



ASSESSMENT REPORT

**SYDNEY GAS OPERATIONS PTY LTD
CAMDEN COALBED METHANE PROJECT
DA-15-1-2002-I**

**Department of Planning
July 2002**

REPORT ON THE ASSESSMENT OF A DEVELOPMENT APPLICATION PURSUANT TO SECTION 80 OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979

1. SUMMARY

Sydney Gas Operations Pty Ltd (the applicant) has submitted a Development Application (DA) to the Department for the continued operation of its Coalbed Methane Project (the project) near Camden. The applicant proposes to convert its existing Petroleum Assessment Lease into a Petroleum Production Lease and requires development consent for operation of 20 wells, gas gathering and treatment system, existing office and pipeyard, and completion of 5 additional wells. The proposal falls within the Camden and Wollondilly Council areas.

Under the *Environmental Planning and Assessment Act 1979*, (the Act), the proposed development is classified as State Significant, Integrated and Designated Development. The Minister for Planning is the consent authority for the DA.

The DA and supporting Environmental Impact Statement (EIS) were publicly exhibited from 6 February 2002 until 22 March 2002. A total of 1930 submissions were received from the members of the public during the exhibition period. Of these, 1903 were in support (consisting of 1880 form letters) and 26 submissions raised objection. Ten submissions were received from public authorities and local government.

The submissions were primarily concerned with: noise, odour, vibration, air quality, water quality, groundwater, safety, visual and approval process.

The Environment Protection Authority has given its general terms of approval for the proposal.

The Department has assessed the key issues of noise, vibration, air quality, odour, groundwater and safety/hazard, and considers that all impacts can be managed or mitigated. The operation of the project is unlikely to result in any significant adverse impact on the surrounding area.

The Applicant has not demonstrated that it has a proven reserve of gas that can be extracted with 90% probability. Given that this is a new industry and that it may not be appropriate to require a similar level of reserve as for other resource projects (such as coal mining), the recommended conditions require the Applicant to submit a reserve report on the expiration of 10 years from the date of the consent.

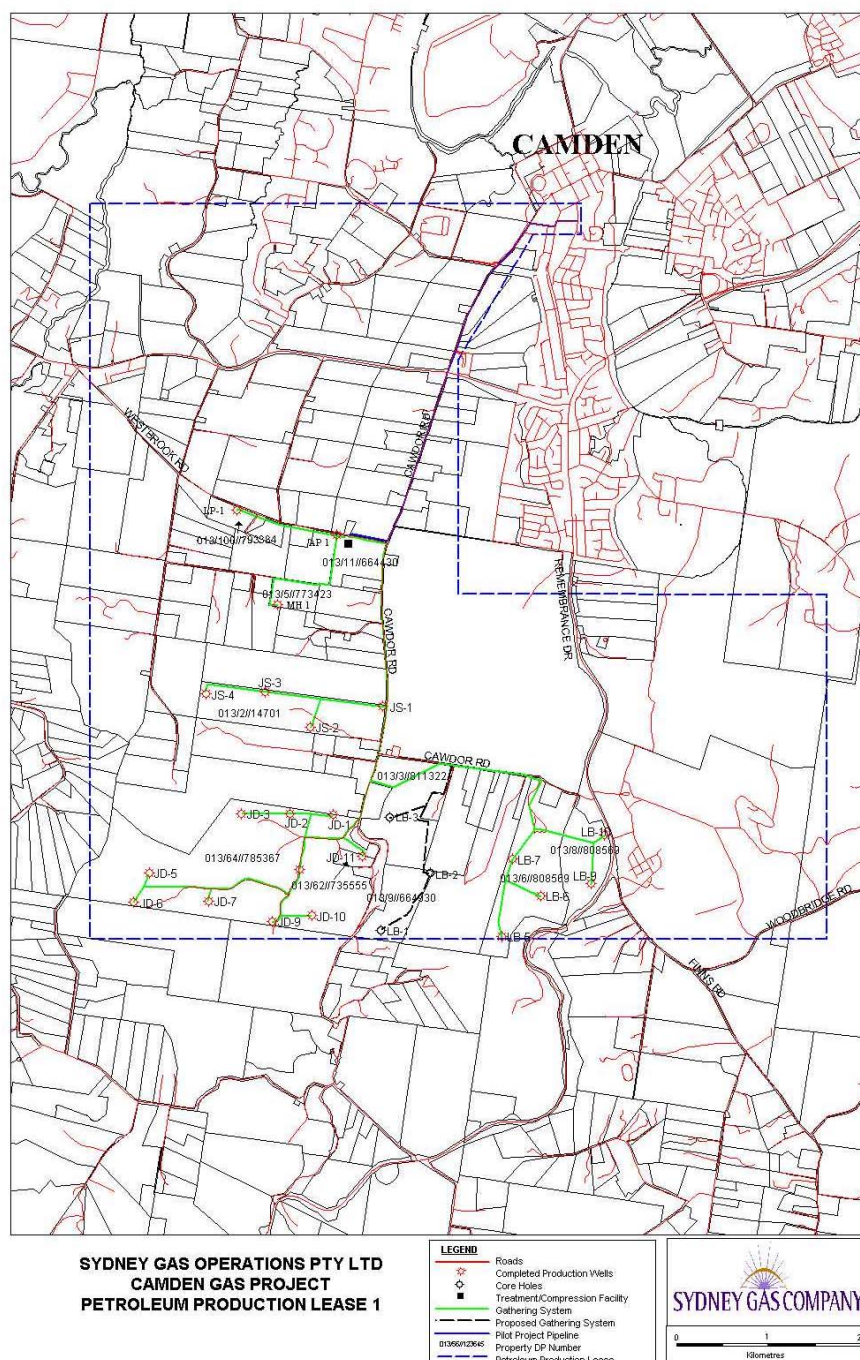
The Department has assessed the DA, the EIS and the submissions on the proposed development, and recommends that the Minister approve the DA, subject to the imposition of certain conditions.

2. SITE CONTEXT

2.1 Location

The project area is located 60 km southwest of Sydney, near the township of Camden (see Figure 1 below). The project covers an area of some 48 km² situated 4 to 8 km south of Camden and is known as PAL 1. Access to the project area is via Remembrance Drive from Camden, Cawdor Road from the east and Old Razorback Road from the south.

