone arrangements (2) an engraving (1) and an isolated find (1).

Table 5.1 - Known Aboriginal Archaeology Sites within the EL

Site Type	DECC Site ID
Rock Engraving	29-1-0001
Burial/s, Stone Arrangements	21-1-0008
Burial/s, Contact, Mission	29-1-0014
Burial/s	29-1-0020
Axe Grinding Groove, Stone Arrangement	29-1-0021
Isolated Find	29-1-0051
Axe Grinding Groove	29-1-0022
Axe Grinding Groove	29-1-0023
Axe Grinding Groove	29-1-0069
Axe Grinding Groove	29-1-0074
Scarred Tree	29-1-0050
Scarred Tree	29-1-0056
Scarred Tree	29-1-0057
Scarred Tree	29-1-0058
Scarred Tree	29-1-0059
Scarred Tree	29-1-0060
Scarred Tree	29-1-0061
Scarred Tree	29-1-0062
Scarred Tree	29-1-0063

Table 5.1 - Known Aboriginal Archaeology Sites within the EL (cont)

Scarred Tree	29-1-0064
Scarred Tree	29-1-0065
Scarred Tree	29-1-0066
Scarred Tree	29-1-0070
Scarred Tree	29-1-0071
Scarred Tree	29-1-0072
Scarred Tree	29-1-0073
Scarred Tree	29-1-0075
Scarred Tree	29-1-0076
Scarred Tree	29-1-0085
Scarred Tree	29-1-0086
Scarred Tree	29-1-0087
Scarred Tree	29-2-0082
Scarred Tree	29-2-0162

Archaeological due diligence inspections have been undertaken for all exploration activities undertaken to date. The inspections were undertaken by an Umwelt Archaeologist to assess the archaeological significance of the exploration activity locations and representatives of the Aboriginal community to assess the Aboriginal cultural heritage significance. To date three Aboriginal archaeological sites have been identified during the due diligence inspections (refer to **Table 5.2**). All of these sites have been avoided by exploration drilling activities.

Table 5.2 - Identified Aboriginal Archaeology Sites

Site Name	Site Type
Caroona 1	Isolated find (single grey chert flake)
Caroona 2	Isolated find (single brown chert broken flake)
Caroona 3	Isolated find (broken retouched rhyolite flake)

All ground disturbing exploration activity locations will be subject to archaeological due diligence inspections prior to the commencement of exploration activities to determine potential impacts on archaeological values. These inspections will be undertaken by an archaeologist and representatives of the Aboriginal community. The planning and operational controls outlined in the Caroona EEMP (Umwelt 2006) will be implemented at each of the exploration activity sites to minimise the potential impact on Aboriginal Heritage, including:

- where possible, exploration activities will be located so that they do not impact on Aboriginal sites;
- if impact is unavoidable, the required approvals/licences will be obtained from the relevant authorities prior to the commencement of work; and
- should previously unidentified Aboriginal sites be found during exploration activities, work will immediately cease and the sites will be reported to the Exploration Manager who will arrange for the appropriate assessment to be undertaken.

As the controls outlined in the EEMP (Umwelt 2006) are to be implemented at each of the exploration drilling locations, it is considered that the potential impacts on Aboriginal Heritage at these sites will be minimal. Should any impacts be required to Aboriginal sites, these impacts will be formally assessed as part of a Section 90 consent process under the *National Parks and Wildlife Act 1974*, prior to impact.

5.2.2 Historic Heritage

A search was undertaken of the Australian Heritage Database and NSW Heritage Office database to identify sites of historic heritage. The Carroona Mission Cemetery is listed as a historical place on the Register of the National Estate. The Cemetery is located approximately 0.5 kilometres north of Carroona. The Walhallow Homestead is listed under the Quirindi LEP as a Heritage Item and is located approximately one kilometre north-west of Carroona. Due to the length of occupation of the Liverpool Plains region, it is considered highly likely that items of heritage significance will be located within the Carroona EL area. Based on the available historical information, the primary areas with the potential to have high historic heritage value are:

- the Walhallow/Carroona Aboriginal settlement, including the cemetery associated with the settlement;
- the village of Carroona, including the Croaker Memorial Union Church and the sandstone quarry used for the construction of the church and other local buildings; and
- other farm buildings and settlements associated with the early settlement of the area and ongoing farming activities.

