Gunnedah Gas Pty Ltd

Review of Environmental Factors
Petroleum Exploration
Licence no PEL 452

Upstream Petroleum

Controlled Document No. 54752-HS-04-0001

Revision 1, February 26th, 2007

I: DOCUMENT CONTROL

This Review of Environmental Factors for the drilling of exploration wells in PEL 452 is a "controlled document". Should the recipient (user) become aware of any changes or corrections that are required please photocopy this page and the relevant page(s) to be changed, note the corrections and deliver them to:

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II: DOCUMENT REVISIONS

The HSEQ Manager Upstream Petroleum is responsible for controlling and ensuring any revision of this Review of Environmental Factors. Responsibility for managing change in this document is detailed within the Upstream Petroleum (UP) Change Management Procedure *(UP/00/SP/DOC/PC05).*

This Review of Environmental Factors shall be revised in the following circumstances:

- On discovery of a significant new or changed environmental effect or risk;
- Significant change in the drilling program.

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Please note the following requested / recommended changes to the following page(s):

Section: ..... Pages: .....

Section: ..... Pages: .....

Other comments:.....

.....After meeting with a DPI- Mineral Resources representative additions to the REF include :

- Figure 3.1 enlarged
- Removal of Landholder names from Table 3.2
- Expansion of program schedule in Section 3.2
- Clarify lease preparation process in Sections 3.3 and 5.6.2
- Mitigation to hydrology expanded in Section 5.3.3
- Wet weather policy expanded in Section 5.4.2
- Chemical management expanded in Section 5.7

REVISION HISTORY

Rev	Date	Description	By	Chkd	App
0	15/2/07	Issued for approval	JB	LC/AH	PH
A	2/1/07	Draft	JB	LC/AH	PH

III: APPROVALS

This Review of Environmental Factors has been reviewed by Upstream Petroleum Pty Ltd and Gunnedah Gas Pty Ltd and is approved for exploration drilling in PEL 452. Gunnedah Gas confirms that the information in this document is accurate, neither false or misleading, and addresses the content requirement detailed in the Guidelines for Review of Environmental Factors (June 2006) – Mineral Resources Division, NSW DPI.

Gunnedah Gas- PEL 452

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Approval: Gunnedah Gas Pty Ltd

NAME	Signature	Date
Peter Francis Director		28/2/07

The Upstream Petroleum organisation has reviewed the contents of this Review of Environmental Factors, agree that the specific requirements are achievable and commit to implementing them before or during the drilling programme (as appropriate).

Approval: Upstream Petroleum Pty Ltd

NAME	Signature	Date
Simon Mewing Queensland Operations Manager		28/2/07

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1. Introduction

1.1 Background

This Review of Environmental Factors (REF) has been prepared for the drilling of up to seven exploration wells in Petroleum Exploration Licence no 80 ("PEL 452') located in New South Wales (NSW). PEL 452 permits exploration for petroleum, including coal seam methane, by methods including the drilling of exploration boreholes.

Condition 1.0 of the PEL 452 licence instrument states that prior to carrying out any drilling activities a REF is required to be submitted to the Department of Primary Industries-Mineral Resources ("DPI-MR") to enable a determination to be made under Part 5 of the *Environmental Planning and Assessment Act 1979.*

1.2 Proponent Contact Information

Upstream Petroleum Pty Ltd (UP) has been contracted by Gunnedah Gas to act as Project Manager (including preparation of regulatory documentation) for the Drilling operations to be undertaken in PEL 452, planned to commence in mid 2007. UP is an Australian integrated oil and gas service provider and provides expertise in exploration and production activities under contract to the oil exploration and production industry across a broad range of upstream professional disciplines from well completions to facility management.

The registered office for the operating proponent is:

Gunnedah Gas Pty Ltd (A.B.N. 79 115 880 772)

Address:	Level 25, Chifley Tower, 2 Chifley Square, Sydney, NSW 2000
Telephone Number:	(04) 1217-8128
Fax Number:	02 9420 2106
Email:	pfrancis@gunnedahgas.com.au
Contact Person:	Peter Francis

The operations office and address for correspondence of the proponent's Project Manager is:

Upstream Petroleum Pty Ltd (A.B.N. 49 080 394 985)

Address:	165 Melbourne Street, South Brisbane, Qld, 4101
Telephone Number:	07 3844 4972
Fax Number:	07 3844 4971
Email:	simonmewing@upstreampetroleum.com.au
Contact Person:	Simon Mewing

Details on the land tenure to which the application refers to is provided in Section 3.1.2.

1.3 Structure

This REF addresses the following issues:

- **Section 2.0** provides a summary of relevant regulations applicable to the activity;
- **Section 3.0** provides a description of the proposed activities including location and timing;
- **Section 4.0** provides a description of the local environment including its physical, natural and socio-economic overview;
- **Section 5.0** provides an outline of the potential environmental impacts and mitigation measures;
- **Section 6.0** provides concluding comments on its likely impact.

2. Legislation & Planning Framework

2.1 Licences and Approvals Required

Pursuant to Section 7 of the *Petroleum (Onshore) Act 1991*, it is an offence to explore for petroleum (which includes coal seam methane) without a Petroleum Title. Gunnedah Gas currently holds PEL 452, which permits Gunnedah Gas to explore for petroleum (Section 7, *Petroleum (Onshore) Act 1991*).

Gunnedah Gas must also obtain an approval under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP & A Act) from the DPI-MR prior to carrying out exploration.

Under Section 5A of the EP & A Act, DPI is required to consider whether the activity is likely to have a significant effect on threatened species, populations or ecological communities, or their habitats. Section 5A lists seven factors to be considered, commonly referred to the 'seven part' test of significance. These are as follows:

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;*

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;*

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
(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,

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
(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
(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.

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

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

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*

Under the *Protection of the Environment Operations Act 1997*, pollution incidents causing or threatening material harm must be notified. Under Section 147 material harm means:

- harm to the environment is material if:
  (a) if involves actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial, or

(b) it results in actual or potential loss or property damage of an amount, or amounts in aggregate, exceeding $10,000 (or such other amount as is prescribed by the regulations), and

- loss includes the reasonable costs and expenses that would be incurred in taking all reasonable and practicable measures to prevent, mitigate or make good harm to the environment.

It does not matter that harm to the environment is caused only in the premises where the pollution incident occurs.

The *National Parks and Wildlife Act 1974,* protects Aboriginal objects and places (under Part 6) and threatened species, populations and ecological communities, their habitats and critical habitats (Part 8A). Under Section 5A of the EP & A Act, DPI is required to consider whether the activity is likely to have any impact on these matters.

The *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth) protects matters of national significance. As outlined in section 4.3.4 Gunnedah Gas does not consider that this proposal will trigger this Act, and it is not intended to lodge a referral to the Commonwealth Department of Environment and Heritage.

2.2 Zoning

Proposed drill holes will be located within the Liverpool Plains Shire Council local government area.

All of the proposed drill holes fall within the Zone 1 (a) (Rural "A" Zone).

2.3 Stakeholder Consultation

Gunnedah Gas proposes to contact and negotiate with affected landowners in respect to land access, compensation and/or ownership. This step will involve the conducting of various land enquiries and onsite attendances to meet with the landowners in question. Regular contact with landholders will be conducted as necessary.

Key stakeholders during this phase of the project include:

- State regulatory agencies (DPI – Mineral Resources Division);
- Local government (Liverpool Plains Shire Council);
- Landowners/occupiers;
- Aboriginal Groups (Nungaroo Aboriginal Land Council; and
- Utilities operators.

A notice of intended entry will be provided to each affected landowner. A pro forma Landowner Permit form is attached in Appendix 2.

Further consultation with other groups such as any local environmental groups, or the Local Aboriginal Land Council will occur if the proposed exploration wells indicate a commercially viable operation that will necessitate the construction of pipelines and other associated infrastructure.

3. Project Description

3.1 Location and Tenure

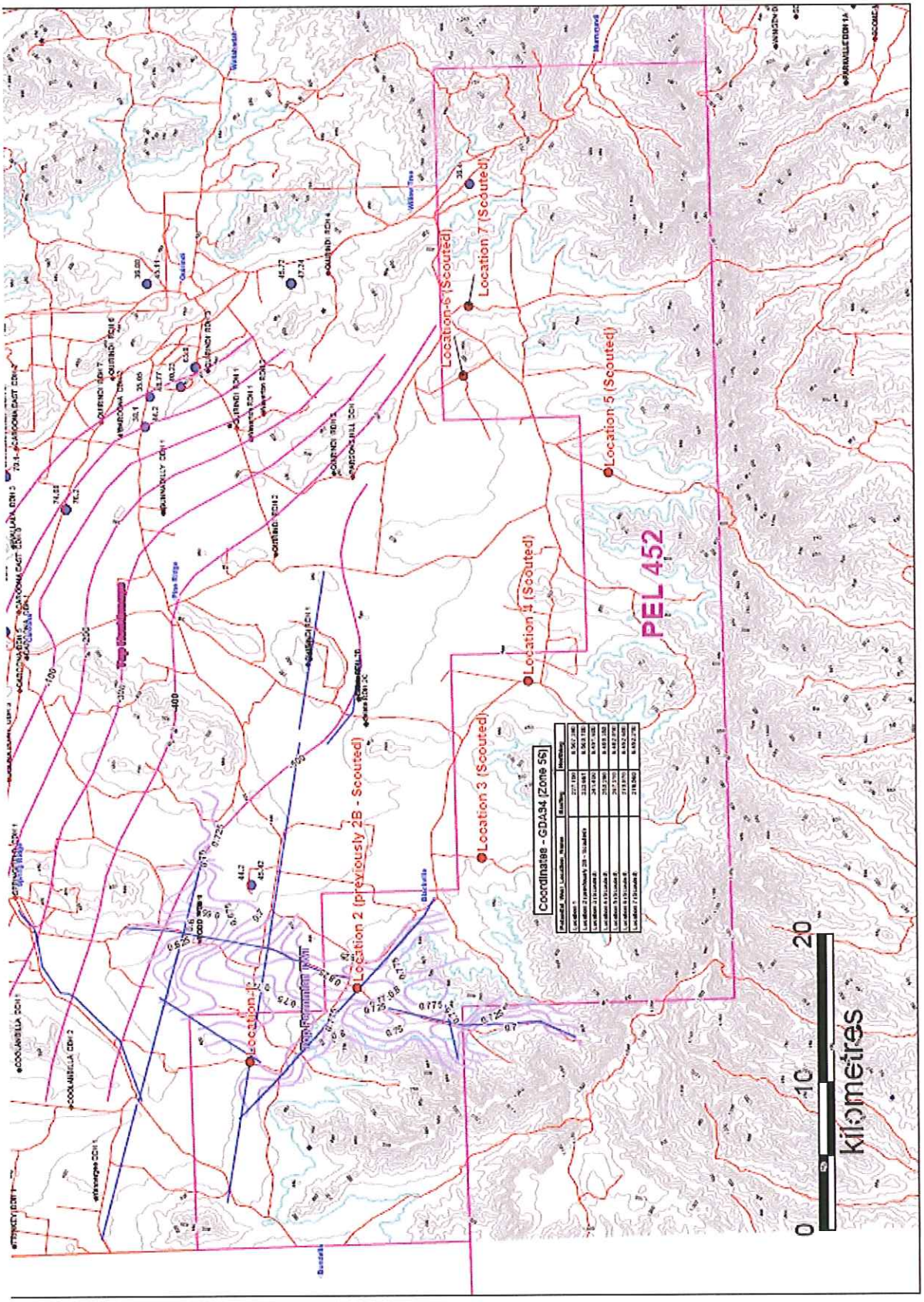
3.1.1 Location

Gunnedah Gas Pty Limited ("Gunnedah Gas") holds Petroleum Exploration Licence No 452 ("PEL 452") and proposes to drill up to 7 exploration wells at the co-ordinates shown in Table 3.1 below. Figure 3.1 shows the location of the permit and well sites. The well depths are expected to be in the range from about 400m to 900m deep.

Table 3-1 : Co-ordinates of Proposed Well Sites (GDA-Zone 56)

Potential_Well_Location_Name	Easting	Northing
Location 1	227,700	6,507,390
Location 2 (previously 2B - Scouted)	232,661	6,500,100
Location 3 (Scouted)	241,400	6,491,600
Location 4 (Scouted)	253,290	6,488,355
Location 5 (Scouted)	267,310	6,482,810
Location 6 (Scouted)	273,870	6,492,600
Location 7 (Scouted)	278,560	6,492,210

Figure 3-1: Well Location



3.1.2 Tenure

The tentative landowner details for the seven well locations is shown Table 3.1 below

Table 3-2: Tentative Land Owner and Tenure Details

Well	Landholder	Address	Details
Well 1	TBA	TBA	Lot 51/777534
Well 2	TBA	TBA	Lot 13/755489
Well 3	TBA	TBA	Lot 100/547571
Well 4	TBA	TBA	TBA
Well 5	TBA	TBA	Lot 75/ 751016
Well 6	TBA	TBA	Lot 63/751016
Well 7	TBA	TBA	Lot2/788967

The final well locations are yet to be confirmed.