Figure 1 – Location Map



2.2 Site Description

The project has been established on a number of rural landholdings (Johndilo, Logan Brae and other smaller rural properties). These landholdings are largely used for rural pastoral activities such as dairy farming or grazing. The physical infrastructure comprises wells, gas gathering system, gas treatment facility and steel pipeline. The wells are located on private property and the gas gathering system and pipeline are located within the road reserve of local roads. The Applicant also operates a gas treatment facility (Ray Beddoe Treatment Plant) on a 1 ha site in Westbrook Road, and a site office and pipeyard depot on the Johndilo property.

2.3 Surrounding Landuses

The Cawdor area has a mix of agricultural activities and rural-residential development. Agricultural activities largely comprise grazing, cropping, dairy farming, poultry farms and horse studs/trotting tracks. The area is undergoing change as pressure for rural-residential development increases. Many properties are being subdivided into lot sizes of less than 3 ha.

Other major landuses in the surrounding area include the Elizabeth Macarthur Agricultural Institute, educational establishments (Camden High School and Cawdor Public School), Camden Park urban release area, and rural-residential development. The Camden urban area is located to the northeast of the project area.

3. THE PROPOSED DEVELOPMENT

3.1 Outline of Proposal

The Applicant seeks development consent for the continued operation of the Camden Coalbed Methane project. The project involves the development of coalbed methane gas production from the Illawarra Coal measures in the PAL 1 area south of Camden. The natural gas would be supplied to the AGL gas distribution network at Camden.

The proposal involves:

- > Operation of the existing 20 production wells;
- > Completion of 5 additional wells (2 drilled but not yet connected to the gas gathering system and 3 yet to be drilled);
- > Operation of the existing and proposed gas gathering system;
- > Operation of the existing gas treatment plant (compression and removal of water from gas produced by the wells);
- > Production of up to 93,000 GJ/month from the treatment plant;
- > Sale and distribution of gas to the AGL gas network; and
- > Operation of the existing site office and pipeyard depot.

The existing operation was commissioned in April 2001 under a Production Assessment Lease granted by the Department of Mineral Resources (DMR). The proposal is in PAL 1, which is part of the wider Petroleum Exploration Lease 2 for the Sydney Basin, which the Applicant holds. The Applicant has to obtain development approval to enable it to apply to the DMR for a Petroleum Production Lease to permit full-scale commercial production of gas. The proposal will eventually become part of a larger 300 well production area extracting gas from the Illawarra Coal Measures in the Camden/Wollondilly area. These future developments are not part of the proposal and will be the subject of future development applications.

3.2 Existing Operation

A total of 22 wells have been drilled in PAL 1, of which 20 have been completed and production testing either commenced or completed. The wells are grouped, with 10 on the Johndilo property, 5 on the Logan Brae property and 5 in the Westbrook Road area. Two wells have been drilled but not yet completed or connected to the gas gathering system.

Once the wells have been drilled the targeted coal seams are hydraulically fractured to allow the gas to flow back to the well bore and to the surface. The fracturing process involves the pumping of a water and sand mixture at pressure to open up/break the coal seams. The sand enables the fractures to remain open and as water is removed from the coal, the reservoir pressure decreases and methane is desorbed. The fracture channels allow the methane to flow to the well bore.

Presently the completed wells are producing approximately 1500 GJ/day.

3.3 Gas Gathering System

An underground gas gathering system has been installed to deliver gas from the wellheads to the gas treatment plant. The system consists of a polyethylene gas pipeline, polyethylene water pipeline, electric power and data transmission cable. The system is located along property boundaries and fence lines wherever possible on private property and within the road reserve (footpath/road shoulder) of public roads.

3.4 Gas Treatment Plant (Ray Beddoe Treatment Plant)

The plant is located on Westbrook Road and consists of a compressor and dehydration unit, storage tanks for odourant and butane/LPG, flare stack and office. Incoming gas is delivered to the compressor, which raises the pressure of the gas to enable delivery to the AGL gas network. The gas passes through the dehydrator, which removes excess water. Prior to delivery to the AGL network the calorific value of the gas is adjusted (injection of butane) to meet AGL requirements, and odourised as a safety measure. Excess water is stored in the detention/storage basin. Gas may be flared off in the event the plant is not operational. The plant has a maximum throughput

of 3000 GJ/day. The capacity of the plant is designed for 25 gas producing wells. The plant operates 24 hours /day seven days per week.

3.5 Gas Pipeline

Treated gas is delivered to the AGL gas distribution network at Camden through a 4.8-km long 200 mm steel pipeline. The pipeline is located in the road shoulder/footpath. The route of the pipeline follows Cawdor Road, Barsden, Broughton and Park Streets to the AGL network at Menangle Road.

3.6 Site Office/Depot

A site office and pipeyard depot is located on a 1 ha site on the Johndilo property. The facility provides office accommodation, communication and equipment storage facilities for the project. The office currently has a staff of 15 people. Storage sheds, casing and tubing storage racks, mobile site office and sundry equipment occupy the site.

3.7 Project Closure and Rehabilitation

The life of the project is estimated at 15-20 years. The decommissioning of each well would involve the following process.

- > Disconnection from the gas gathering system.
- > Removal of surface infrastructure.
- > Grouting the full length of the well casing.
- > Rehabilitation/revegetation of well site and surrounds.

All underground pipework associated with the project would be purged to remove residue gas, capped and left in situ.

3.8 Project Justification

The applicant states the project is needed to:

- > Meet future demands for natural gas;
- > Provide more efficient and reliable energy availability;
- > Address commonwealth, State and Regional energy initiatives; and
- > Provide regional, economic and social benefits.

4 STATUTORY FRAMEWORK

4.1 Permissibility

Most of the existing development is located in the Wollondilly local government area on land which is zoned Rural 1(a2) Rural A2 or Rural 1(a3) Rural A3. Within these zones the proposal is permissible with consent.

The pipeline is located largely within the Camden local government area and on land zoned Rural 1(a), Special Uses – Cemetery 5(a), Open Space 6(a),

Service Industrial 4(b), and Residential 2(a), 2(b) and 2(c) . The proposal would be permissible with consent under the Rural and Service-Industrial zone but would be prohibited in the Special Use, Open Space and Residential zones.