Similarly to Aboriginal heritage, all proposed exploration activity locations will be subject to a due diligence inspection to identify any historic heritage values prior to the commencement of works and the controls of the EEMP (Umwelt 2006) will be implemented at each of the boreholes, including:

- where possible, exploration activities will be located so that they do not impact on historic heritage values;
- should impact be unavoidable, required approvals/licences will be obtained from the relevant authorities prior to the commencement of work; and
- should previously unidentified heritage sites/objects be found during exploration activities, work will immediately cease and the sites will be reported to the Exploration Manager who will arrange for the appropriate assessment to be undertaken.

As a result of the above controls, it is considered that the potential impacts on historic heritage values as a result of exploration activities will be minimal, with any proposed impacts on sites recorded during future due diligence inspections to be subject to further detailed assessment and approval from the NSW Heritage Office as required.

5.3 Amenity

5.3.1 Noise

Exploration activities will be undertaken in accordance with the Carroona Project EEMP (Umwelt 2006) to minimise potential noise impacts on residential receivers. Section 6.8.2 of

the EEMP (Umwelt 2006) requires that drill rigs are fitted with appropriate noise suppression equipment (e.g. mufflers). Other operational controls outlined in the EEMP (Umwelt 2006) that will be implemented to control noise levels include all equipment used on site being maintained in good working order, pre-start inspections of equipment and noise control devices, and generally restricting exploration activities to daylight hours.

5.3.2 Air Quality

DECC requires that best management practices are adopted during all mineral exploration activities (NSW Minerals Council 1998). Ideally, no visible dust should be created nor should exhausts from any equipment or vehicles be visible for more than 10 seconds (NSW Minerals Council 1998). In accordance with Section 6.8.2 of the EEMP (Umwelt 2006) drill rigs will be fitted with appropriate dust suppression equipment (e.g. water sprays), pre-start inspections of dust control equipment will be undertaken and speed limits on access tracks will be adhered to at all times to minimise dust generation.

As a result of the operational controls to be implemented during drilling operations it is considered that the potential impacts on air quality will be minimal.

5.4 Water, Hazardous Substances and Waste Management

5.4.1 Water

Surface Water

As discussed in **Section 4.0**, the EL lies within the Namoi Valley catchment and is bisected by the Mooki River. A section of Quirindi Creek, a tributary of the Mooki River, flows from east to west through the EL. Yarraman Creek flows through the south-west portion of the EL area. These water sources have variable river flows throughout the year and are ephemeral systems prone to drought (DIPNR 2005). The Namoi River is a major tributary of the Murray-Darling River system, and has been identified as a river where increased salinity problems are predicted (Murray-Darling Basin Commission 2004).

Surface water operational controls will be implemented for all exploration activities in accordance with the measures specified in the EEMP (Umwelt 2006). This will include the construction of drilling sumps (and other containment measures) to hold slurry and dirty water generated during drilling and the disposal of all slurry and dirty water off-site at an appropriately licensed facility. Temporary sediment and erosion controls will also be constructed to prevent runoff of sediment from drilling compounds. With these controls in place, it is expected that the impact of exploration activities on surface water will be minimal.

Groundwater

DECC requires that mineral exploration activities that could potentially intersect the groundwater table are required to be planned and conducted in a manner which does not cause adverse changes to groundwater quality, the aquifer encountered or leakage between aquifers (NSW Minerals Council 1998). To minimise the potential impacts on groundwater, exploration activities will be undertaken in accordance with the controls outlined in the EEMP (Umwelt 2006). Operational controls relating to groundwater management include using appropriately licensed drillers, sealing bores to prevent any ingress of water into the hole which would allow for cross contamination between aquifers and grouting holes on completion of testing. With these controls in place, it is expected that the impact of exploration activities on groundwater will be minimal.