The relevant land is freehold land which is not an area reserved or dedicated under the *National Parks and Wildlife Act 1974*; reserved or dedicated under the *Crown Lands Act 1989* for preservation or other environmental protection purposes; a World Heritage Area; an Environmental Protection Zone in any relevant environmental planning instrument; land protected under SEPP14 - Coastal Wetlands or SEPP 26 – Littoral Rainforests; identified as wilderness under the *Wilderness Act 1987* or declared as wilderness under the *National Parks and Wildlife Act 1974*; aquatic reserves under the *Fisheries Management Act 1994*; wetland areas dedicated under the Ramsar Wetlands Convention; land subject to a conservation agreement under the *National Parks and Wildlife Act 1974*; Western Lands Lease or land identified as State Forest under the *Forestry Act 1916*. There are currently no native title claims for the above locations.

Appendix 4 provides pictures of the land proposed for the well locations. As evidenced by these photos, all wells are situated on flat to undulating, highly modified farming sites.

3.2 Project Schedule

Drilling is expected to commence in mid 2007. The number of wells drilled will depend on exploration results, but will be not less than 4 wells in the first two years of the PEL.

Timeline of activities at each well is expected to follow:

- Commence lease preparation 2 to 4 weeks before expected rig arrival date. Where reasonable, leases will be prepared as a group prior to mobilising a drilling rig to the area.
- Earth works for lease completed in 3 to 5 days per site
- Drilling operations are expected to take 10 -15 days to complete.
- Permeability testing operations, if conducted, will extend onsite operations by approximately 1 week
- Each well will be plugged and abandoned at the end of testing operations. Where possible, this will be done immediately with the same rig used for drilling activities
- Rehabilitation activities will commence on each site as soon as possible. As with lease construction, rehabilitation will be conducted on sites as a group where reasonable. Replacement of soil and reseeding (where requested by the landowner) will be completed within one year.

3.3 Planned Activities

Gunnedah Gas proposes to carry out the drilling for coal seam methane as follows.

Gunnedah Gas will contact and negotiate with affected landowners in respect to land access, compensation and/or ownership. This step will involve the conducting of various land enquiries and onsite attendances to meet with the landowners in question.

Once landowner agreements have entered into, site preparation and drilling will commence.

Existing access tracks will be used where possible. New tracks required for drill sites and other excavations will avoid existing vegetation where possible. Disturbance to the soil will be minimised by using "blade-up" clearing. This technique removes vegetation with little or no soil disturbance. Tracks on slopes will have drains cut at regular intervals to reduce the risk of gullying and soil erosion. If cut and fill is required on a site, erosion control methods will be used to prevent erosion. Topsoil will be removed and stored separately on the side of the lease. Vehicular activity will be minimised when the ground is soft after rain. The surface will be progressively rehabilitated.

The equipment to be used will be an exploration drill rig. No buildings will be constructed during drilling on the relevant sites. The areas to be disturbed for drilling activities will be a maximum of two hectares for each drill hole.

The drilling will involve drilling an open hole through the weathered material into competent rock and cementing a surface casing in place. This surface casing will have a blow out preventer installed on top of it. The hole will then be progressed by open hole rotary drilling to a prescribed depth. Depending on well design and completion plans, casing may be run or the hole left open. Drilling will then carry on using continuous coring techniques for the purposes of recovering coal core and in a selection of wells permitting testing to be conducted with the drilling program.

The driller may expect to encounter igneous intrusions that will require impregnated diamond bits to core. Some conglomerate is also expected though indications to date are that this will not have a very hard matrix and would be readily cored using a surface set core bit. A water-based drilling fluid will be required for this program containing Barium Sulphate. As it is possible that some water reactive clays may be found KCl may be added to the drilling fluid in very low quantities to control swelling. There will also be a need to add biodegradable polymers while coring. Water will be sourced from nearby dams/bores where possible, otherwise bore installation (with relevant approvals) will be considered.

The first stage in assessing the coal seam methane field is to drill exploration holes to obtain information on coal depths, sizes, continuity and quality. Core holes will also be drilled to obtain core for assessing gas content, gas type, poro-perm properties, diffusion and shrinkage behaviour. In addition, tests for desorption isotherm behaviour may be undertaken on a selection of the coal recovered.

A selection of the potential production horizons may be tested for permeability by Drill Stem Test (DST) and injection fall-off tests. Stress tests may also be undertaken in the some holes to gain an understanding of the stress levels and direction as this may affect directional permeability.

It should be noted that these borehole locations are chosen as nodes for exploration. In the event that they show favourable trends then it is proposed that additional holes should be drilled around them to prove a local resource.

If the planned holes reveal methane and adequate permeability then it may be prudent to explore the limit of the coal seams on the eastern flanks of the Rocky Glen Ridge. This would be best accomplished by the use of seismic reflection surveys

The number of employees present at each site is expected to be in the range of 3 to 10. The hours of operation will be 12 hours a day seven days a week, as negotiated with the landowner. If well-sites are less than 1 km from a residence this will be highlighted and noted in the landowner agreements. It is proposed to commence these operations in the second quarter of 2007.

Drilling activities are temporary and will not have any long term impact on the visual amenity of the area.

3.4 Abandonment

Wells not used in production tests will be abandoned and the area rehabilitated in line with legislative regulation and licence requirements. Cement plugs will be set to fill the wellbore from total depth to the surface, the casing will be cut back and an abandonment plaque placed on the nearest fence line. The original topsoil will be respread and the area will then be rehabilitated in consultation with the land owner.

3.5 Justification of the Activity

Drilling of the proposed wells is an essential step in evaluating the hydrocarbon potential of the Gunnedah Basin. Discovery of gas reserves in this area has the potential to increase the state's reserves and revenue from gas and underpin future exploration or production in the region.

The proposed drilling program described above is a combination of core holes, exploration wells, Drill stem tests and potentially seismic. All of these items are required to thoroughly define and identify commercially useful reserves of coal seam methane.

Data supplied shows the geology of the area to consist of:

- Triassic and Permian Gunnedah Basin strata, overlain by
- Surat Basin strata, overlain by
- Tertiary basalt (making up the Liverpool Range)
- Volcanic intrusions are present in drill holes to the north of the PELA.

The target zone is the Black Jack Formation, with the Hoskisson Seam at its base.

Gunnedah Basin strata dips regionally to the southwest, and extrapolated structure contours on the Hoskisson Seam run roughly parallel the northern boundary of the PEL 452 at around -500m.

Ground elevation in the floor of the valleys is about 350m, so minimum depth to the Hoskisson Seam within the PEL 452 is about 900m.

The basalt is thick and rugged along the southern border of the PELA and thins towards the north. A number of alluvial valleys head south into the Liverpool Range, and the drill sites have been chosen near the intersection of these valleys with the northern PELA boundary, where the depth to the Hoskisson Seam is minimal.

There is no drill hole control within the PEL 452 itself, and trends have been extrapolated some distance from drillhole control to the north. Consequently the prognosed depths are tentative only.

Within the holes to the north, gas content in the Hoskisson Seam is low, mostly less than $3m^3/t$, so increased depth in PEL 452 may see an improvement in gas content and saturation, similar to the situation in PEL450. Permeability at that depth is an unknown.

3.6 Evaluation of Alternatives

There are no reasonable industry alternatives to the drilling method proposed in Section 3.3 if commercially useful amounts of coal seam methane are to be located and assessed.

4. Environmental Description

4.1 Regional Description

Unless otherwise stated the major source reference for this section is as follows:

National Parks and Wildlife Service, *The Bioregions of New South Wales- their biodiversity, conservation and history,* at
http://www.nationalparks.nsw.gov.au/npws.nsf/Content/Brigalow+Belt+South+Bioregion

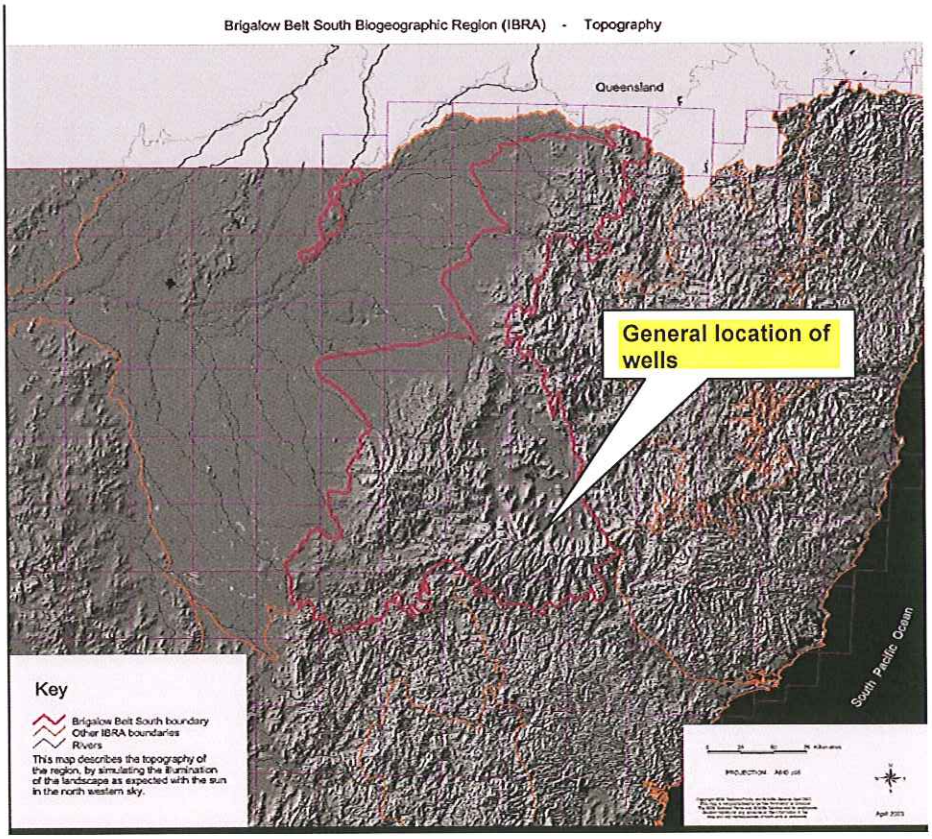
4.1.1 Bioregion

PEL 452 falls within the Brigalow Belt South Bioregion which extends from south of Dubbo in central western NSW to mid Queensland coast of which about 20% is located in NSW. The towns of Baradine, Binnaway, Coonabarabran, Dubbo, Gunnedah, Merriwa, Moree and Narrabri occur within this bioregion.

4.1.2 Topography

The bioregion forms the southern extremity of the Queensland Brigalow Belt but is not dominated by Brigalow (*Acacia harpohylla)*. It consists of landscapes derived from both extensive basalt flows and quartz sandstones and consequently has variable soils and vegetation depending on local rock type or sediment source (see Figure 4.1).

Figure 4-1: Topography Map



The topography of the Liverpool Plains Shire where the well sites are located can be described as being in two basic landforms (Edge, 2005):

- Steep to undulating land northeast, east and south (Figure 4.2); and
- Flat to undulating land to northwest and west.

Figure 4-2: Typical Topography in the South

Ref: Edge, 2005.

4.1.3 Geology

Regional

The bioregion's bedrock comprises horizontally bedded Jurassic and Triassic quartz sandstone and shale with limited areas of conglomerate or basalts. Some of the sandstone at the heads of streams forms a low but rugged topography of cliffs and small plateau features. Streams follow the direction of major joint planes in the narrow sandstone gorges, depositing alluvial fans of coarse sands and gravels in the wider valleys.

Even further down the valley the topography is more subdued, partly buried in alluvial debris and largely eroded to rolling plains. Evidence of larger stream courses of Quaternary age occur in the long, sand-filled channels and clay plains with gilgai, or shallow depressions between ridges in which rainwater collects.

These sedimentary rocks are the fingers' edge of the Surat Basin and the alluvial plains derived from them are important water intake beds for the Great Australian Basin, a large Jurassic-Cretaceous basin covering a large part of eastern Australia, of which the Surat Basin is a part.

Some of the Jurassic sediments contain interbedded volcanics that are locally important in affecting soils and vegetation. The more important volcanics are the extensive basalt flows of the Liverpool Range and Warrumbungles (which represents the eroded core of an ancient shield volcano), and flow remnants of the Inverell Basalts at Croppa Creek.

The Liverpool Range is the largest lava field province in NSW, dated between 32 and 40 million years, with up to 400m thickness of basalt covering an area of over 6,000 km2. The lava fields did not have a central volcanic vent but erupted from multiple fissures.

All the volcanic flows covered a pre-existing topography that is now being exposed as a result of erosion, revealing buried river gravels and lake sediments that contain well-preserved plant and fish fossils and a long record of climate change through those slices of geologic time.

Today's landscape is dominated by Quaternary sediments in the form of alluvial fans and outwash slopes that resemble the larger fans of the adjacent Darling Riverine Plains Bioregion to the west but are composed of coarser sediment and fan out at slightly steeper angles. The relative distribution of sediment from basalt or sandstone has a major impact on soil quality and vegetation.

Local

At the local government level of the Liverpool Plains Shire the geology varies from deep alluvial to granite. The deep alluvial material is found on the Liverpool Plain and there are some sandstone outcrops as well as basalt intrusions found on the Liverpool Range (Edge, 2005).

4.1.4 Soils

Soils vary greatly across this topography, as do microclimate and aspect, so it is necessary to differentiate areas of hill tops and plateau from slopes and valley floors in both sandstone and basalt areas as all of these factors affect the vegetation.