4.2 Minister's Role

The proposal is State Significant Development under a declaration made by the Minister under S.76A (7)(b) of the Act. The declaration applied to all development associated with the Sydney Gas Camden Coalbed Methane Project that is permissible with consent in the Camden and Wollondilly local government areas. The declaration was published in the NSW Government Gazette on 11 January 2002. The Minister is the consent authority for State Significant Development under S.76A (9) of the Act. Therefore the Minister is the consent authority for the proposal.

4.3 Legislative Context

4.3.1 Petroleum (Onshore) Act 1991

The DMR granted the Applicant an Assessment Lease in November 2000 under the *Petroleum (Onshore) Act 1991* (POA Act) to enable an assessment of the quantity and quality of methane gas in the PAL 1 area. Under the POA Act all work associated with an assessment lease is considered to be an activity under Part 5 of the Act and the provisions of that Part apply. The DMR became the determining authority for the "activity". The Applicant prepared a Statement of Environmental Effects for the wells, gas gathering system, treatment plant and gas pipeline, which the DMR subsequently approved.

The applicant is required to obtain a Production Lease from the DMR for the continued operation of the methane gas project. Under the POA Act development consent under the Act is required before the DMR can issue a Production Lease.

4.3.2 Environmental Planning and Assessment Act 1979

The proposal is State Significant Development, designated development and integrated development in accordance with the provisions of the Act and the *Environmental Planning and Assessment Regulation 2000*.

State Significant Development

The proposal is State Significant Development under a declaration made by the Minister under S.76A (7)(b) of the Act. As the proposal may not be permissible in part of the project area, S.76A (8)(c) of the Act permits the development to be carried out with development consent. The Minister is the consent authority for State Significant Development.

Designated Development

The proposal is designated development in accordance with Schedule 3 of the Regulation. Schedule 3 refers to:

Petroleum works that:

(c) *that refine crude petroleum, shale oil or natural gas...*

The proposal involves the refining of natural gas and therefore is designated development. Under the Regulation, an Environmental Impact Statement (EIS) must accompany development applications for designated development. An EIS was prepared in accordance with the Act and the Regulations, and the Director-General's requirements, dated 11 December 2001.

Integrated Development

The proposal is integrated development as defined in S.91 of the Act since, in addition to development consent, it requires an approval from the Environment Protection Authority (EPA). Specifically, the development requires an Environment Protection Licence from the EPA under the *Protection of the Environment Operations Act, 1997*.

The EPA was consulted during the preparation of the Director-General's requirements for the EIS and notified of the lodgement of the development application for the proposal. The Department forwarded copies of all submissions received during the exhibition of the development application and the EPA has provided comments and General Terms of Approval for the development. This information has been incorporated into the recommended instrument of consent and considered in the Department's assessment of the proposal. The provision of General Terms of Approval by the EPA indicates that it is satisfied the relevant approval may be issued.

4.3.3 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* would apply to the proposed development if it were determined, under S.5A of the Act, that there would be a significant impact on threatened species or ecological communities due to the proposal. The Applicant has made an assessment under S.5A for threatened species, found and likely to occur on the site, concluding that the proposal would not create a significant impact on the Cumberland Plains Woodland and Sydney Coastal River Flat Forest. Surveys were also conducted for *Pimelea Spicata* (plant) and *Meridolum Cornovirens* (land snail) which potentially may occur in the area. No rare or threatened species were observed in the area during field surveys. The Department concluded there would not be a significant impact on threatened species or ecological communities as a result of the proposal and a Species Impact Statement is not required.

4.3.4 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (PBC Act) requires approval from the Commonwealth Minister for the Environment for actions that have a significant impact on matters of national environmental significance. The Applicant has made an assessment of the proposal in relation to threatened species and communities. The Cumberland Plains Woodland community is listed as a threatened ecological community under the EPBC Act. This community is represented in the project area, however, the operation of the proposal does not pose a threat and is unlikely to have a significant impact on the Cumberland Plains Woodland community. The Department has concluded that an approval under the EPBC Act is not required.

4.4 Relevant Environmental Planning Instruments

4.4.1 State Environmental Planning Policy No. 33

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development aims to identify developments with the potential for significant off-site impacts, in terms of risk and/or offence (odour, noise, etc.). A development is defined as potentially hazardous and/or potentially offensive if, without mitigating measures in place, the development would have a significant risk and/or offensive impact in the locality.

The proposal is considered potentially hazardous. In accordance with SEPP 33, the Applicant prepared a Preliminary Hazard Analysis for the proposal to demonstrate that the proposed risk mitigation measures could adequately reduce off-site risk impacts to an acceptable level. The Department has considered potential hazards and risk impacts of the proposal, concluding that the proposed development is not a hazardous development.

The proposal is also considered potentially offensive as it requires an Environment Protection Licence (EPL) from the EPA. The EPA has issued General Terms of Approval for the proposed development, thereby indicating that it is prepared to issue the EPL. As such, the proposal does not constitute offensive development.

4.4.2 State Environmental Planning Policy No. 44

State Environmental Planning Policy No. 44 – Koala Habitat Protection applies to the proposal since it is within the Wollondilly local government area, which is listed in Schedule 1 of the policy. The provisions of SEPP 44 require the consent authority to consider whether there is potential koala habitat on the site. Potential koala habitat is defined as areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

The flora and fauna assessment undertaken by the Applicant identified three dominant tree species in the PAL 1 area, *Eucalyptus tereticornis* (forest red

gum), *Eucalyptus moluccana* (grey box) and *Eucalyptus crebra* (ironbark). Only *E.tereticornis* is a scheduled feed tree. Although on a regional scale *E. tereicornis* is likely to exceed the 15% limit, these trees are greatly dispersed. The Applicant states that at no individual well site does this tree type exceed the 15% threshold within 100m of a well. There are no records of breeding koalas within 10 km of the site. The Department is satisfied that the development site is not a potential koala habitat and the provisions of SEPP 44 do not prevent the Minister from granting consent.