5.4.2 Hazardous Substances and Waste Management

All wastes generated by exploration activities will be collected, segregated and stored in properly constructed containers and removed to an approved landfill or other disposal site in accordance with local council requirements. No servicing of equipment will be undertaken on site. All chemicals, fuels and oils used on site will be appropriately banded, and spill and oil absorbent materials will be maintained on site. Drill cuttings and fluids will be contained in in-ground sumps. Any soil potentially contaminated by chemicals, oils, fuels or other drilling products will be collected and disposed of in an approved manner and the site rehabilitated on completion in accordance with the process outlined in **Section 6.0**.

5.5 Soils, Land Use and Natural Resources

As discussed in **Section 4.0**, the soils of the EL area are characterised by deep, highly fertile Black Earths interspersed with Red Earths, Red Brown Earths and Solodics (NSW NPWS 2002). The dominant surrounding land uses are a mixture of cropping, grazing, feed lots and State Forest. Other land uses in the broader area include extractive industries, mines, industrial uses and tourism (Liverpool Plains Shire Council 2005).

The land capability of the majority of the EL area is Class two or three, with smaller portions of State Forest and Classes four, five, six, seven and eight. Class two means that the land is suitable for regular cultivation but has some limitations to production due to site conditions (e.g. erosion). Class three indicates that the land is suitable for cropping on a rotational basis, with production limited by soil erosion hazards.

The impact of proposed exploration activities on soils, land use and natural resources are expected to be minimal as the activities to be undertaken are defined as Category 1 under the Caroon EL. This category of exploration activity only involves minor clearing or cutting of native vegetation, minor excavation and minimal site preparation. As such, there will be minimal clearing of tree or shrub vegetation and minimal ground disturbance required for completion of the boreholes and therefore minimal impact to soils and natural resources will occur. The drilling program will have a minimal impact on the current use of the land as exploration activities at each site is only undertaken for a period of approximately two to four weeks.

5.6 Community

As discussed in **Section 3.3**, BHP Billiton is undertaking an extensive community consultation program as part of its exploration activities. This includes consultation with landholders to determine landholder preferences for borehole locations and consultation with the broader community via the Caroon Exploration Program CCC.

The operational controls designed for the Caroon exploration program (as outlined in the EEMP, Umwelt 2006) have been designed to minimise impacts on the local environment and community. Due to the operational controls to be implemented during drilling and the short period of time that exploration activities will occur in any one location, the potential impacts of the exploration program on the community is predicted to be minimal.

5.7 Cumulative Impacts

The controls outlined in this REF and the EEMP (Umwelt 2006) have been designed to minimise potential cumulative impacts from exploration activities. The controls outlined in the EEMP will be implemented for all exploration activities during the Carroona exploration program. Exploration activities at each site will be of a short term nature and all sites will be appropriately rehabilitated after activities cease. Due to the short term nature of exploration activities in any one location and the controls to be implemented during drilling, the cumulative impacts of the Carroona exploration operations are predicted to be minimal.

6.0 Rehabilitation

Topsoil (including groundcover) will be removed from areas to be disturbed for completion of exploration boreholes and appropriately stored and protected from erosion for use in later rehabilitation. Once the drill holes have been sealed, surveyed and marked, disturbed land will be rehabilitated using the stored topsoil (and groundcover). Where exploration activities are located in an EEC no seeding will be undertaken following the respreading of topsoil so as not to introduce non-endemic species to the site. The seed stores in the topsoil and natural recolonisation from surrounding vegetation will result in natural regeneration of the EEC.

In accordance with the Carroona EL, land disturbed will be rehabilitated to a stable and permanent form suitable for a subsequent land use acceptable to the DPI. Regular inspections of the rehabilitated exploration activities sites will be undertaken in accordance with the EEMP (Umwelt, 2006) until satisfactory rehabilitation is achieved. Rehabilitation activities will be completed as soon as possible after the cessation of exploration work at the site.