The sandstone ridge tops carry thin, discontinuous soils with stony, sandy profiles and low nutrient status. Downslope, texture contrast soils (soils that have a sharp increase in texture, ie. increase in clay content, on passing from surface soil layers to subsoil) are more common and are typically found with harsh clay sub-soils, while in the valley floors sediments tend to be sorted into deep sands with yellow earthy profiles, harsh grey clays, or more texture contrast soils with a greater concentration of soluble salts.

In basalt country the hill tops have stony, red or brown, well-structured clays with high nutrient values. Similar but often thicker soils are found on the slopes and the valley floors where they too accumulate clay materials.

4.1.1 Climate

The bioregion is located with the eastern subhumid region of NSW. A subhumid climate, with no dry season and a hot summer, characterise the south-eastern section of the bioregion, while a generally dry subtropical climate dominates to the northwest. Minor patches to the southeast of the bioregion fall within the temperate zone with no dry season and a warm summer. To the far west of the bioregion and in the outlier enclosed within the Darling riverine bioregion plains bioregion, the climate can be described as hot and semi-arid.

The Bureau of Meteorology data for Quirindi which is located about 24km north-north east from well location 7 is provided in Table 4.1 below.

Table 4-1: Climate data for Quirindi

Issue	Mar	Apr	May	June
Mean daily max (deg C)	29.3	24.8	20.4	16.5
Highest max temp (deg C)	39.3	36.0	27.6	26.4
Mean Daily Mean (deg C)	13.4	9.0	5.1	2.8
Mean Rainfall (mm)	53.7	42.2	45.4	50.1
Highest monthly rainfall (mm)	292.5	183.0	157.2	234.5
Lowest monthly rainfall (mm)	0.0	0.0	0.3	0.0
Highest daily Rain (mm)	136.7	74.7	85.9	89.2

4.2 Hydrology

Several major rivers flow through the bioregion including the MacIntre, Gwydir, Namoi, Castlereagh, Goulburn, Talbraga and Macquarie Rivers. The Liverpool Range in the South eastern corner of the Bioregion feeds the headwaters of the Hunter and Namoi River. The planned activities are located in the Namoi River catchment.

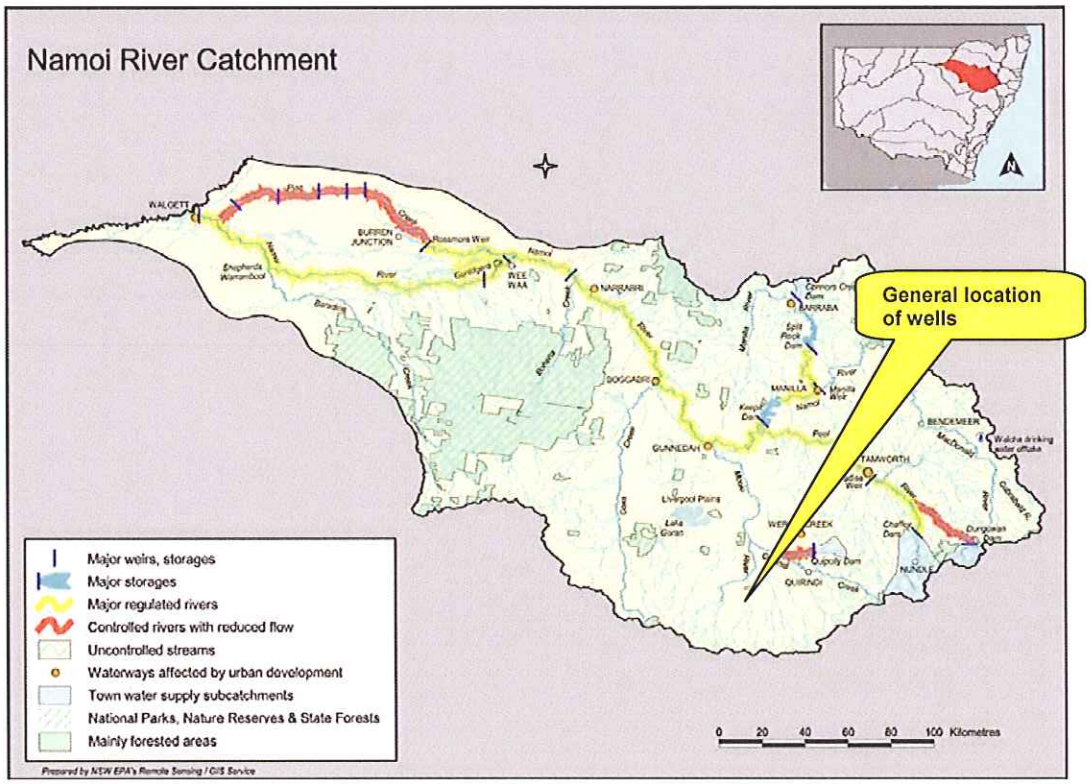
The Namoi basin can be divided into the following four natural subdivisions (EPA, 1994):

- Upper Catchment - runs north-west from Nundle to Barraba including parts of the Liverpool and Nandewar Ranges; steep to rugged; originally savannah woodland, now cleared
- Liverpool Plains - mainly the Mooki and Coxs River catchments; flat with slopes rarely exceeding 3°; cracking clays or clay loams with red clay subsoils; naturally a treeless plain dominated by grasses with patches of savannah woodland, now cleared
- Riverine Zone - follows the Namoi River; extensive flood plains; heavy clay soils and loams; naturally dominated by grassland. Stream banks, anabranches and natural wetlands were originally lined with natural vegetation communities (such as river red gums) but have since been cleared; the river now assumes characteristics of an inland delta
- Pilliga - south-west; flat; predominantly State Forest with extensive woodlands dominated by cypress pine and ironbark associations; intermittent streams, only flowing with significant rainfall or heavy falls in the Warrumbungle Ranges.

The main uses of surface water in the region are irrigation, stock watering and domestic use (EPA, 1995).

The wells are located in the Liverpool Plains subdivision as shown in Figure 4.3

Figure 4-3: Namoi River Catchment



While the proposed well locations are not located on or adjacent to any surface water bodies, the main creeks located near the various well locations are as follows:

- Coomoo Coomoo Creek (Well 1);
- Yarraman Creek (Well 2);
- Unidentified Creek (Well 3);
- Yarrimanbah Creek (Well 4);
- Millers Creek (Well 5);
- Big Jack Creek (Well 6); and
- Warrah Creek (Well 7).

These creeks have their headwaters in the ranges to the south and flow through the flat Liverpool Plains. The main river into which these creeks drain is the Mooki River which enters the Namoi River (Edge, 2005).

Groundwater in the Liverpool Plains ranges from 5-10 m average depth to the water table; whereas in the Ranges it can be > 10m (Edge, 2005).

4.3 Flora and Fauna

The information presented below is based on a desktop assessment which included searching various published literature, databases and an examination of aerial photographs of the area of interest.

The NSW Department of Environment and Conservation Atlas of NSW Wildlife On-line database was searched for records of threatened ecological communities, plants and animals within the study area.

Matters of conservation significance listed under the EPBC Act that are known or predicted to occur in the study area was determined using the EPBC Protected Matters search tool.

4.3.1 Plant Communities

The sandstone areas of the bioregion support various forests and woodlands. Woodlands dominated by blue-leaved ironbark (*Eucalyptus fibrosa*), scribbly gum (*Eucalyptus rossii*), black cypress pine (*Callitris endlicheri*), whitewood (*Atalaya hemiglauca*) and rough-barked apple (*Angophora floribunda*) are found on stony sandstone plateau and streams.

Silver-leaved ironbark (*Eucalyptus melanophloia*), spotted gum (*Eucalyptus maculata*) and smooth-barked apple (*Angophora costata*) occur on stony hills in the north of the bioregion. Narrow-leaved red ironbark (*Eucalyptus creba),* white cypress pine (*Callitris glaucophylla*), red stringybark (*Eucalyptus macrorhynca*), patches of mallee (*Eucalyptus sp.*) and broom heath (*Melaleuca uncinata*) occur on gentler sandstone slopes.

Pilliga box (*Eucalyptus pilligaensis*), with grey box (*Eucalyptus moluccanna*), poplar box (Eucalyptus populnea), fuzzy box (*Eucalyptus conica*), bull oak (*Casuarina luemhannii*), rosewood (*Heterodendrum oleifolium*), whitewood, wilga (*Geijera parviflora*), belah (*Casuarina cristata*), yarran (*Acacia homalophylla*) and budda (*Eremophila mitchellii*) occur on heavier alluvial soils in the west and north of the bioregion.

Poplar box, Pilliga box, Blakely's red gum (*Eucalyptus blakelyi*), White Cypress Pine and red ironbark (*Eucalyptus sideroxylon*) occur on coarser soils with occasional silver-leaved ironbark, white box (*Eucalyptus albens*) and fuzzy box in run-on sites. River red gum (*Eucalyptus camaldulensis*) lines all streams.

In the southern end of the bioregion the vegetation comprises narrow-leaved ironbark, white cypress pine and white box on hills and slopes. Patches of black cypress pine, hill red gum (*Eucalyptus dealbata*), the occasional kurrajong (*Brachychiton populneum*) and scrubby

acacia species are present in rocky outcrops. Grey box (*Eucalyptus microcarpa*), yellow box (*Eucalyptus melliodora*) and rough-barked apple occur on valley floors, while river red gum lines larger streams and river oak (*Casuarina cunninghamiana*) the tributaries.

The vegetation on the northern basalts includes brigalow, belah, whitewood, wilga, budda and poplar box on the hills, with river red gum, belah, myall (*Acacia pendula*) and poplar box on the flats. White box with silver-leaved ironbark, white wood, bull oak and brigalow are present on alluvial clays. River red gum occurs on all streams.

Diverse grasslands dominate the Liverpool Plains. Common species include plains grass (*Stipa sp.*), panic grass (*Panicum sp.*), windmill grass (*Chloris sp.*) and blue grass (*Dicanthium sp.*) on black earths, with the occasional white box, yellow box, poplar box and wilga. On the high (colder) ridge crests, silvertop stringybark (*Eucalyptus laevopinea*), manna gum (*Eucalyptus viminalis*) and mountain gum (*Eucalyptus dalrympleana*) are found with snow gum (*Eucalyptus pauciflora*) in cold air drainage hollows.

Tallow wood (*Eucalyptus microcorys*), blackbutt (*Eucalyptus pilularis*) and blue gum (*Eucalyptus saligna*) occur on eastern slopes with small areas of vine forest. On northern slopes, white box with rough-barked apple occur with belah in the creeks. Yellow box and Blakely's red gum are found on slopes with a southerly aspect.

Since European settlement the majority of the Namoi River catchment has been cleared or thinned for cropping and grazing, as per the proposed well locations. Lampert and Short (2004) state that:

- Remnant vegetation is now limited to areas where agriculture is restricted, due to inaccessibility or low soil fertility;
- Along many streamlines riparian vegetation corridors are thin and discontinuous or non-existent; and
- Where a riparian corridor has been maintained it is often structurally compromised and/or dominated by exotics.

4.3.2. Significant flora

There are 3 endangered ecological communities within the bioregion listed under Schedule 1 of the TSC Act. These are the semi-evergreen vine thicket *Cadellia pentastylis* (Ooline or scrub myrtle) and carbeen open forest communities. The bioregion is important for the long-term viability of these vegetation communities which are predominantly found here, with a small area lying in the Nandewar Bioregion. The carbeen open forest communities are now restricted to the Brigalow Belt South Bioregion and very limited areas of the Darling Riverine Plains Bioregion.

Brigalow, box woodlands and plains grasses as the most threatened plant communities in the bioregion.

The grassy white box woodland community also occurs in this bioregion. It is nationally endangered and protected under the EPBC Act 1999.

At a species level there are 4 endangered and 12 vulnerable species listed in the schedules of the TSC Act. Records within the bioregion tend to be concentrated in the major reserves and forests of the bioregion such as Goonoo State Forest, the Warrumbungles, Mt Kaputar and the Pilliga.

A search of the NSW Department of Environment and Conservation Atlas of NSW on-line data base was searched but showed little survey data for the area. Therefore a broader search was made of the Namoi Catchment Management Area subregion of the Liverpool Plains (B).

There are two endangered ecological communities found in the Namoi CMA. These are as follows:

1. *Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River*

Restricted to all natural creeks, rivers, streams and associated lagoons, billabongs, lakes, flow diversions to anabranches, the anabranches, and the floodplains of the Darling River within NSW, and including Menindee Lakes and the Barwon River. The Aquatic ecological community in the natural drainage system of the lowland catchment of the Darling River is known or predicted to occur in the following sub-regions of the Namoi Catchment Management Region Including the Liverpool Plains (Part B area).

This community will not be impacted by the proposed well sites as there will not be any works proposed that will impact on water bodies including the creeks in the immediate area of the well sites.

2. *Artesian Springs Ecological Community.*

Naturally restricted to the artesian springs of the Great Artesian Basin in north-western NSW. The springs occur where artesian water emerges at the surface through fault-lines in the overlying rock and produce mounds from the salts and sediments as the water evaporates. The vegetation within the community frequently consists of sedges or similar vegetation, however, trees and shrubs may be adjacent to the springs or nearby.

This community is not located in the vicinity of the well site locations.

A further 8 threatened plants where identified and these are listed in Table 4.2 below.