4.4.3 Wollondilly Local Environmental Plan 1991

All the existing and proposed gas wells and associated gas gathering system, treatment plant and office/depot are located in the Wollondilly local government area. The land is zoned either 1(a2) (Rural A2) or 1(a3) (Rural A3) under the Wollondilly Local Environmental Plan 1991 (LEP 1991). The objectives of both zones are the same, being:

- (a) to protect the agricultural potential of rural land and to prevent fragmentation of viable rural holdings, and
- (b) to prevent inappropriate, premature and sporadic subdivisions and to ensure consolidation of urban areas so as to enhance the prospect of economic provision of services, and
- (c) to prevent, on the fringe of urban areas, the subdivision of land into small lots which would prejudice the proper layout of additional urban areas as a result of natural growth, and
- (d) to retain the scenic quality and overall character of the land, and
- (e) to encourage agricultural activities that are within the rural capability of the land.

The only difference between the zones, is that abattoirs are prohibited in the 1(a2) zone.

The Applicant has defined the proposal as “generating works” as defined in the Model Provisions, 1980 as “a building or place used for the purposes of making or generating gas, electricity or other forms of energy”. In the development control table of the 1(a2) and 1(a3) zones generating works is permissible with consent as it does not fall within the list of purposes that are permissible without consent or prohibited.

The Department considers a more accurate description of the purpose of the proposal is “petroleum works that refine natural gas”, the same definition that makes the proposal designated development. Under LEP 1991 the proposal would be permissible with development consent.

4.4.4 Camden Local Environmental Plans

The steel pipeline part of the proposal, linking the treatment plant with the AGL natural gas pipeline at Camden, falls within the Camden local government area. The pipeline route traverses two local environmental plans (LEP 46 and LEP 48). The land is zoned 1(a) Rural under both LEPs, except for the small area of

land along Barsden, Broughton and Park Streets and Menangle Road which are zoned Open Space, Industrial and Residential under Camden LEP 46. The pipeline also passes through land in Cawdor Road zoned Special Uses – Cemetery under LEP 46

The proposal is permissible with consent in the 1(a) Rural zone. However, it is prohibited development in the Open Space, Residential and Special Uses zoned land.

5 CONSULTATION

5.1 Notification Procedure

The development application and environmental impact statement was lodged with the Department on 31 January 2002.

The Department subsequently:

- Notified the surrounding landowners and residences, and relevant State Government agencies;
- Advertised the exhibition period of the DA and EIS in the Sydney Morning Herald (once) and the Camden/Wollondilly Advertiser (twice);
- Exhibited the DA and EIS in 5 locations (2 in Sydney, Parramatta, Camden and Picton) for 45 days between 6 February and 22 March 2002; and
- Extended the exhibition period within which public submissions were received by 2 weeks and advertised the extension of the exhibition period in the Camden/Wollondilly Advertiser.

This satisfies the requirements for public participation of State Significant advertised development in the Regulation.

A summary of the number of submissions received by the Department is contained in Table 1 below.

Table 1 – Submissions Received.

Stakeholder Group	Number of Submissions Received
Pre-Exhibition	
Private individuals	9
Sub-Total	9
Exhibition Period	
Government agencies	10
Elected representatives	3
Private individuals	1924
(Form letter)	1880
(Original submissions)	44
Special interest groups	6
Sub-Total	1943
Post-Exhibition	

Private individuals	104
Sub-Total	104
TOTAL	2056

5.2 Submissions from Government Agencies

The Department received submissions from 10 Government agencies, including the integrated approval body. The views of each agency are summarised below.

5.2.1 Bureau of Meteorology

No objections to the development.

5.2.2 NSW National Parks and Wildlife Service

The National Parks and Wildlife Service (NPWS) has a statutory responsibility for the protection and care of flora and fauna and Aboriginal sites, and to ensure that potential impacts to these are appropriately assessed. In general, the NPWS has no major concerns with the proposal.

Specific comments include:

- > supports the proposed mitigative measures to reduce impacts on core vegetation;
- > suggests that during the construction phase, measures be taken to clearly delineate the work area and establish a barrier to those areas to be avoided (eg fencing). Any rehabilitation and revegetation of disturbed areas should use locally sourced indigenous species;
- > the approach to engaging the Aboriginal Community is appropriate and generally consistent with current consultation practices;
- > notes that the Tharawal Local Aboriginal Land Council may not be the only relevant group for consultation purposes and seeks clarification if other relevant Aboriginal groups were consulted; and
- > NPWS consent will be required if Aboriginal relics or places will be destroyed and suggests including a condition that requires Sydney Gas *'to continue consultation with the Aboriginal Community during the implementation of the proposal and in the design of any future works proposed.'*

5.2.3 Camden Council

Camden Council provided an extract of minutes from the Development Committee Meeting of 11 March 2002 where Council resolved to make a submission on the DA and sought a public inquiry into the Project. The report to Council claims there is insufficient information in the EIS to assess the environmental impacts.

The following specific comments on the EIS were made:

- > noise assessment is incomplete (7 days should have been monitored not 3) and no amelioration plans have been identified in relation to noise level exceedences. Council suggests either enclosure of the areas of the plant responsible for the noise, or, upgrade of the noise attention barriers to meet required standards;
- > odour assessment is incomplete. There is some uncertainty as to the safety/environmental impacts of the odourant additive.
- > rehabilitation, maintenance and bonds - cannot be located in the EIS as described. Detailed information is required on this.
- > cadastral information – requests that a temporary easement be created for all wells and pipelines.
- > irrigation and salinity - the EIS has not addressed the capability of the soils to receive irrigation from water collected at the well sites. Further, there is reference to chemicals being introduced to the wells during drilling and fracking, however, quantities and its impacts on water quality are not discussed.
- > extension of an existing well – suggests that approvals for extensions of wells should be obtained under the EP and A Act.

5.2.4 NSW Department of Mineral Resources

The Department of Mineral Resources considers the EIS has addressed the Director-General's requirements.

The following specific comments are made:

- > gas reserves – the EIS does not contain information that would allow the DMR to evaluate gas reserves within the project area. The DMR recognises that there are large quantities of gas in the coal seams and would support a production lease for the continued production, exploration and research of the reserve base;
- > a safety management plan is in place for the current operations and a plan would also be required if the production lease were granted. To date they have carried out drilling and testing operations satisfactorily and safety issues can be effectively managed; and
- > rehabilitation of the site is a DMR responsibility. The DMR considers Sydney Gas has satisfactorily rehabilitated its well sites. DMR holds a security deposit to cover rehabilitation costs of the wells already drilled and the treatment facility.