Drill holes will be sealed, surveyed and marked generally in accordance with the DPI guideline *Borehole Sealing Requirements on Land: Coal Exploration*. However, where the site geologist determines that the strata's risk of failure is low, the cement mixture will be deposited in the entire depth of the borehole, which may exceed 200 metres, the recommended maximum depth of filling at any one time outlined in the guidelines. To overcome any potential impacts from slumping or the concrete seal failing, the borehole will be inspected approximately two weeks after sealing and appropriate remedial activities will be undertaken should any slumping be identified.

7.0 Summary of Impacts and Conclusions

The operational controls outlined in this REF and the EEMP (Umwelt 2006), along with the conditions contained in the Carroona Project EL have been designed to minimise potential impacts of exploration activities on the environment and community. This includes measures to minimise impacts on the EECs found within the EL that may be impacted by exploration activities, with the assessment of significance conducted as part of this REF finding that the impact of the exploration program on the EECs will not be significant. The REF also considers the impact of exploration activities occurring within exempted areas identified within the Carroona EL area, and has found that these activities are unlikely to have a significant impact on the local environment. With the proposed controls in place, the impact of the proposed exploration program on the local environment and community is expected to be minimal.

8.0 References

- Banks, R.G. 1995. *Soil Landscapes of the Curlewis 1:100 000 Sheet Map*. Department of Conservation and Land Management, Sydney.
- DIPNR, 2005. *A Guide to the Water Sharing Plan for the Phillips Creek, Mooki River, Quirindi Creek and Warrah Creek Water Sources (as amended 1 July 2004)*.
- Liverpool Plains Shire Council, 2005. *Liverpool Plains Shire Growth Management Strategy*.
- NSW Minerals Council, 1998. *Guidelines for Environmentally Responsible Mineral Exploration in NSW*.
- NSW Scientific Committee, 2004. *Native Vegetation on Cracking Clay Soils of the Liverpool Plains – Endangered Ecological Community Listing: NSW Scientific Committee Final Determination*.
- NSW Scientific Committee, 2005. *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes Bioregions – Endangered Ecological Community Listing: NSW Scientific Committee Final Determination*.
- NSW Scientific Committee, 2007. *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions - endangered ecological community listing*.
- Prober, S.M., Thiele, K.R. 2004. Floristic Patterns along an east-west gradient in grassy box woodland of Central New South Wales. *Cunninghamia* **8**, 306-325.
- Umwelt, 2006. *Exploration Environmental Management Plan for the Caroona Project – EL 6505*. Report prepared for BHP Billiton.

APPENDIX 1

Seven Part Test of Significance

Appendix 1 - Seven Part Test of Significance ***Environmental Planning & Assessment Act 1979***

The reconnaissance drilling activities proposed to be undertaken by BHP Billiton within the Caroona EL area will involve the drilling of approximately 300 partially cored boreholes, at a grid spacing of between approximately 500 and 4000 metres. At each site, the impact of reconnaissance drilling will be limited to a compound of approximately 20 metres by 20 metres, with ground disturbing works limited to the drilling of the borehole and excavation of two water sumps. Each site will be rehabilitated once exploration activities have ceased, in accordance with the rehabilitation works described in Section 6.0 of the main text. Some tracks used to access drill sites may be gravelled at the request of landowners to improve access. The improvement of existing access tracks will not result in additional ground disturbance. Therefore, the extent of impact of exploration activities will be minimal.

A small proportion of the drilling locations inspected by Umwelt to date contain vegetation which comprises (or potentially comprises) the endangered ecological community (EEC) *Native Vegetation on Cracking Clay Soils of the Liverpool Plains*, listed under the *Threatened Species Conservation Act 1995* (TSC Act). Detailed ecological surveys of the community and a statistical analysis of the results would be required to confirm the presence of the EEC. In the absence of these detailed surveys, the potential presence of the EEC is determined during environmental due diligence inspections. This EEC potentially occurs on floodplains on cracking clay soils within the Caroona EL area, generally in road reserves and grazed paddocks.