Table 4-2: Flora Species Listed under the TSC Act 1995 known or predicted to occur in Liverpool Plains (Part B) of the NCMA

Species	Common Name	Status	Habitat/foraging/breeding	Comment
Cadellia pentastylis	Ooline	Vulnerable	Ooline is a medium-sized spreading tree usually about 10 m tall, and rarely to 25 m. It is very slow-growing. The glossy green leaves are 2 - 4 cm long and 15 - 20 mm wide, with broadly rounded tips. The upper sides of the leaves are darker and glossier than the undersides. The white flowers are small and usually single. Each flower produces a cluster of up to five rounded, brown berries, 3 - 5 mm wide. Cadellia pentastylis is of considerable biogeographic interest as it is a relic of an extensive rainforest vegetation that covered much of Australia in the past. Occurs along the western edge of the North West Slopes from north of Gunnedah to west of Tenterfield. Also occurs in Queensland. The natural range of Ooline is from 24°S to 30°S	Unlikely to occur at well sites as outside range.
Cyperus conicus	Cyperus conicus	Endangered	Tufted, greyish perennial sedge with short thick underground stem. Leaves somewhat rough, 3-5 mm wide. Flowerhead simple or compound with 4-10 branches to 8 cm long, comprising numerous spikelets 2.5-3 mm long and about 0.8 mm wide, pale brown tinged yellow or red-brown. Fruit a	Unlikely to occur at well sites as not suitable habitat.or soils

Species	Common Name	Status	Habitat/foraging/breeding	Comment
			triangular black nut, about 1.8 mm long and 0.8 mm diameter. Occurs rarely in the Pilliga area of NSW and is also found in Victoria, Qld, the NT and WA. Soils are usually sandy or silty and damp to wet.	
Dichanthium setosum	Bluegrass	Vulnerable	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, as well as in Queensland and Western Australia. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas. Associated with heavy basaltic black soils	Planned activities will have minimal to nil impact.
Digitaria porrecta	Finger Panic Grass	Endangered	Finger Panic Grass occurs in NSW and Queensland. In NSW it is found on the North West Slopes and Plains, from near Moree south to Tambar Springs and from Tamworth to Coonabarabran. It largely occurs on private land.	Planned activities will have minimal to nil impact
Philotheca ericifolia	Philotheca ericifolia	Vulnerable	Known only from the upper Hunter Valley and Pilliga to Peak Hill districts of NSW. The records are scattered over a range of over 400 km between West Wyalong and the Pilliga Scrub. Site localities include Pilliga East State Forest, Goonoo State Forest, Hervey Range, Wingen Maid Nature Reserve, Toongi, Denman, Rylestone district and Kandos Weir Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies. It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops.	Planned activities will have minimal to nil impact
Pomaderris queenslandica	Scant Pomaderris	Endangered	Widely scattered but not common in north-east NSW and in Queensland. It is only known from a few locations on the New England Tablelands and North West Slopes, including near Torrington and Coolatai, and also from several locations on the NSW north coast. Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks.	Planned activities will have minimal to nil impact
Swainsona murrayana	Slender Darling Pea	Vulnerable	Found throughout NSW , it has been recorded in the Jerilderie and Deniliquin areas of the southern riverine plain, the Hay plain as far north as Willandra National Park, near Broken Hill and in various localities between Dubbo and Moree.	Planned activities will have minimal to nil impact

Species	Common Name	Status	Habitat/foraging/breeding	Comment
			The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams	
Thesium australe	Austral Toadmax	Vulnerable	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (Themeda australis). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	Planned activities will have minimal to nil impact

4.3.3 Weeds

The noxious weeds that have been declared in the Liverpool Plains Shire Council area are provided in Appendix 1. In all there are 58 species that have been declared.

4.3.3 Fauna

Although few systematic surveys have been conducted in the bioregion, records from a variety of surveys can be used to illustrate the vertebrate fauna of the bioregion, which consists of 18 amphibian species, 68 reptiles, 281 birds and 82 mammal species (see NSW NPWS 2000a).

Many of these species are considered threatened, including the endangered malleefowl (*Leipoa ocellata*), for which the bioregion contains important habitat, and the vulnerable koala (*Phascolarctos cinereus*) which has important populations in the Warrumbungles, the Pilliga and the area around Gunnedah. In this bioregion the tree species often selected by koalas include Blakely's red gum, river red gum and white box, while pilliga box, poplar box, narrow-leaved ironbark and rough-barked apple are occasionally used for food.

Another significant mammal species in the bioregion is the vulnerable eastern pygmy possum (*Cercartetus nanus*) which has a very patchy distribution, with more than 10 records of the species known from each of only 5 locations in NSW, the Pilliga State Forest being one of them .

As its name suggests, the Pilliga mouse (*Pseudomys pilligaensis*) is known only from the Pilliga State Forest, although its preferred habitat has not yet been established. It is thought to prefer mixed eucalypt forest with a shrubby understorey with logs and litter and may face threat from disturbance of ground storey vegetation.

A species of hopping mouse (*Notomys*) is thought to be present in the remnant forests of the bioregion. It is known only from hairs and footprints and is yet to be found in the Brigalow Belt South.

The birds of the bioregion are highly diverse, mainly consisting of tropical woodland species and comprising the largest number of Australian resident species of any bioregion. There are no major populations of rare or threatened birds in the bioregion and although many birds within the bioregion have restricted ranges, none is endemic. Exotic species are low in numbers and those present are located mainly around towns.

Although bird species diversity is high relative to other NSW bioregions, the Brigalow Belt South Bioregion has experienced major declines in ground-nesting, ground-feeding insectivorous and grassland birds, a trend common to many parts of Australia. An increased reporting rate in the bioregion's rainforest and temperate forest taxa may reflect greater survey effort in these habitats. Reduction of bird diversity in habitat fragments and the continued loss of woodland and freshwater birds seem to be the prediction for the future. However, there was an increase in the numbers of mallard (*Anas platyrhynchos*), cattle egret (*Bubulcus ibis*) and the common myna (*Acridotheres tristis*).

A search of the NSW Department of Environment and Conservation Atlas of NSW on-line data base was conducted but showed little survey data for the area. Therefore a broader search was made of the Namoi Catchment Management Area subregion of the Liverpool Plains (B). This returned a result of 49 species. These are listed in Table 4.3 below.

Table 4-3: Fauna Species Listed under the TSC Act 1995 known or predicted to occur in Liverpool Plains (Part B) of the NCMA

Species	Common Name	Status	Habitat/foraging/breeding	Comment
Anseranas semipalmata	Magpie Goose	Vulnerable	The Magpie Goose is still relatively common in the Australian northern tropics, but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Since the 1980s there have been an increasing number of records in central and northern NSW. Vagrants can follow food sources to south-eastern NSW. Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges.	Planned activities will have minimal to nil impact
Alectura lathami- endangered population	Australian Brush-turkey population in the Nandewar and Brigalow belt south bioregions	Endangered Population	The Australian Brush-turkey has a largely coastal distribution from Cape York south as far as the Illawarra in NSW. It occurs in forested and wooded areas of tropical and warm-temperate districts, particularly above 300 m to at least 1200 m altitude. A population of the Australian Brush-turkey is known from the Nandewar and Brigalow Belt South Bioregions. Recent records for the species show the population to range from north east of Warialda, to Narrabri, approximately 115 km to the south-west, and occur within the local government areas of Yallaroi, Bingara, Narrabri, Barraba and Moree Plains.	Planned activities will have minimal to nil impact
Ardeotis australis	Australian Bustard	Endangered	The Australian Bustard mainly occurs in inland Australia and is now scarce or absent from southern and south-eastern Australia. In NSW, they are mainly found in the north-west corner and less often recorded in the lower western and central west plains regions. Occasional vagrants are still seen as far east as the western slopes and Riverine plain. Breeding now only occurs in the north-west region of NSW. Mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams.	Planned activities will have minimal to nil impact
Bidyanus bidyanus	Silver perch	Vulnerable	Silver perch were once widespread and abundant throughout most of the Murray-Darling river system. They have now declined to low numbers or disappeared from most of their former range.	Planned activities will have minimal to nil impact
Botaurus poiciloptilus	Australasian Bittern	Vulnerable	The Australasian Bittern is a large, stocky bird, reaching up to 75 cm in length. Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spikerushes (Eleocharis spp.).	Planned activities will have minimal to nil impact
Burhinus grallarius	Bush Stone-curlew	Endangered	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights.	Planned activities will have minimal to nil impact
Calyptorhynchus lathami	Glossy Black Cockatoo	Vulnerable	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia.	Planned activities will have minimal to nil impact

Species	Common Name	Status	Habitat/foraging/breeding	Comment
			Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur.	
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Hirundo ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies.	Planned activities will have minimal to nil impact
Chalinolobus picatus	Little Pied Bat	Vulnerable	The Little-Pied Bat is found in inland Queensland and NSW (including Western Plains and slopes) extending slightly into South Australia and Victoria. Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress-pine forest, mallee, Bimbil box. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings.	Planned activities will have minimal to nil impact
Cercartetus nanus	Eastern Pygmy-Possum	Vulnerable	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extents from the coast inland as far as the Pillaga, Dubbo, Parkes and Wagga Wagga on the western slopes. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (*Pseudocheirus peregrinus)* dreys or thickets of vegetation, (eg. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks.	Planned activities will have minimal to nil impact
Climacteris Picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable	The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. The western boundary of the range of Climacteris picumnus victoriae runs approximately through Wagga Wagga, Temora, Forbes, Dubbo and Inverell and along this line the subspecies intergrades with the arid zone subspecies of Brown Treecreeper *Climacteris picumnus picumnus*. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis)* Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component	Planned activities will have minimal to nil impact

Species	Common Name	Status	Habitat/foraging/breeding	Comment
Dasyurus maculates	Spotted-tailed Quoll	Vulnerable	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and may raid possum and glider dens and prey on roosting birds.	Planned activities will have minimal to nil impact
Ephippiorhynchus asiaticus	Black-necked Stork	Endangered	The species is widespread across coastal northern and eastern Australia, becoming increasingly uncommon further south into NSW, and rarely south of Sydney. Some birds may move long distances and can be recorded well outside their normal range. Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.	Planned activities will have minimal to nil impact
Falco hypoleucos	Grey Falcon	Vulnerable	The Grey Falcon is sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey.	Planned activities will have minimal to nil impact
Grantiella Picta	Painted honey-eater	Vulnerable	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema. Insects and nectar from mistletoe or eucalypts are occasionally eaten. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.	Planned activities will have minimal to nil impact
Grus rubicunda	Brogla	Vulnerable	The Brolga was formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. It still abundant in the northern tropics, but very sparse across the southern part of its range. Though Brolgas often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps, where they will forage with their head entirely submerged	Planned activities will have minimal to nil impact
Hamirostra melanosternon	Black-breasted Buzzard	Vulnerable	The Black-breasted Buzzard is found sparsely in areas of less than 500mm rainfall, from north-western NSW and north-eastern South Australia to the east coast at about Rockhampton, then across northern Australia south almost to Perth, avoiding only the Western Australian deserts. Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands. Not a powerful hunter, despite its size, mostly taking reptiles, small mammals, birds, including nestlings, and carrion. Also specialises in feeding on large eggs, including those of emus, which it cracks on a rock.	Planned activities will have minimal to nil impact

Species	Common Name	Status	Habitat/foraging/breeding	Comment
			Breeds from August to October near water in a tall tree. The stick nest is large and flat and lined with green leaves. Normally two eggs are laid.	
Hoplovephalus bitorquatus	Pale headed Snake	Vulnerable	The Pale-Headed Snake is a medium-sized largely tree-dwelling snake to 90 cm long. A patchy distribution from north-east Queensland to north-east NSW. In NSW it occurs from the coast to the western side of the Great Divide as far south as Tuggerah. Found mainly in dry eucalypt forests and woodlands, cypress woodland and occasionally in rainforest or moist eucalypt forest. Favours streamside areas, particularly in drier habitats.	Planned activities will have minimal to nil impact
Lathamus discolour	Swift Parrot	Endangered	The Swift Parrot is small parrot about 25 cm long. It is bright green with red around the bill, throat and forehead. Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Commonly used lerp infested trees include Grey Box E. microcarpa, Grey Box E. moluccana and Blackbutt E. pilularis. Return to home foraging sites on a cyclic basis depending on food availability. Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum E. globulus. Migrates to the Australian south-east mainland between March and October	Planned activities will have minimal to nil impact
Leipoa ocellata	Malleefowl	Endangered	Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300-450 mm mean annual rainfall) areas. Less frequently found in other eucalypt woodlands (e.g., mixed Western Grey Box and Yellow Gum or Bimble Box, Ironbark-Callitris Pine, Callitris Pine, Mulga (*Acacia aneura*), and Gidgee(*A. cambagei).*	Planned activities will have minimal to nil impact
Limosa limosa	Black-tailed Godwit	Vulnerable	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia (Palaearctic) and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, the it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the north and south coast, and inland. Records in western NSW indicate that a regular inland passage is used by the species, as it may occur around any of the large lakes in the western areas during summer, when the muddy shores are exposed.	Planned activities will have minimal to nil impact
Lophoictinia isura	Square-tailed Kite	Vulnerable	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Planned activities will have minimal to nil impact
Macropus dorsalis	Black-stripped Wallaby	Endangered	From the Townsville area in Queensland to northern NSW where it occurs on both sides of the Great Divide. On the north west slopes of NSW it occurs in Brigalow remnants to south of Narrabri. On the north coast it is confined to the upper catchments of the Clarence and Richmond Rivers. Preferred habitat is characterised by dense woody or shrubby vegetation within three metres of the ground. This dense vegetation must occur near a more open, grassy area to provide suitable feeding habitat.	Planned activities will have minimal to nil impact
Melanodryas cucullata cucullata	Hooded Robin (south eastern form)	Vulnerable	The Hooded Robin is common in few places, and rarely found on the coast. It is considered a sedentary species, but local seasonal movements are possible. The south-eastern form is found from Brisbane to Adelaide throughout much of inland NSW, with the exception of the north-west. The species is widespread,	Planned activities will have minimal to