5.2.5 NSW Heritage Office

The Heritage Office has a number of concerns with the project, in terms of the development approval process and possible adverse impacts on significant rural cultural landscapes. Specific issues raised are:

- > concern about the process used in moving from a limited run exploration/assessment licence to an expanded extraction/production licence. This meant that due process was not observed at the

- appropriate time, in particular stakeholder consultation with the Heritage Office;
- > the proposal may impact on proposed and actual State Heritage Register items in or adjoining PAL 1 (such as Camden Park Estate and Brownlow Hill Estate);
 - > land west of Remembrance Drive (Logan Brae and Johndilo properties) is of great historical and aesthetic heritage significance. Careful consideration needs to be given to new uses and intensification of land uses.
 - > Further development in the area needs to consider the visual setting of the immediate landscape – being generally open farmland. Wells LB9 and LB10 should be dismantled due to their visual impact on the proposed Camden Park Estate SHR boundary and the Highway;
 - > The Heritage Office has suggested a number of conditions if approval is given.

5.2.6 Wollondilly Shire Council

Wollondilly Council has resolved to request the holding of a Commission of Inquiry under section 119 of the Act into the proposal. The Council's comments on the proposal are:

- > detailed justification for the inclusion of the Camden Park Residential Release Area (CPRRA) and the Elizabeth Macarthur Agricultural Institute (EMAI) in the PAL 1 area has not been provided. Council is concerned at the potential conflict with future residential development in the CPRRA and agricultural research activities occurring at the EMAI;
- > the EIS is skewed towards construction rather than those associated with its operations;
- > requests that a project performance review be given to assess the impacts presently experienced as they are likely to be similar to the proposed production operations;
- > the EIS does not adequately address the permissibility of the project within the zones applying to the Wollondilly LEP, particularly in the CPRRA; and
- > requests more detailed information regarding the 'safe' distance between residences and the gas equipment. Council has resolved not to permit any dwellings within 200 m of a gas well.

5.2.7 Sydney Catchment Authority

The proposal is located outside the operational area of the Sydney Catchment Authority, therefore the Authority has no comments to make.

5.2.8 NSW Agriculture

NSW Agriculture strongly objects to the inclusion of the Elizabeth Macarthur Agricultural Institute (EMAI) in the development application. The extension of Sydney Gas activities on to EMAI would put at risk research of national significance.

The proposal to dilute extracted water that is to be used for irrigation purposes to 500-800 $\mu\text{S}/\text{cm}$ is supported. Supports the planting of native species to reduce the visual impact of the well sites and would also provide stock shelter.

5.2.9 Environment Protection Authority

The Environment Protection Authority did not make a submission in relation to the proposed development, but has issued General Terms of Approval. These are summarised below:

- > the Applicant must undertake monitoring of air emissions from 4 locations in the treatment plant;
- > the Applicant must negotiate with the EPA the load limits of specified assessable pollutants and ensure that their discharge from the site does not exceed the negotiated load limits;
- > the Applicant must not exceed the prescribed concentration limits for specified pollutants at the identified location;
- > the Applicant must achieve a destruction efficiency and a combustion parameter equal to or greater than the lower limit specified for that parameter at the identified location;
- > the Applicant must not permit waste generated outside the site to be received at the site, or permit waste generated at the site to be disposed of at the site;
- > the Applicant must comply with the specified noise limits at the identified locations
- > during well maintenance activities, the Applicant must implement noise mitigation measures to achieve the specified noise limits;
- > the Applicant must not cause or permit the emission of offensive odours;
- > the Applicant must minimise or prevent the emission of dust;
- > the coalbed methane gas flare must be ground-level, shrouded, provided with automatic combustion air control, automatic shut-off gas valve and automatic restart system;
- > the activated carbon filter on the odour control system shall be replaced prior to breakthrough occurring;
- > the Applicant must implement and adhere to a Stormwater Management Plan for the operation phase;
- > waste water must only be applied to the specified areas;
- > the Applicant must adhere to the prescribed hours for planned maintenance and deliveries;
- > the Applicant must undertake the monitoring of the concentration of specified pollutants in accordance with the prescribed sampling method, unit of measures and frequency, at the identified locations;
- > the Applicant must submit an annual report to the EPA on the annual monitoring undertaken, summary of complaints received, compliance with conditions and calculation of licence fees;
- > the Applicant must continue to maintain the community advisory panel; and

- > the Applicant must implement a noise reduction program for the treatment plant to comply with the specified noise limits at the identified locations.

5.2.10 Department of Land and Water Conservation

The Department of Land and Water Conservation has reviewed the EIS and made the following comments:

- > the DLWC has issued a Part 3A approval for some works and that ongoing liaison is occurring for proposed works.
- > future works near watercourses that are part of this EIS makes the proposal integrated development and must be referred to DLWC for consideration;
- > a salinity management strategy should be developed as part of the Environmental Management Plan and should include soil sampling and monitoring to ensure there is not a build up of salt within the soil profile;
- > does not recommend the use of salt laden water for dust suppression;
- > the EMP should address all potentially significant quality parameters of the water to be disposed of, not just for salt;
- > long term studies should be commenced for subsidence to track any potential effects of extended extraction of gas and some groundwater;
- > the methodology used in wells completed is appropriate for the isolation of overlying aquifers and the prevention of cross contamination from saline sources. DLWC is unclear of the integrity of the well isolation components in the long term and in particular the maintenance methodology; and
- > the DLWC should be given the opportunity to review environmental impact data, studies and management of the proposal.

5.3 Submissions from Elected Representatives

5.3.1 Mr Ian Slack-Smith MP, Member for Barwon

Supports the proposal. Notes the importance of New South Wales to have its own supply of natural gas, that New South Wales contains one of the biggest land masses of coalbed methane and Sydney Gas should be supported to exploit the resource.