No drilling locations inspected by Umwelt to date contain vegetation which comprises the EEC *Inland Grey Box Woodland in the Brigalow Belt South Bioregion*, listed under the TSC Act. There is, however, potential for this EEC to occur within the Caroona EL area, generally in areas of remnant woodland on slopes and rises. The largest woodland remnant within the Caroona EL area, Doona State Forest, contains a large number of drilling sites which have been previously inspected and this EEC was not recorded. There are smaller areas of remnant woodland within the EL which have not been surveyed to date and could potentially contain this EEC.

It is currently not known how many of the 300 boreholes are likely to contain vegetation which comprises *Native Vegetation on Cracking Clay Soils of the Liverpool Plains* or *Inland Grey Box Woodland in the Brigalow Belt South Bioregion* EECs. The potential impacts associated with borehole sites being located within these EECs are assessed using the following seven part tests.

Native Vegetation on Cracking Clay Soils of the Liverpool Plains

This EEC occurs on cracking clay soils (vertisols – including soils referred to as ‘black earth’) on the Liverpool Plains. The community is generally composed of grasslands which are often dominated by plains grass (*Austrostipa aristiglumis*), Queensland blue grass (*Dichanthium sericeum*) or coolibah grass (*Panicum queenslandicum*). It can also include shrubs and trees which are generally sparse but may be locally common. The majority of this community has been converted to agricultural land, and there are no examples within conservation reserves (NSW Scientific Committee 2004).

- a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction;**

Not applicable.

- b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction;**

Not applicable.

- c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or**

The potential impact for each proposed drilling site will be limited to a small area, up to approximately 20 x 20 metres. All borehole sites will be located at a grid spacing of between 500 and 4000 metres. Within each drilling compound, earthworks will only be required for the borehole itself and two sumps to contain drilling water. The grass in the borehole compound may also be slashed to reduce the bushfire hazard. The small area and low intensity of impact resulting from this project will not have an adverse effect on the extent of the community, such that its local occurrence will be placed at risk of extinction.

- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction;**

The potential impact associated with each proposed drilling site will be limited to a small area and boreholes sites will be located at a grid spacing of greater than approximately 500 metres. The proposed drilling activities are not likely to result in the introduction or removal of species that would result in the modification of the composition of the community such that its local occurrence will be placed at risk of extinction.

- d) in relation to the habitat of a threatened species, population or ecological community:**

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed; and**

The extent of habitat removal will be limited to a small area only. It is expected that each site will largely recover following the completion of drilling of the proposed boreholes, with rehabilitation undertaken in accordance with the procedure outlined in Section 6.0 of the main text.

- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and**

All drilling sites that have been assessed to date form part of a more or less continuous area of the same vegetation community, being located in grazed paddocks or road reserves. Considering the small area of potential disturbance, low intensity of drilling, and the extent of surrounding vegetation of the same community, the sites are not considered likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

-
- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality;**

Considering the small area of impact, the low intensity of drilling, the area of surrounding vegetation of the same community and the likely recovery of the vegetation following completion of drilling of the proposed boreholes, the habitat to be impacted is considered unlikely to provide important habitat for the long-term survival of the ecological community in the area.

- e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly);**

There are no areas of critical habitat listed under the TSC Act in the area.

- f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan;**

A recovery plan has not been prepared for this ecological community. There are no threat abatement plans relevant to this ecological community.

- g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

The proposed exploration drilling may constitute the key threatening process of 'clearing of native vegetation', however, the relatively small area of disturbance is not considered likely to result in a loss of biodiversity.

Inland Grey Box in the Brigalow Belt South Bioregion

This EEC is found on the relatively fertile soils of the western slopes and plains of NSW. *Eucalyptus microcarpa* (inland grey box) is the most characteristic species in this EEC (NSW Scientific Committee 2007). It is often found in association with *Eucalyptus populnea* subsp. *bimbil* (bimbil box), *Callitris glaucophylla* (white cypress-pine), *Brachychiton populneus* subsp. *populneus* (kurrajong), *Allocasuarina luehmannii* (bulloak) or *Eucalyptus melliodora* (yellow box), and sometimes with *Eucalyptus albens* (white box). Shrubs are typically sparse or absent, however, a variable ground layer of grass and herbaceous species is usually present (NSW Scientific Committee 2007). The community generally occurs as an open woodland 15 to 25 metres tall, but in some locations the overstorey may be absent as a result of disturbance (NSW Scientific Committee 2007).