Species	Common Name	Status	Habitat/foraging/breeding	Comment
			found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses.	nil impact
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Vulnerable	The subspecies is widespread, from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond River district. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*Eucalyptus albens*), Grey Box (*Eucalyptus microcarpa*), Yellow Box (*Eucalyptus melliodora*) and Forest Red Gum (*Eucalyptus tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees. A gregarious species usually seen in pairs and small groups of up to 12 birds. Feeding territories are large making the species locally nomadic. Recent studies have found that the Black-chinned Honeyeater tends to occur in the largest woodland patches in the landscape as birds forage over large home ranges of at least 5 hectares.	Planned activities will have minimal to nil impact
Neophema pulchella	Turquoise Parrot	Vulnerable	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Forages quietly and may be quite tolerant of disturbance. However, if flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.	Planned activities will have minimal to nil impact
Ninox connivens	Barking Owl	Vulnerable	The Barking Owl is found throughout Australia except for the central arid regions and Tasmania. It is quite common in parts of northern Australia, but is generally considered uncommon in southern Australia. It has declined across much of its distribution across NSW and now occurs only sparsely. It is most frequently recorded on the western slopes and plains. It is rarely recorded in the far west or in coastal and escarpment forests. Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts.	Planned activities will have minimal to nil impact

Species	Common Name	Status	Habitat/foraging/breeding	Comment
Ninox Strenua	Powerful Owl	Vulnerable	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. Now uncommon throughout its range where it occurs at low densities. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-oak Allocasuarina littoralis, Blackwood Acacia melanoxylon, Rough-barked Apple Angorphora floribunda, Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species.	Planned activities will have minimal to nil impact
Notopala sublineata	River Snail	Endangered	Until 2004 no live specimens of the river snail had been found in NSW for over 30 years. Although now virtually extinct throughout its natural range, some populations have been recorded as surviving in artificial habitats (irrigation pipelines) in the Murray and Darling systems. Live specimens were discovered in late 2004 from irrigation pipelines near Mildura.	Planned activities will have nil impact
Nyctophilus timoriensis	Greater Long-eared Bat (south eastern form)	Vulnerable	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, bulloke Allocasuarina leuhmanni and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	Planned activities will have minimal to nil impact
Oxyura australis	Blue-billed duck	Vulnerable	The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached.	Planned activities will have minimal to nil impact
Petaurus australis	Yellow-bellied Glider	Vulnerable	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. Live in small family groups of two - six individuals and are nocturnal. Den, often in family groups, in hollows of large trees.	Planned activities will have minimal to nil impact

Species	Common Name	Status	Habitat/foraging/breeding	Comment
Petaurus norfolcensis	Squirrel Glider	Vulnerable	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Live in family groups of a single adult male one or more adult females and offspring. Require abundant tree hollows for refuge and nest sites.	Planned activities will have minimal to nil impact
Petrogale penicillata	Brush-tailed Rock-wallaby	Endangered	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. However the distribution of the species across its original range has declined significantly in the west and south and has become more fragmented. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north.	Planned activities will have minimal to nil impact
Phascolartus cinereus	Koala	Vulnerable	Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the western region. It was historically abundant on the south coast of NSW, but now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Planned activities will have minimal to nil impact
Polytelis swainsonii	Superb Parrot	Vulnerable	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. It is estimated that there are less than 5000 breeding pairs left in the wild. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.	Planned activities will have minimal to nil impact
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Vulnerable	The Grey-crowned Babbler is found throughout large parts of northern Australia and in south-eastern Australia. In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Hay. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Flight is laborious so birds prefer to hop to the top of a tree and glide down to the next one. Birds are generally unable to cross large open areas.	Planned activities will have minimal to nil impact
Pseudomys pilligaensis	Pilliga Mouse	Vulnerable	Distribution restricted to the Pilliga region of New South Wales. The Pilliga Mouse is very sparsely distributed and appears to prefer areas with a sparse ground cover. Some evidence exists of marked population fluctuations by this species. The Pilliga Mouse is restricted to an isolated area of low-nutrient deep sand which has long been recognised as supporting a distinctive vegetation type (Pilliga Scrub).	Planned activities will have nil impact

Species	Common Name	Status	Habitat/foraging/breeding	Comment
Pyrrholaemus sagittatus	Speckled Warbler	Vulnerable	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	Planned activities will have minimal to nil impact
Stagonopleura guttata	Diamond Firetail	Vulnerable	The Diamond Firetail is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Cental and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW. Also found in the Australian Capital Territory, Queensland, Victoria and South Australia. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, natural temperate grassland, and in secondary grassland derived from other communities.	Planned activities will have minimal to nil impact
Stictonetta naevosa	Freckled Duck	Vulnerable	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Planned activities will have minimal to nil impact
Tyto novaehollandiae	Masked Owl	Vulnerable	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides.	Planned activities will have minimal to nil impact
Underwoodisaurus sphyrurus	Border Thick-tailed gecko	Vulnerable	Found only on the tablelands and slopes of northern NSW and southern Queensland, reaching south to Tamworth and west to Moree. Most common in the granite country of the New England Tablelands. Preferred habitat includes rocky hills with dry open eucalypt forest or woodland. Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter.	Planned activities will have minimal to nil impact
Vespadelus troughtoni	Eastern Cave Bat	Vulnerable	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	Planned activities will have minimal to nil impact

4.3.4 EPBC Act

As summarised below in Table 4.2, there are no World Heritage Properties, National Heritage Places, Wetlands of International Significance (Ramsar Sites), or Commonwealth marine areas.

Table 4-4: Matters of National Environmental Significance

Aspect	Well 1	Well 2	Well 3	Well 4	Well 5	Well 6	Well 7
World Heritage Property	None	None	None	None	None	None	None
National Heritage Places	None	None	None	None	None	None	None
Ramsar Wetlands	None	None	None	None	None	None	None
Marine Area	None	None	None	None	None	None	None
Threatened Ecological Communities	1	1	1	1	1	1	1
Threatened Species	15	16	14	12	11	12	12
Migratory Species	7	7	7	7	7	6	6

Threatened Ecological Community

There is one Threatened Ecological Community that could potentially be found within the region where the well sites are to be located. This is the White Box- Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland which is critically endangered. This was formerly widespread along the western slopes and table lands of the Great Dividing Range, throughout southern Queensland, western NSW, ACT and Victoria. Now less than 5% remains in good condition and much of this occurs in small isolated pockets (DEH, 2006).

It is expected that the rugged terrain of the Liverpool Ranges in the upper Mooki catchment would still support this community. However, the lower slopes of these hills have been almost completely cleared (Lampert and Short, 2004). Grasslands remain as isolated stands on alluvial fans and in flood-prone areas with most of the region now cleared for cropping (Lampert and Short, 2004).

The proposed well sites will be located in previously cleared land and as such will not have a significant impact on this TEC.

Threatened Species

Depending on well site location there were up to 16 threatened species that could be potentially located in the region. These are summarised in Table 4.5 below.

Table 4-5: Threatened Species under EPBC Act

Species	Common Name	Status	Habitat/foraging/breeding	Comment
Birds				
Lathamus discolor	Swift Parrot	Endangered	Breeds in Tasmania; migrates in autumn and winter to mainland; forages in nectar rich iron bark forests	Drilling pads will be located on previously cleared land.
Polytelis swainsonii	Superb Parrot	Vulnerable	The parrots are found in the NSW southwest slopes as well as northern parts of the ACT and north central Victoria. Each spring they retreat towards the southwest to breed, mainly in River and Blakely's red gums. They then move further north and east, relying on woodland habitat for flowers, fruits and seed, particularly in box and Blakely's red gum. As one of the many Australian bird species that uses tree hollows for breeding, clearing of woodland areas has had a large impact on the parrot and, with minimal replacement of old trees, its numbers may continue to decline in the future.	No Habitat trees will be removed and the drill pads will be located on previously cleared land
Rostratula australis	Australian Painted Snipe	Vulnerable	The Australian Painted Snipe is usually found in shallow inland wetlands, either freshwater or brackish, that are either permanently or temporarily filled. It is a cryptic bird that is hard to see and often overlooked. Usually only single birds are seen, though larger groups of up to 30 have been recorded. It nests on the ground amongst tall reed-like vegetation near water, and feeds near the water's edge and on mudflats, taking invertebrates, such as insects and worms, and seeds.	Suitable habitat unlikely in area of drilling activity
Xanthomyza phrygia	Regent Honey Eater	Endangered	The Regent Honeyeater was once common in the woodlands of eastern Australia, particularly along the inland slopes of the Great Dividing Range. It once occurred as far west as Adelaide, but has now disappeared from South Australia and western Victoria. Within this reduced range its population is fragmented, and the only breeding habitat is in north-eastern Victoria and the central coast of New South Wales. Regent Honeyeaters feed on nectar and insects within box-ironbark eucalypt forests. When they're not breeding, birds roam widely in search of these unpredictable food sources. Approximately 75% of this habitat has been destroyed by clearing, and the habitat that remains is being degraded by the continuing removal of trees.	Suitable habitat unlikely in area of drilling activity

Species	Common Name	Status	Habitat/foraging/breeding	Comment
Mammals				
Chalinolobus dwyeri	Large eared Pied Bat	Vulnerable	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes.	Drilling activities will not disturb preferred habitat
Nyctophilus timorienensis	Eastern Long-Eared Bat	Vulnerable	Inhabits a variety of vegetation types, including mallee, bulloke Allocasuarina leuhmanni and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	Drilling activities will not disturb preferred habitat; no habitat trees will be removed.
Petrolegale penicillata	Brush-tailed Rock wallaby	Vulnerable	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. However the distribution of the species across its original range has declined significantly in the west and south and has become more fragmented. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night.	Drilling activities will not disturb preferred habitat; or impact on breeding or foraging activities.
Dasyurus maculates maculatus	Spot-tailed Quoll	Endangered	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground, although also an excellent climber and may	Drilling activities will not disturb preferred habitat; or impact on breeding or foraging activities.

Species	Common Name	Status	Habitat/foraging/breeding	Comment
			raid possum and glider dens and prey on roosting birds.	
Ray finned Fishes				
Maccullochella Peelii peelii	Murray Cod, Cod, Goodoo	Vulnerable	Rivers	Water courses will not be impacted by the planned activity
Reptiles				
Elseya belli	Bells' Turtle Namoi River Turtle	Vulnerable	Sandy banks and pools	Water courses will not be impacted by the planned activity; bank will not be disturbed
Plants				
Dichanthium setosum	Blue grass	Vulnerable	Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, as well as in Queensland and Western Australia. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas. Associated with heavy basaltic black soils	Planned activities will have minimal to nil impact.
Digitaria porrecta	Finger Panic grass	Endangered	Finger Panic Grass occurs in NSW and Queensland. In NSW it is found on the North West Slopes and Plains, from near Moree south to Tambar Springs and from Tamworth to Coonabarabran. It largely occurs on private land.	Planned activities will have minimal to nil impact
Diuris sheaffiana	Tricolour Diuris Pink Donkey Orchid	Vulnerable	The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (Callitris spp.). It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. Usually recorded as common and locally frequent in populations, however only one or two plants have also been observed at sites. The species has been noted as growing in large colonies. Disturbance regimes are not known, although the species is usually recorded from disturbed habitats. Associated species include Callitris glaucophylla, Eucalyptus populnea, Eucalyptus intertexta, Ironbark and Acacia shrubland. The understorey is often grassy with herbaceous plants such as Bulbine species. Flowers from September to November or generally spring. The species is a tuberous, deciduous terrestrial orchid and the flowers have a pleasant, light sweet scent.	Planned activities will have minimal to nil impact

Species	Common Name	Status	Habitat/foraging/breeding	Comment
Goodenia machbarronii	Narrow Goodenia	Vulnerable	Narrow Goodenia grows on the western slopes of the Great Dividing Range in NSW, south from the Guyra and Inverell districts. It is widely distributed throughout the tablelands, western slopes and western plains. The species also occurs in north-eastern Victoria and the Darling Downs in Queensland. In NSW it has been recorded at Tingha, Guyra, the Warrumbungle Ranges, east of Rylstone, the Pilliga and Denobollie State Forests, the Narrabri, Coonabarabran, Torrington and Tocumwal districts, Grenfell, Weddin Mountain, Gungal, the Milthorpe district, and Holbrook (the Type locality).	Planned activities will have minimal to nil impact
Thesium australe	Austral Toadflax	Vulnerable	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (Themeda australis). A root parasite that takes water and some nutrient from other plants, especially Kangaroo Grass.	Planned activities will have minimal to nil impact

Migratory Terrestrial and Wetland Species

There are 5 migratory terrestrial bird species and a further two birds that are wetland species that are listed. However, it is considered that the planned activities will not have any significant impact on these species.

Listed Marine Species

There are 10 species of birds that are listed marine species that may overfly the area. These are 'other matters' protected by the EPBC Act. However, it is considered that the planned activities will not have any significant impact on these species.