5.3.2 The Hon George Souris MP, Leader of the NSW National Party

Supports the proposal. Notes the importance of New South Wales to have its own supply of natural gas, that New South Wales contains one of the biggest land masses of coalbed methane and Sydney Gas should be supported to exploit the resource.

5.3.3 The Hon Richard Face MP, Minister for Gaming and Racing, Minister Assisting the Premier on Hunter Development

Supports the proposal. The importance to the State of a supply of gas is crucial to its development and survival. New South Wales has the biggest landmass of coalbed methane in the world and Sydney Gas should be supported and encouraged.

5.4 Individuals and Special Interest Groups

The Department received a total of 1930 submissions from private individuals and special interest groups during the exhibition period. Of these, 1903 submissions were in support of the proposal (1880 of these were form letters). The remainder either raised objection/concern (26 submissions) or did not state a clear position (1 submission).

Nine submissions raising objections were received prior to exhibition of the proposal, and 104 form letter submissions were received in support following the exhibition period.

All submissions received during the exhibition period have been considered in the assessment of the proposal. A summary of each submission is provided in Appendix A.

The main issues raised in submissions is listed below in Table 2.

Table 2 – Issues Raised in Individual Submissions

Key Issue
Safety • Potential health risks to Camden High School students and staff. • Health problems such as sore eyes, throats, difficulty in breathing and nausea. • The venting process, which releases a mixture of gas and water, is a potential health and environmental hazard. • Concerns about leaks or explosions. • Safety concerns about gas well flaring. • Plastic gas pipe on surface and risk of being punctured. • Inappropriate being so close to residents and schools. • The wells are not effectively secured and are dangerous. • Wells should have fire-fighting equipment installed.
Noise/Vibration • Drilling work and the treatment plant are very noisy. • Vibration impacts may damage school buildings. • Noise associated with servicing of the wells has impacted on use of the adjoining property. • Noise generated by lighting of well flare. • Risk of air blasts associated with drilling and fracing. • Structural faults have occurred after drilling and fracing operations.

• EIS does not address redrilling and refraccing operations.
Socio-Economic • Proposal will stimulate the local economy through use of local suppliers/employment. • New industry for the State which will stimulate the economy. • Impact on future land development. • Adverse impact on the lifestyle of the area. • Impact on land values. • Wollondilly Council's has proposed a 200m no development buffer/easement around the wells. • Development of an alternative energy source. • Questionable benefit to the community and unproven commercial gas extraction method. • Worked outside approved hours of operation. • Potential conflict between coal mining activities and gas extraction.
Transport • Truck movements will interfere with the dropping off/picking up of school children. • Dust associated with heavy truck movements 24 hours a day.
Odour • Problems with leakage of odourant. • Strong gas odour can be smelt many kilometres from the plant.
Statutory Process • Will there be more wells in the future. • Ratepayers can't keep private enterprise off their land but the Government can keep them off Crown land. • Private operators can proceed without restriction which are placed on ratepayers. • No consultation prior to work proceeding. • EIS was only required after the wells and treatment plant were built. • In breach of the Petroleum (Onshore) Act as JD1 is less than 200m from a dwelling. • Wells should be located within 200m of a property boundary.
Visual • The treatment plant is an eyesore. • Impact of unnatural light from the well flare. • Visually polluting. • No screening of the wells or to make them more sympathetic with the surrounding environment.
Groundwater • Sydney Gas may be responsible for drop in the watertable since drilling started. • Creeks near wells have stopped running after drilling and farm dams and bores are drying up. • Claims that water extracted from wells is suitable for irrigation is not substantiated. • Potential impacts on tributaries leading to the Nepean River.

6 JUSTIFICATION OF THE PROPOSAL

6.1 Need For The Project

The Applicant states the project is needed to:

- > Meet future demands for natural gas;
- > Provide a more efficient and reliable energy availability;
- > Address Commonwealth, State and regional energy initiatives; and
- > Provide regional, economic and social benefits.

Presently all natural gas supplies to New South Wales come from interstate, the majority from the Cooper Basin in South Australia through the Moomba-Sydney Pipeline. The development of the Eastern Gas Pipeline from Longford in Victoria has provided a second source of natural gas from the Bass Strait fields.

The proposal would develop an existing natural gas resource in the Sydney Basin and be more cost effective than delivery from interstate. The project is presently delivering gas to the AGL distribution network at Camden. The establishment of a domestic gas supply in New South Wales would not only provide an additional supply but also improve reliability of supply.

The consumption of natural gas in New South Wales is expected to increase from the current 140 PJ per annum to around 230 PJ per year by 2015. Approximately 70% of the supply is consumed by the industrial sector, followed by the residential and commercial sectors sharing the remainder. To maintain supply to this expanding market it is important to develop new supplies. The proposal would provide a small, but important step in ensuring that supply to the Sydney market is maintained into the future.

Natural gas is the cleanest and most environmentally acceptable of the fossil fuels. Compared to other fossil fuels such as coal, natural gas produces one third less greenhouse gas emissions than the burning of coal. The proposal would provide a convenient and competitively priced source of natural gas that would compete favourably against electricity generated by coal-fired power stations. This competition would encourage transfer from electricity to gas for industrial and residential users and provide a small but important contribution to meeting the international target reductions in greenhouse gas emissions.

The EIS states the proposal is consistent with the State Government objective of encouraging petroleum exploration, and in particular exploring the possibilities of coalbed methane. The proposal is also consistent with the National Greenhouse Strategy to develop an efficient and sustainable energy use and supply.

The development and operation of the project has positive flow-on effects to the community through the employment of local contractors and personnel, and from purchase of goods and services from local businesses.

The EIS has considered alternatives for the project, these include consideration of alternative energy sources, alternative coalbed methane gas seams, alternative siting for wells and the pipeline connections, and do nothing option.

The project has been developed to exploit an existing methane gas source, and as discussed above, the use of natural gas has significant advantages in terms of energy efficiency and greenhouse gas emissions. The Camden coal seams were chosen because of the proximity to existing gas infrastructure, the extensive geological data available and that the southern coalfields have been extensively mined.

The location of the wells, connection infrastructure and treatment plant were determined after consideration of technical, environmental and site specific constraints. A similar approach would be undertaken for the location of the 3 additional wells on the Logan Brae property.