- a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction;**

Not applicable.

- b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction;**

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or

The potential impact for each proposed drilling site will be limited to a small area, up to approximately 20 x 20 metres. All borehole sites will be located at a grid spacing of between 500 and 4000 metres. Within each drilling compound, earthworks will only be required for the borehole itself and two sumps to contain drilling water. Some shrubs and juvenile trees may require removal from the compound, however, sites are generally located in open areas which will not require the removal of large amounts of vegetation. The grass in the drilling compound may also be slashed to reduce the bushfire hazard. The small area and low intensity of impact resulting from this project will not have an adverse effect on the extent of the community such that its local occurrence will be placed at risk of extinction.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction;

The potential impact associated with each proposed drilling site will be limited to a small area and boreholes sites will be located at a grid spacing of greater than approximately 500 metres. The proposed drilling activities are not likely to result in the introduction or removal of species that would result in the modification of the composition of the community such that its local occurrence will be placed at risk of extinction.

d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed; and

The extent of habitat removal will be limited to a very small area. It is expected that each site will largely recover following the completion of drilling of the proposed boreholes, with rehabilitation undertaken in accordance with the procedure outlined in Section 6.0 of the main text.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

Any sites which may conform to this EEC are likely to form part of a more or less continuous area of the same vegetation community, being located in open woodland. Considering the small area of potential disturbance, low intensity of drilling, and the extent of surrounding vegetation of the same community, the sites are not considered likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality;

Considering the small area of impact, low intensity of drilling, the area of surrounding vegetation of the same community and the likely recovery of the vegetation following completion of drilling of the proposed borehole, the habitat to be impacted is considered

unlikely to provide important habitat for the long-term survival of the ecological community in the area.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly);

There are no areas of critical habitat listed under the TSC Act in the area.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan;

A recovery plan has not been prepared for this ecological community. There are no threat abatement plans relevant to this ecological community.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The proposed exploration drilling may constitute the key threatening process of 'clearing of native vegetation', however, the relatively small area of disturbance is not considered likely to result in a loss of biodiversity.

Conclusion

The *Native Vegetation on Cracking Clay Soils of the Liverpool Plains* EEC has been tentatively recorded at a small proportion of the drilling sites inspected to date. It is therefore likely that the EEC may be present at some of the remaining 300 borehole sites. As the borehole sites will be located at a grid spacing of greater than approximately 500 metres, the expected area of disturbance from the drilling activities will be small and the sites will be rehabilitated in accordance with procedures outlined in Section 6.0 of the main text, it is not likely that a significant impact on sites found to contain this EEC will occur.

The *Inland Grey Box Woodland in the Brigalow Belt South Bioregion* EEC has not been previously recorded within the Caroon EL, however there is potential for the EEC to occur. The potential impacts associated with the presence of this EEC at some of the remaining 300 borehole sites were assessed pre-emptively using the seven part test above. As the borehole sites will be located at a grid spacing of greater than approximately 500 metres of another borehole site, the expected area of disturbance from the drilling activities will be small and the sites will be rehabilitated in accordance with procedures outlined in Section 6.0 of the main text, it is not likely that a significant impact on sites found to contain this EEC will occur.

References:

NSW Scientific Committee (2004). *Native Vegetation on Cracking Clay Soils of the Liverpool Plains – Endangered Ecological Community Listing: NSW Scientific Committee Final Determination.*

NSW Scientific Committee (2007). *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions – Endangered Ecological Community Listing: NSW Scientific Community Final Determination.*

**Umwelt (Australia) Pty Limited
2/20 The Boulevard
PO Box 838
Toronto NSW 2283**

**Ph. 02 4950 5322
Fax 02 4950 5737**