4.5 Socio-Economic

4.5.2 Local Government Area

The planned activities lie within the Liverpool Plains Shire Council local government area. The Shire was formed in 2004 by the amalgamation of Quirindi Shire, substantial parts of Parry and Murrundi Shires, and small parts of Gunnedah Shire. The largest town within the LGA is Quirindi which has population of about 2,127 persons in the 2001 census. Other towns include Werris Creek (1,446 persons), Wallabadah (181 persons), Willow Tree (190 persons) Caroona (147 persons) and Spring Ridge (132 persons) (Edge, 2005). The LGA has a size of about 5,086 sq km with a total population of 7,924 persons in the 2001 census (Edge, 2005).

4.5.1 Landuse

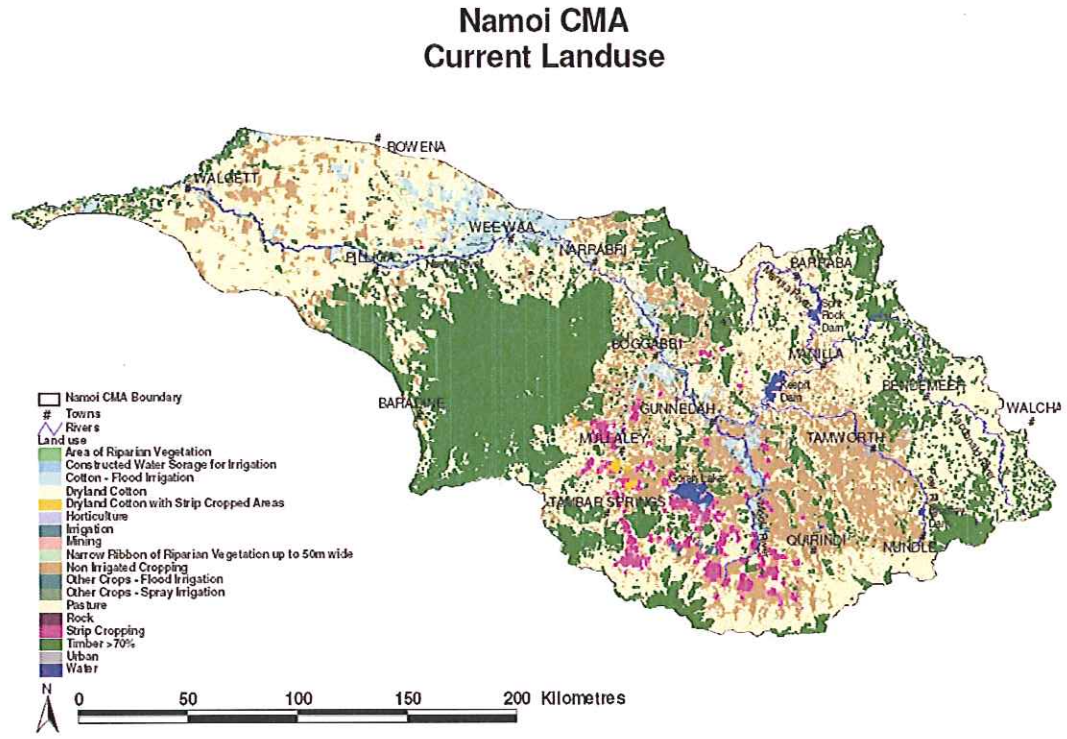
The proposed well sites are located within the Namoi River catchment which has been used extensively for agricultural activities since the 1830s (see Figure 4.4). Agricultural activities

include mixed farming of sheep, cattle and grain crops with a gradually larger reliance on cattle. Downstream in the Narrabri/Wee Waa districts irrigated cotton is produced.

The primary land uses within the Liverpool Plains Shire are agricultural (64.6%), urban (18.4%), vacant cleared land (6.7%), and native vegetation (3.9%) (Edge, 2005).

Agricultural uses include cattle and sheep, cropping, orchards, irrigated cropping, equine, and intensive agricultural (Edge, 2005). Some 51.4% of holdings are >100ha (Edge, 2005).

Figure 4-4: Land use in the Namoi River Catchment



Ref: NCMA, 2006

4.6 Heritage

4.6.1 Aboriginal Heritage

The land council for the area is the Nungaroo Aboriginal Land Council. A search of NPWS Aboriginal Heritage Information System was made and identified a number of sites in the region. The nearest sites are located about 1.5-2 km from the nearest well sites. The proposed well sites are away from the banks of any waterholes and will be on previously cleared pasture.

As of 30th September 2006 there were no Native Title claims over the proposed well site locations (see map at http://www.nntt.gov.au/publications/state_maps.html)

4.6.2 Non-Indigenous Cultural Heritage

A search of the NSW Heritage Office database for the Liverpool Plains local council area did not identify any sites of cultural heritage in the vicinity of the proposed well sites (see http://www.heritage.nsw.gov.au/07_subnav_01_1.cfm)

5.0 Environmental Impacts and Mitigation Measures

5.1 General

The activities will be undertaken in accordance with the APPEA, 1996, *Code of Environmental Practice- Onshore* where applicable.

5.2 Air Quality

The existing air quality of the area is good, given the lack of heavy industry and low population. The majority of pollutants arise from grazing operations and operation of machinery both for trade and domestic purposes.

5.2.1 Potential Impacts and Mitigation

The proposed activity has the potential to introduce air pollution arising from the sources discussed below.

- *Dust generated from the disturbance of the earth during drill pad construction and vehicle movements.*

  The dust generated by the mobilisation for the drilling and ancillary equipment to and from a location can vary significantly depending on road and weather conditions. In the case of improved or well compacted roads, dust will not be a significant issue and the drill rig will be moved to the proposed drilling locations and rigged up with occasional dust suppression using a water cart usually adequate to reduce dust generation.

  Liaison with local homesteads which may be affected by rig traffic will take place, informing occupants of possible high traffic periods (ie during transport of the rig and equipment). Speed limits on rig traffic may be imposed to minimise dust when passing homesteads. If speed limits are required the limit imposed will be clearly sign posted.

  The movement of rig equipment to and from the proposed drill sites is expected to have more impact than the movements of equipment on sealed and unsealed roads within the district. The rig mobilisation, potentially up to 10 trailer loads in total, may require additional preparation of access ways. Additional access preparation will take place on external road ways where required to facilitate the safe entry of the drilling rig. Damage to any external/internal access will be repaired as soon as possible after occurrence to minimise any impact on the public.

  Gunnedah Gas will notify Liverpool Plains Shire Council of the proposed start time of exploration drilling prior to its commencement and will liaise with the appropriate Council representative should any repairs to Council roads be necessary.

- *Emissions from vehicles, generators and drilling power supplies.*

  The amount of emissions expelled during this drilling activity is not expected to exceed greenhouse gas emission standards. Operation of diesel fuelled vehicular traffic, plant and power generation, will be temporary and the minimal emissions are not expect to impact on air quality.

- *Flaring of gas as part of safe drilling practices or pre approved testing operations.*

It is considered possible that gas bearing formations will be intersected during drilling. A number of safety precautions and contingencies are therefore incorporated into the program in order to minimise any risks.

Appropriately located, sized and banked flare pits will be installed at the commencement of drilling operations. The drill rig operator will locate the "blooie lines" so that gas kicks are directed into the flare pits where an ignition source can safely account for these gas shows.

Approval from the relevant DPI-MR Safety Inspector will be sought prior to any flaring activity other than that occurring as part of normal drilling safety procedures. This includes any flaring that is likely to occur as part of reservoir testing procedures (DST) or otherwise.

5.3 Hydrology

5.3.1 Existing Environment

There are several creeks in the vicinity of the well sites that could be potentially affected if there are any spills or incidents.

5.3.3 Potential Impacts and Mitigation

Preference will be to procure water supplies from dams or bores located in the vicinity of the drilling sites. In order to acquire the water necessary for drilling fluids in situations were water can not be obtained through the above resources; approval will be sought from the appropriate authorities and landholder for the installation of a bore to access water from suitable reservoirs. This consent will be sought before the commencement of drilling operations.

Drinking water will be trucked to site.

There is avenue to contaminate surface water or ground water via run off through activities associated with chemical storage & handling onsite, refuelling equipment and drilling fluids and cuttings management. To mitigate this risk best practice will be used when storing/handling chemicals and refuelling. In order to minimise possible environmental impact to surface water, chemical storage will be bunded to direct surface water around the storage areas. A Fit For Purpose rig has been contracted and serviced to ensure the engines will not drop oil. If a leak does develop, plastic sheeting will be placed under the rig to contain spills and the leak will be repaired as soon as possible. Spill kits will be available onsite for the immediate containment and removal of spilt fluids and contaminated soil.

Prior to excavation of the sump required for drilling, an evaluation will be made as to whether the sump will require a lining. The decision will take into account factors such as whether the soil is highly permeable, if shallow groundwater contamination is likely and what type of chemicals will be used in the drilling fluids.

Should a lining be required it will be removed after drilling and the contents of the sump disposed of in a safe manner. In the case that no lining is required, all liquid waste and cuttings resulting from drilling operations will be accumulated in the excavated sump over the course of drilling operations. This waste will mostly be comprised of mixtures of water and various minerals arising from the borehole. After drilling, in accordance with customary good practice the excess water may be removed and the materials allowed to dry out before backfilling the pit. Any waste pits present after the rig has left will be fenced to protect livestock and other animals.

In relation to produced formation water the following mitigation measures will be put in place:

- All produced water will be collected and stored in a secure manner which prevents leakage and contamination of soil, surface water and groundwater;
- Any on-site water storage dams will be fully lined with an impermeable barrier; and designed and managed to maintain sufficient freeboard to contain runoff and precipitation from a 1 in 20 storm;
- Volumes of produced formation water will be measured and recorded on a daily basis;
- Prior to the removal or discharge of water from the site the DPI-Manger Petroleum Operations will be notified. This notification will include the following details:

  a) Water source;
  b) Water volume;
  c) Water quality;
  d) Method of removal or discharge (eg truck, pipeline);
  e) Intended frequency of removal;
  f) Discharge point (eg name, type, location, operator and environmental protection licence).
  g) Documentation for chain of custody must be maintained and available for inspection by DPI on request.

5.4 Geology and Soils

5.4.1 Existing Environment

All well sites are to be located in cleared pasture or agricultural land.

5.4.2 Potential Impacts

An area of up to 2 hectares is required to accommodate a fully operational drilling rig and ancillary equipment, of which a portion may be required to be cleared and graded level depending on the existing topology. Topsoils will be removed and stockpiled for replacement during site rehabilitation. If imported soils are required these will be sourced from the local area and if required permission will be obtained prior to this being undertaken.

Management measures will include:

- Restricting the area to be disturbed to the minimum;
- Stockpiling top soil separately from other spoil and respreading;
- Return of natural/previous land contours;
- Reseeding if required in consultation with landholders;
- Removal of all imported soil material.

As the region has an approximately even monthly rainfall across the year, periods of wet weather are expected. Rain forecasts for the area will be followed on the Bureau of Meteorology website at http://www.bom.gov.au/products/IDG00073.shtml. In the event of expected flooding, the Operations Manager and the Company Wellsite Representative will jointly decide whether to remove personnel and/or equipment from site.

In the event of expected rainfall the decision to cease onsite operations, restrict travel or suspend travel on internal and council roads will be jointly made between the Operations Manager and the Company Wellsite Representative, with consultation with the Health, Safety and Environment Department.

This decision will take into account:

- Short and long term weather forecasts,
- Potential damage, including compaction of soils, damage to flora and short term visual effects and appropriate rehabilitation methods,
- Road conditions- state of repair, soil type, drainage performance and potential impact of traversing road,
- Council roads and internal field roads will be considered separately,
- Site location- topography of the site, soil type and drainage.

5.5 Noise and Vibration

5.5.1 Existing Environment

Due to the low population and lack of heavy industry, noise levels are quite low but can be quite variable due to periodic faming operations.

5.5.2 Potential Impacts and Mitigation

The proposed activity is like to generate noise as a result of the following procedures:

- The drilling activity
- The movement of trucks and vehicular transport

The equipment used for mobilisation and powering of the drilling rigs have mufflers installed on their respective power plants and prime movers. The proposed drilling sites remain a significant distance from the nearest dwellings and combined with the muffling of the engines and the short term nature of the drilling activity, operations are unlikely to create any significant noise impacts for residents. Drilling operations will occur only for a 12 hr period of operation.

Mitigation Measures will include:

- Identifying all potentially affected noise and/or vibration sensitive receivers (including residences, schools, commercial premises and noise sensitive equipment) that may be affected by the approved activities;
- Predicting potential noise and vibration levels from the proposed operations where appropriate (depending on where nearest sensitive receptors are located relative to the well sites);
- Identifying and implementing all reasonable and feasible mitigation methods to reduce noise and vibration impacts;
- Documenting and implementing any specific work practices that will be employed to limit noise and vibration;
- Conducting noise and vibration monitoring where appropriate eg subject to noise complaints;
- Appropriately informing affected residences and other relevant parties in advance of any activities and updating information as required;
- Except in emergencies or with the written consent of all parties who are located less than 1 km from the wellsite, no activities which are likely to disturb landholders or other affected parties (with the exception of dewatering, venting or flaring) are permitted at well sites or associated areas outside the following times:
  a) 7.00 am to 6.00 pm on weekdays;
  b) 8.00 am to 1.00 pm on Saturdays;

Note that the above measures will be subject to any directions issued in writing by the DPI-Manager Petroleum Operations.