The EIS states that if the project did not proceed then an opportunity to develop a convenient and economically viable natural gas supply within the Sydney Basin would be foregone. The proposal has significant potential benefits in terms of the regional economy and community.

Consideration

The Department is in agreement with the objectives of the proposal to exploit a resource, which has potential benefits for the regional economy. The proposal is consistent with the State Government's objective of encouraging the exploitation and investment in the mineral resources industry. It is noted that the 25-well proposal is the first stage of a wider proposal to develop a 300 well project encompassing a much larger area to the east and south of the PAL 1 area. Although the proposal is small in scale, compared to the annual consumption of natural gas in the State, the development of a local supply would have positive benefits for the local economy and community. The Department considers the Applicant has adequately demonstrated the need for the project.

6.2 The Resource

The proposal involves the development of coalbed methane gas production from the Illawarra Coal measures. Coalbed methane is the natural gas formed during the coalification process. The methane is adsorbed into the coal and is released by lowering the pressure of the coal seams.

The Applicant states that Sydney University's Warren Centre has estimated that the Sydney Basin may contain up to 130,000 PJ of total gas in place in all coals. The EIS estimates that the total resources within the Bulli seam coal in the PAL 1 area is 69.9 PJ. This estimate does not take into account methane that is associated with a number of other coal seams above and below the

Bulli coal seam. The drilling program has concentrated on the Bulli seam as it represents the best quality and most consistent seam in the area.

The rate of gas recovery is undetermined and would remain so indefinitely, as geological factors such as permeability vary throughout the PAL 1 area. This results in variable recoveries and flow rates recorded in all well sites. The Applicant states that based on the total gas recovered to date indications are that the PAL 1 area would generate economic flow rates for at least 15-20 years.

In the Sydney Basin most of the coal bearing strata are concentrated within two major layers, known as the upper and lower coal measures. In the Southern Coalfields the upper coal measures are referred to as the Illawarra Coal Measures. The upper measures appear to contain the most coalbed methane resource and the lower measures (the Clyde Coal Measures) contain little coalbed methane.

In the Illawarra Coal Measures the major coal seams represented are the Bulli, Balgownie, Wongawilli and Tongarra. The lower sections of the Illawarra Coal Measures contain relatively thin coal seams and these formations are unlikely to have significant coalbed methane resources. In the PAL 1 area the thickness of the Bulli coal seam ranges from 3.0 to 3.9 metres. The Applicant has also targeted the Tongarra coal seam and recorded reasonable gas flows. The Tongarra coal seam has a thickness of approximately 1.8 metres in the PAL 1 area.

Consideration

It is acknowledged by the Department and DMR that the Sydney Basin has favourable geological attributes for the development of a coalbed methane industry. The Applicant has demonstrated that there is a large potential methane gas resource and that it has to date been successful in recovering gas. However, the recovery rates are not consistent across all wells with only several producing at high flow rates and the majority at low rates. The EIS has addressed the resource in ground but has not demonstrated a proven reserve, which is discussed below.

6.3 Proven Reserve

The Department and the DMR required the Applicant to demonstrate that there are sufficient reserves for fifteen years production. The Applicant has provided information on the potential CBM resources and reserves in the PAL 1 area. The information states that the PAL 1 area contains a minimum of 115 PJ of gas in place and a minimum of 27 PJ of proved reserve has been calculated for PAL 1. The reserves are based on gas from the Bulli and Tongarra coal seams.

Consideration

The petroleum industry has adopted a standard set of definitions for reserve estimation for use by governments and industry. Reserves are those quantities of petroleum which are anticipated to be commercially recovered from known accumulations from a given date forward. All reserve estimates involve some degree of uncertainty. Proved reserves are defined by the Society of Petroleum Engineers (SPE) and the World Petroleum Congress (WPC) as those quantities of petroleum that can be estimated with reasonable certainty to be commercially recoverable from known reservoirs, current economic conditions, operating methods and government regulations. Reserves are considered proved if the commercial productivity of the reservoir is supported by actual production or formation tests. There should be a 90% probability that the quantities actually recovered will equal or exceed the estimate.

The Applicant submits that for planning approval purposes the Department should be satisfied by the acceptance of gas in place resource. The reliance on a proved reserve report is inappropriate for the following reasons:

- > Reserve reports are used for financial purposes;
- > The SPE and WPC standards were developed for the conventional oil and gas industry;
- > The standards are guidelines only;
- > Coalbed methane is an unconventional gas resource requiring a different approach; and
- > Proved reserve reports are not required by regulatory authorities in the USA where the coalbed methane industry is most developed.

In New South Wales it is standard practice for mining proposals to demonstrate proven reserve. The Department notes that coalbed methane is a new industry and different to coal mining, however, the matter of a proved reserve needs to be demonstrated in order that an informed view can be formed on whether the Applicant can extract the resource with some degree of certainty and in commercial quantities and to balance the needs of competing land uses, in this case the agricultural use of the land, and increasingly, rural-residential development in the Cawdor Valley.

The Department and DMR consider a proven reserve of gas that can be extracted with 90% probability has not been demonstrated. However, as coalbed methane is a new industry that is different to traditional resource projects (such as coal mining and extractive industries) it may not be appropriate that evidence demonstrating a proved reserve be provided as part of the DA documentation at this stage in the project. The proposal is a pilot project of 25 wells involved in research and development in production and extraction techniques on gas extraction from underlying coal seams. The ability to demonstrate proven reserve depends on technology and engineering feasibility developed over time. Currently the Applicant uses vertical drilling and fracturing of the coal seam up to 100m from the borehole pit. New techniques being considered include horizontal drilling and use of different

mediums in fracturing of the seams. Over time new production and extraction techniques can be expected to be developed and these would affect the recoverability of the resource. In view of this a 21-year consent period with production milestones is considered appropriate.

The recommended conditions include a production milestone which requires the Applicant to submit a reserve report to the Director-General after the expiration of 10 years of the date of the consent. The reserve report would need to be prepared by an independent petroleum expert and be consistent with the definitions approved by the SPE and WPC. This report would indicate to the Director-General how the project was proceeding in terms of recoverability of the resource. If the Applicant was unable to demonstrate a proven reserve, ie gas can be extracted with 90% probability, then further justification as to why production should continue has to be provided.