5.6 Flora and Fauna

5.6.1 Existing Environment

A search of the threatened species database maintained by the Department of Environment and Conservation refers to a number of flora and fauna species in the region of the well sites. However the area has been previously cleared and is unlikely to be of significance to threatened species or communities.

Appendix 1 lists the many potential weeds that could be in or near the proposed well locations.

5.6.2 Potential Impacts

The likelihood of disturbing actual or potential habitat associated with species of significance is low because of the small area and temporary nature of the impact; the extent and duration of clearing and grazing that has occurred locally; and the absence of remnant vegetation at the proposed drilling sites suitable for inhabitation by endangered birds and animals. The sites will be rehabilitated with the original topsoil and reseeded in consultation with the landowner.

If grazing of cattle is being conducted in the area of the drilling rig, an assessment will be made as to whether the drilling site needs to be fenced in. In addition, if unfenced roads are present on the roads to/from the rig, drivers will be made aware both of the hazard this presents and the environmental impact a collision may have as part of the site induction or journey management programs.

There is a potential for the introduction of weeds and pest species to the site via the entry of vehicles and plant. This shall be mitigated as follows; all vehicles heading to site will be required to follow a journey management protocol which will include documenting the areas and road conditions that the vehicle has recently transited. These vehicles will be assessed for weed exposure in area of origin and if it is deemed required the vehicle, plant or ancillary equipment will be washed down at a suitable site external to the project area. This will entail the complete removal of soils and organic matter from all areas capable of holding such material. This may also be undertaken between well locations depending on weed infestations at each site.

The location of washing down of vehicles and ancillary equipment will depend on the location from which the drilling contractor and other equipment will be mobilising.

5.7 Chemical and Hazardous Substance Management

A variety of chemicals will be required for the project. These include fuel, lubes, oils, solvents and drilling mud additives. Appropriate storage and handling is necessary to avoid the risk of land or water contamination or posing a threat to health or safety.

The following management measures will be implemented:

- The amount of hazardous material stored and used on site shall be kept to the minimum practicable.

- Hazardous materials shall be transported, stored and handled in accordance with the requirements of relevant legislation (e.g. *Road and Rail Transport (Dangerous Goods) Act 1997, Australian Dangerous Goods Code*) and Australian and Industry Standards.

- Fuels, lubricants and chemicals shall be stored and, where practicable, handled within containment/hardstand areas designed to prevent the release of spilt substances to the environment, in accordance with relevant legislation and standards.

- A Fit For Purpose rig has been contracted and serviced to ensure the engines will not leak oil. If a leak does develop, plastic sheeting will be placed under the rig to contain spills and the leak will be repaired as soon as possible.

- A spill kit will be available at site.

- All storage and handling equipment (including transfer hoses) shall be kept in a well maintained condition.

- Where it is necessary to refuel equipment on site, adequate spill prevention and containment measures (e.g. drip trays) shall be used.

- Material Safety Data Sheets and handling procedures for hazardous chemicals and materials shall be kept on site.

Spill prevention and response measures will include:

- Appropriate spill response material shall be maintained on site.
  Spills or leaks shall be immediately reported to the senior representative onsite and clean up actions initiated.

- In the event of a spill, the material shall be contained to the smallest area practicable.

- Personnel shall be advised of the location and use of the spill containment equipment in the site induction.

- Spilt material and contaminated soils shall be treated on site or removed off-site for disposal at an appropriately licensed facility, as determined in consultation with Department of Environment and Conservation ("DEC") and DPI-MR.

Spills shall be reported in accordance with regulatory and licensing requirements. There is a duty to notify the appropriate regulatory authority (broadly, the EPA or the local council) of pollution incidents where material harm to the environment is caused or threatened (see section 3.1 for definition of material harm)

The relevant information about a pollution incident required to be notified consists of the following:

- the time, date, nature, duration and location of the incident,
- the location of the place where pollution is occurring or is likely to occur,
- the nature, the estimated quantity or volume and the concentration of any pollutants involved,
- the circumstances in which the incident occurred (including the cause of the incident, if known),
- the action taken or proposed to be taken to deal with the incident and any resulting pollution or threatened pollution,
- other information prescribed by the regulations.

5.8 Waste Minimisation and Management

A range of wastes are generated during drilling operations. Typical wastes are summarised in Table 2.

Table 2: Typical Drilling Wastes and Disposal Methods

Waste	Disposal Method
Domestic Waste	
Sewage and grey water	A portable toilet facility will be used on-site
Food waste, paper and plastic	Collected at rig site (may be compacted) for disposal to approved landfill.
Glass and cans	Collected at the rig site for disposal to approved landfill and recycling where feasible.
Workshop waste (rags, filters)	Approved landfill
Industrial Waste	
Chemical bags and cardboard packaging materials	Compacted and collected at rig site for disposal to licensed facility.
Scrap metals	Collected in designated skip for recycling or to licensed facility.
Used chemical and fuel drums	Collected in designated skip for recycling where feasible.
Waste oils and liquid Chemical residues	Recycled or to licensed treatment/ disposal facility
Chemical wastes	Approved landfill or return to supplier.
Timber pallets (skids)	Recycled or to licensed disposal facility.
Vehicle tyres	Shredded and disposed to approved landfill.

The worksite will require the provision of systems for the management of sewage wastes. Personnel numbers can reach up to 10 in the case of drilling operations. Standard practice for sewage disposal for drilling operations in remote areas will be followed and sewage pipes will discharge into an excavation pit. Alternatively, an environmental treatment unit may be utilised if practical and appropriate, with treated waste waters being discharged to an excavated pit. The sewage waste pit(s) will be backfilled following completion of well site operations, when the camp is relocated to the next site.

All industrial solid wastes created during drilling and well operations will be collected in designated skips for eventual recycling or disposal to an appropriately licensed facility. Other wastes associated with drilling and well operations, including drilling fluids and muds, cuttings, any other fluids (for example frac gel) and waste waters will be disposed of to the excavated drilling sump. The contents of the drill sump will be allowed to dry before being covered with at least one metre of fill cover. Topsoil will be respread over restored surfaces at final abandonment to encourage revegetation of disturbed surfaces.

The following management measures will be implemented:

- All worksite and well lease operations shall be kept free from litter.
- Waste material (including domestic waste) shall be collected and stored in suitable bins to prevent loss and scavenging by stock, wildlife and feral animals.

- Where practicable, recyclable material (e.g. glass and cans, scrap metals, used chemical and fuel drums and timber pallets) shall be collected in designated skips for recycling.

- The waste bins shall be removed from the site as necessary following completion of drilling and their contents are to be deposited at a licensed waste management facility for appropriate disposal.

- All wastes are to be transported in covered or sealed containers to prevent the loss of waste materials during transport.

- Waste shall be transported in accordance with appropriate standards and legislative requirements.

- With the exception of drilling fluid, drill cuttings and other fluids disposed during well clean-up, and sewage wastes, all wastes are to be disposed of at a licensed waste disposal facility.

- Pits for the containment of sewage and grey water (either at campsite or well locations) shall be of sufficient depth to allow for the subsequent covering with a minimum of one (1) metre of overburden.

- Pits shall not be established in locations which pose a hazard to stock or wildlife. The fencing shall be stock proof and, for 'organic beef accredited' properties, steel or untreated timber posts shall be used.

- Flare pits shall also be fenced as above.

- Sumps containing waste fluids/cuttings shall be fenced off immediately following the rig moving off the premises.

A perimeter fence will enclose all the above pits, sumps etc.

5.7 Visual Amenity

5.7.1 Existing Environment

The landscape in the region is dominated by broad views of rural properties, with scattered pastoral infrastructure such as bores, tanks, dams, fences, roads, homesteads and other buildings.

5.7.2 Potential Impacts and Mitigation Measures

The visual impacts of drilling will be temporary and insignificant. Production testing infrastructure will also have no significant impact as it is typically small scale (e.g. tanks, ponds and possibly demountable buildings), is not inconsistent with existing rural infrastructure and is visible only from the immediate vicinity.

Work is scheduled on a 12 hour basis as negotiated with landowners, however if drilling is operated on a 24 hour a day basis, the site will be sufficiently lit for safe working conditions. Due to the level terrain this light can be expected to be visible from a reasonable distance, however due to the short duration of each well this is not considered a significant alteration to the visual amenity. Lighting will be kept to a minimum and will be focused on the working areas only.

5.8 Socio-Economic

5.8.1 Existing Environment

The catchment has been used extensively for agricultural activities since the 1830s. The main agricultural activities of irrigated cotton and broadacre cropping (mainly sorghum, sunflower and wheat) occur predominantly along the alluvial floodplains of the Namoi River Valley. Sheep and cattle grazing occur throughout the catchment, but is more widespread in the upper catchment area.

5.8.2 Potential Impacts and Mitigation Measures

Potential impacts include disturbance to farming activities and disturbance to livestock.

To minimise impacts on landholders the following aspects will be undertaken:

- Prior to the commencement of activities at each site, every effort will be made to provide notice of the planned activities, in particular drilling and/or fraccing operations, to immediate neighbours of the land on which the activities are to take place. Reasonable requests by landholders for limited rescheduling of activities will be accommodated;
- Access roads will be maintained in a condition satisfactory to the DPI and Landholders;
- The site will be adequately fenced with a lockable gate and adequate signs warning of potential danger put in place;
- There will be a buffer cleared outside the security fence line to maintain an effective barrier against bushfires;
- The area of land disturbance will be minimised subject to safety constraints;
- The site will be maintained in a clean and tidy condition and a program of ongoing environmental maintenance leading to full restoration of the site.

5.9 Cultural Heritage

5.9.1 Existing Environment

The land where the well sites are located has been previously disturbed and cleared. However, a database search of the area will be made prior to drilling commencing.

5.9.2 Potential Impacts and Mitigation Measures

Potential impacts include disturbance to unrecorded artefacts or burial sites. However to minimise any potential impacts the following management measures will be implemented:

- Heritage exclusion zones or sites identified during the inspection shall be avoided.
- Personnel, vehicles and equipment shall be restricted to designated work areas and access tracks.
- Aboriginal heritage issues and the potential for discovery of sites shall be covered in site inductions.

If a site is discovered during operations, the following procedure shall be implemented:

- Halt work at this location and establish a 100 metre buffer around the site. Work may continue outside the buffer area.

- Contact the project's archaeologist, relevant Local Aboriginal Land Council and National Parks and Wildlife Service (Department of Environment and Conservation), so that an evaluation of the nature of the discovery can be undertaken, along with an appropriate course of action.

- The course of action may consist of recording the site location, removal of the cultural material or site protection as appropriate under the relevant legislation.

- If human remains are encountered, the local Police shall also be notified.

6.0 Conclusions

Drilling of the proposed wells is an essential step in evaluating the hydrocarbon potential of the Gunnedah basin. Discovery of gas reserves in this area has the potential to increase the state's reserves and revenue from gas and underpin future exploration or production in the region.

The proposed activities involve a range of potential environmental impacts, which are common to drilling activities such as those carried out elsewhere in the Gunnedah Basin. It is considered that the potential impacts can be successfully mitigated with the application of the management strategies outlined in this document. The strategies are consistent with the APPEA *Code of Environmental Practice* and are typical of good oilfield practice.

Section 5A of the EP Act lists seven factors to be considered, commonly referred to the seven part test of significance. An assessment was made against the seven factors to be considered under Section 5A of the EP &P Act ie "seven part test of significance" and concluded that:

(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,

No known threatened species have been identified that would be impacted by this proposal. The size and nature of the proposal is unlikely to effect the life cycle of any viable populations of threatened flora/fauna if present.

(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,

There are no known endangered populations that have been identified that would be impacted by this proposal. The size and nature of the proposal is unlikely to effect the life cycle of any viable populations of endangered populations if present at the sites.

(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
(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,

There are no known endangered ecological communities or critically endangered communities that have been identified that would be impacted by this proposal.

(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
(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
(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,

It is not proposed to clear any habitat for this proposal.

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

It is not proposed to clear any habitat for this proposal.

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

It is not proposed to clear any habitat for this proposal.

(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

It is not proposed to clear any habitat for this proposal, and planned activities will not constitute a threatening process.

If the management strategies are effectively implemented, it is expected that:

- impacts to air quality will be minor, localised and insignificant;
- adverse effects on water resources will be minimal during drilling and initial production testing. Adverse impacts will also be avoided during any extended production testing that may follow (under separate approval) by careful design and operation in oil handling infrastructure and water holding ponds and avoidance (or shut-down) of operations during periods of inundation;
- off-site impacts to soils will be avoided and on-site impacts will be minor and will be rehabilitated;
- noise and vibration impacts will be short term, and no threatened species or communities are likely to be impacted;
- there will be no significant use of, or impact to, natural resources;
- impacts on the community and visual amenity will be insignificant and short term, particularly as the sites are remote;
- impacts to heritage places or sites will be avoided;
- disturbances to pastoral land use will be minor and short term and managed in consultation with affected landholder(s); and
- there will be no significant cumulative environmental impacts.

On completion of the operations, the sites will be rehabilitated to reflect the pre-existing land form and use. All waste will be disposed of in an appropriate manner.

Glossary

DPI-MR	Department of Primary Industries- Mineral Resources
EP & A	Environmental Planning and Assessment Act
PELA	Petroleum Exploration Licence Area
REF	Review of Environmental Factors
TSC	Threatened Species Conservation Act 1995

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Further reading

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Appendix 1

Noxious Weeds in Liverpool Plains Shire Council Area

The following weeds are declared noxious in the control area of Liverpool Plains Shire Council:

Weed	Class	Legal requirements
African boxthorn [Lycium ferocissimum]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
African feathergrass [Pennisetum macrourum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
African turnipweed [Sisymbrium runcinatum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
African turnipweed [Sisymbrium thellungii]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Alligator weed [Alternanthera philoxeroides]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Anchored water hyacinth [Eichhornia azurea]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Annual ragweed [Ambrosia artemisiifolia]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Arrowhead [Sagittaria montevidensis]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Artichoke thistle [Cynara cardunculus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Athel tree [Tamarix aphylla]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Bathurst/Noogoora/Californian/cockle burrs [Xanthium species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Bear-skin fescue [Festuca gautieri]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Black knapweed [Centaurea nigra]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Blackberry [Rubus fruticosus aggregate species] except cultivars Black satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smoothstem, Thornfree	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration

Bridal creeper [Asparagus asparagoides]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Broomrapes [Orobanche species] Includes all Orobanche species except the native O. cernua variety australiana and O. minor	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Burr ragweed [Ambrosia confertiflora]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cabomba [Cabomba caroliniana]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cayenne snakeweed [Stachytarpheta cayennensis]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Chilean needle grass [Nassella neesiana]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Chinese violet [Asystasia gangetica subspecies micrantha]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Clockweed [Gaura lindheimeri]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Clockweed [Gaura parviflora]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cockle burrs [Xanthium species]		See Bathurst/Noogoora/Californian/cockle burrs
Columbus grass [Sorghum x almum]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Corn sowthistle [Sonchus arvensis]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Dodder [Cuscuta species] Includes All Cuscuta species except the native species C. australis, C. tasmanica and C. victoriana	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
East Indian hygrophila [Hygrophila polysperma]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
English broom [Cytisus scoparius]		See Scotch broom
Espartillo [Achnatherum brachychaetum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with

		This is an All of NSW declaration
Eurasian water milfoil [Myriophyllum spicatum]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Fine-bristled burr grass [Cenchrus brownii]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Fountain grass [Pennisetum setaceum]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Galenia [Galenia pubescens]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Gallon's curse [Cenchrus biflorus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Giant Parramatta grass [Sporobolus fertilis]	3	The plant must be fully and continuously suppressed and destroyed
Glaucous starthistle [Carthamus glaucus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Golden dodder [Cuscuta campestris]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Golden thistle [Scolymus hispanicus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Green cestrum [Cestrum parqui]	3	The plant must be fully and continuously suppressed and destroyed
Harrisia cactus [Harrisia species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Hawkweed [Hieracium species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Horsetail [Equisetum species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Hymenachne [Hymenachne amplexicaulis]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Italian bugloss [Echium species]		See Paterson's curse, Vipers bugloss, Italian bugloss
Johnson grass [Sorghum halepense]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority

Karoo thorn [Acacia karroo]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Kochia [Bassia scoparia] except Bassia scoparia subspecies trichophylla	1	except B.scoparia subspecies trichophylla The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Lagarosiphon [Lagarosiphon major]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Lantana [Lantana species]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Lippia [Phyla species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Long-leaf willow primrose [Ludwigia longifolia]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Long-style feather grass [Pennisetum villosum]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Mesquite [Prosopis species]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Mexican feather grass [Nassella tenuissima]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Mexican poppy [Argemone mexicana]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Miconia [Miconia species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Mimosa [Mimosa pigra]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Mossman River grass [Cenchrus echinatus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Mother-of-millions [Bryophyllum species and hybrids]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Nodding thistle [Carduus nutans]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Onion grass [Romulea species]	5	The requirements in the Noxious Weeds Act

Includes all Romulea species and varieties except R. rosea var. australis		1993 for a notifiable weed must be complied with This is an All of NSW declaration
Oxalis [Oxalis species and varieties] Includes all Oxalis species and varieties except the native species O. chnoodes, O. exilis, O. perennans, O. radicosa, O. rubens, and O. thompsoniae	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Pampas grass [Cortaderia species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Parkinsonia [Parkinsonia aculeata]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Parthenium weed [Parthenium hysterophorus]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Paterson's curse, Vipers bugloss, Italian bugloss [Echium species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Perennial ragweed [Ambrosia psilostachya]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Pond apple [Annona glabra]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Prickly acacia [Acacia nilotica]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Prickly pear [Cylindropuntia species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Prickly pear [Opuntia species except O. ficus-indica]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed This is an All of NSW declaration
Red rice [Oryza rufipogon]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Rhus tree [Toxicodendron succedaneum]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority This is an All of NSW declaration
Rubbervine [Cryptostegia grandiflora]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Sagittaria [Sagittaria platyphylla]	5	The requirements in the Noxious Weeds Act

		1993 for a notifiable weed must be complied with This is an All of NSW declaration
Salvinia [Salvinia molesta]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Sand oat [Avena strigosa]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Scotch broom [Cytisus scoparius]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Scotch thistle,Stemless thistle,Illyrian thistle, Taurian th [Onopordum species]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Senegal tea plant [Gymnocoronis spilanthoides]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Serrated tussock [Nassella trichotoma]	3	The plant must be fully and continuously suppressed and destroyed and the plant may not be sold, propagated or knowingly distributed
Siam weed [Chromolaena odorata]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Silk forage sorghum [Sorghum species hybrid cultivar]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Silver-leaf nightshade [Solanum elaeagnifolium]	3	The plant must be fully and continuously suppressed and destroyed
Smooth-stemmed turnip [Brassica barrelieri subspecies oxyrrhina]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Soldier thistle [Picnomon acarna]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Spiny burrgrass [Cenchrus incertus]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Spiny burrgrass [Cenchrus longispinus]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority and the plant may not be sold, propagated or knowingly distributed
Spotted knapweed [Centaurea maculosa]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
St. John's wort [Hypericum perforatum]	4	The growth and spread of the plant must be controlled according to the measures

		specified in a management plan published by the local control authority
Star thistle [Centaurea calcitrapa]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Sweet briar [Rosa rubiginosa]	4	The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority
Taurian thistle [Onopordum species]		See Scotch thistle,Stemless thistle,Illyrian thistle, Taurian th
Texas blueweed [Helianthus ciliaris]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Water caltrop [Trapa species]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Water hyacinth [Eichhornia crassipes]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Water lettuce [Pistia stratiotes]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Water soldier [Stratiotes aloides]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Willows [Salix species] Includes all Salix species except S. babylonica, S. x reichardtii, S. x calodendron	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Witchweed [Striga species] Includes all Striga species except native species and Striga parviflora	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Yellow burrhead [Limnocharis flava]	1	The plant must be eradicated from the land and the land must be kept free of the plant This is an All of NSW declaration
Yellow nutgrass [Cyperus esculentus]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration

Appendix 2

Pro Forma Landowner Permit Form

UPSTREAM PETROLEUM PTY LTD

NOTICE OF INTENDED ENTRY

OWNER/OCCUPIER: .....
PROPERTY DESCRIPTION: .....

Dear

Re: Proposed Drilling of ..... Exploration Well in PEL 452

Gunnedah Gas proposes to drill an exploration well, insert name, commencing in third quarter 2006, in Petroleum Exploration License (PEL) 452. Upstream Petroleum will be handling the drilling operations, as a primary contractor, on the behalf of Gunnedah Gas. The location of the well will be approximately insert physical description of location as shown on the attached plan. This letter is intended to record the terms upon which Gunnedah Gas, Upstream Petroleum, its employees and contractors, may enter the land.

Gunnedah Gas and Upstream Petroleum shall conduct its operations in accordance with good oil industry practice and shall maintain and abide with all applicable laws and regulations. The company will give a minimum of 48 hours notice of its intent to enter upon the land.

Gunnedah Gas and Upstream Petroleum shall:

a) not interfere with any improvements on the land without permission of the owner.
b) use existing gates where possible or install temporary stock proof gates where existing gates are not practical to use.
c) leave all gates in the state in which they are found.
d) ensure that all stock on the land are not unduly disturbed
e) take all precautions to reduce the risk of fire on the land.
f) remove all equipment and restore disturbed areas to a suitable state at the completion of operations.
g) plug any abandoned well to industry standards.
h) provide suitable security to the area of operations to ensure no damage or injury can occur to people, live stock or the environment.
i) observe any list of additional landholder particular requirements.

Every attempt will be made to avoid damage to improvements and stock, however, should damage occur a claim for compensation must be tendered to Upstream Petroleum within 90 days after completion of field operations. Once damage has been verified by both parties then compensation of the amount agreed shall be paid within 21 days. In the event of a disagreement, an independent expert, agreed to by both parties, will adjudicate the amount of compensation.

Any enquiries or complaints regarding entry onto the land should be made by telephone or facsimile to Simon Mewing, Queensland Manager, 07 3844 4972, or by letter to Upstream Petroleum.

Signed:_____ Signed:_____
(for and behalf of Landholder) (for and behalf of Upstream Petroleum)

Date: _____ Date: _____

ATTACHMENTS

1. Map showing land to be entered and location of proposed operations.
2. List of additional landholder particular requirements.

World Class Oil and Gas Service Company
Upstream Petroleum Pty Ltd
ABN 49 080 394 985
165 Melbourne Street, South Brisbane Qld 4101
Tel: (61-7) 3844 4972 Fax: (61-7) 3844 4971
Email: simonmewing@upstreampetroleum.com.au

UPSTREAM PETROLEUM PTY LTD

LIST OF ADDITIONAL LANDHOLDER REQUIREMENTS

Owner/Occupier: .....
Property Description: .....

Operation: Proposed Drilling of Exploration Well in PEL 452

Additional Requirements:

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Signed: _____ (for and behalf of Landholder)

Date: _____

Signed: _____ (for and behalf of Upstream Petroleum)

Date: _____

World Class Oil and Gas Service Company
Upstream Petroleum Pty Ltd
ABN 49 080 394 985
165 Melbourne Street, South Brisbane Qld 4101
Tel: (61-7) 3844 4972 Fax: (61-7) 3844 4971
Email: simonmewing@upstreampetroleum.com.au

Appendix 3

Example Communication to Council

UPSTREAM PETROLEUM PTY LTD

27 September 2006

Mr Robert Geraghty
General Manager
Warrumbungle Shire Council
P.O. Box 191
Coonabarabran
NSW 2357

Dear Robert,

Re: **Coal Seam Methane Exploration Holes – PEL 450 – NSW**

Gunnedah Gas, as licence holder of Petroleum Exploration Lease (PEL) 450, proposes to drill a series of Coal Seam Methane test wells during the 4th quarter of this year. The proposed wells are located from the south east of Coonabarabran through to the North East. It is planned to drill two wells initially with up to four more to follow if initial results are encouraging.

Gunnedah Gas acquired the Petroleum Exploration Licence in 1998 as part of a corporate strategy that sought to expose the company to the developing infrastructure and gas markets in eastern Australia. NSW currently imports natural gas from the cooper basin in South Australia and from the Gippsland Basin in Victoria via pipeline. PEL 450 is well located to service local markets around the Coonabarabran, Narrabri, and Gunnedah and, subject to reserves volumes, larger markets in Sydney and Newcastle. Potential also exists for sale into the regional power grid that crosses the permit in a number of locations.

A copy of the Review of Environmental Effects, Emergency Response Plan, Safety Management Plan and other relevant documentation will be made available to the Warrumbungle Shire Council (and any other interested parties) prior to the commencement of field operations.

Gunnedah gas is currently in the process of gaining landholder and departmental approval to conduct the proposed drilling and will also be in contact with other Government departments and relevant parties to ensure the process will be conducted in a professional manner. Gunnedah gas have appointed Upstream Petroleum to provide engineering, logistical support and liaison for their operations in eastern Australia.

The drilling of each well is expected to be of six to ten days duration, however significantly more time is involved in initially setting the proposed site and rehabilitation on completion. It is expected that a minimum of eight personnel will be involved in the operation, all being

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Email: simonmewing@upstreampetroleum.com.au

accommodated locally. At the conclusion of operations, Gunnedah Gas's field representative will personally contact all parties affected by the drilling to ensure that they are satisfied with the way the work was conducted and, in the landholder's case, the condition of their land.

Gunnedah Gas's personnel, together with Upstream Petroleum and their contractors, have had extensive experience working in all types of terrain and vegetation and do not foresee any major problems, however we would appreciate co-operation from the Warrumbungle Shire Council. Please contact the undersigned at our Brisbane office should you have any queries on the proposed operations.

Yours faithfully,

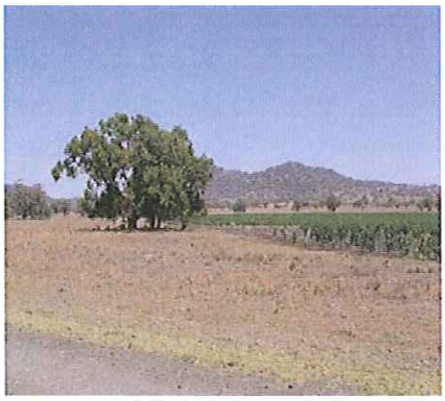
Simon Mewing
Queensland Manager

Appendix 4

Photographs

Location 1

Location 2a



Location 2b

Location 3

Location 4

Location 5

Location 6

Location 7