7 CONSIDERATION OF ENVIRONMENTAL ISSUES

The Department has reviewed the Environmental Impact Statement for the proposed development and considered all submissions received from the public, Government agencies and councils. As a result the Department has identified the following environmental planning issues associated with the proposal:

- > Noise impacts;
- > Vibration impacts;
- > Air quality and odour impacts;
- > Groundwater impacts;
- > Transport impacts;
- > Safety impacts;
- > Flora and fauna impacts;
- > Visual impacts;
- > Socio-economic impacts; and
- > Statutory approval process.

7.1 Noise Impacts

The Environmental Impact Statement indicates that the project area and surrounds is generally rural in nature with the acoustical environment affected by construction of housing and farming related activities. Background noise measurements undertaken by the Applicant show, for the day, evening and night period, levels of 34.8 dB(A), 35.3 dB(A) and 30 dB(A), respectively near the treatment plant, and levels ranging from 33.7 dB(A) to 36 dB(A) during the day at various locations near gas wells. Evening and night background levels were not measured at these locations and the Applicant has adopted the EPA's Industrial Noise Policy background level of 30 dB(A) for these periods.

Construction Impacts

The Applicant has used the EPA's Environmental Noise Control Manual assessment criteria for determination of construction noise levels (construction refers to all drilling related activities). The EPA criteria states that for a construction period of less than 4 weeks the L_{10} noise level should not exceed the existing L_{90} background noise level by more than 20 dB(A) at the nearest residential receiver.

The Applicant states that drilling work is usually completed within a 4 week period. Therefore the EPA's guidelines for a construction period of less than 4 weeks is appropriate for the assessment of drilling noise impacts. The construction noise criteria for these activities requires that they should not exceed the background noise level by more than 20 dB(A). The construction noise criteria for the proposal during the daytime period are:

Table 3 – Construction Noise Criteria

Monitoring Location	Drilling of wells L_{10} dB(A)
85 Westbrook Road	55
Johndillo, Old Razorback Road	55
740 Cawdor Road	54
89 Eagle Road	56

The Applicant performed noise modelling to establish the likely construction noise impacts generated by the drilling activities. The modelling was performed for a hypothetical range of distances representing residences. The results presented in the EIS are shown in Table 4.

Table 4 – Results of Drilling Noise Modelling

Activity	Sound Power L_{10} dB(A)	L_{10} at distance dB(A)								
Distance (metres)		30	50	100	150	200	300	500	1000	1500
percussion drilling (max)	117	79	75	69	65	63	59	55	49	45
Percussion drilling (min)	106	69	64	58	55	52	49	44	38	35
setting casing	117	79	75	69	65	63	59	55	49	45
hydraulic fracturing (max)	125	88	83	77	74	71	68	63	57	54
hydraulic	119	81	77	71	67	65	61	57	51	47

fracturing (min)										
earth moving	107	69	65	59	55	53	49	45	39	35

Note – at distances over 300-metre air absorption may be a significant contribution to actual attenuation

The Applicant states that a reduction in noise levels of up to 7 dB(A) on the Table 4 figures can be achieved by using attenuation measures. These measures would reduce the impact of most construction activities to within the construction noise criteria at distances greater than 200 metres. The exception is the hydraulic fracturing (fracking) which exceeds the criteria at distances up to 500 metres.

Operation Impacts

The Applicant states that the normal operational noise from the treatment plant and the wells does not involve noise of an intermittent or impulsive nature. Once a well is operational (after all the water has been removed and gas is flowing) it is essentially silent.

The noise performance of the treatment plant has been modelled by the Applicant. The noise levels during nighttime operation were modelled under various isothermal and adverse weather conditions. The results presented in the EIS are shown in Table 5 below.

Table 5 – Summary of Treatment Plant Night Time Predicted Noise Levels

Receiver	SI	Wind	4 ⁰ C/100m Inversion	Wind and 4 ⁰ C/100m Inversion	Criteria
A	33.5	40.0	36.6	N/A	35
B	34.1	38.7	37.2	N/A	35
C	34.9	38.5	37.9	N/A	35
D	28.9	37.0	33.0	38.1	35
E	27.8	37.2	33.3	36.0	35
F	31.0	36.3	32.3	N/A	35
G	28.4	36.5	33.4	40.1	35
H	28.4	33.9	33.1	37.5	35
I	29.3	35.6	34.7	39.3	35
J	29.9	35.6	34.8	39.1	35
K	30.0	35.4	34.6	N/A	35
L	29.7	N/A	34.3	N/A	35
M	29.6	N/A	34.6	N/A	35

The results show that the treatment plant meets the criteria under still isothermal conditions at all locations. The wind-affected results show marginal exceedances at all but the three closest residences where the exceedances are 3-5 dB(A). Exceedances of less than 3 dB(A) are predicted

at the closest residences under inverse conditions and the plant complies at all other locations. With combined wind and inversion conditions exceedances of up to 5 dB(A) are predicted at more distant residential locations. The Applicant states the occurrence of such a weather condition is considered to be small and any impacts is unlikely.

The Applicant is reviewing options to fit acoustic treatments to the compressor, which is the dominant noise source at the treatment plant. The use of noise attenuation should result in a 5 dB(A) reduction in noise levels, bringing the plant into compliance under all assessment conditions.

Traffic Noise

The Applicant states that construction and operation of the project will not generate any additional road traffic noise.

Consideration

The Department is generally satisfied that the Applicant has provided an adequate assessment of noise impacts associated with the proposed development. The modelling and consideration of noise issues has been undertaken in accordance with the relevant EPA guidelines.

This report only considers construction noise in the context of redrilling and refracking activities. The approval for drilling of new wells and the conditions under which drilling activities operate is a matter for the Department of Mineral Resources to determine under the *Petroleum (Onshore) Act*. This will be the situation for the proposed new wells LB 1, LB 2 and LB 3.

The EIS states that drilling and related activities generally involve percussion drilling, setting the well cap and casing, and hydraulic fracturing of the coal seam. The noise of these activities is dominated by surface equipment such as generators and compressors, with little underground activity being audible at the surface.

Noise assessment of these activities undertaken by the Applicant indicate that noise levels are related to the direction of the rig and position of compressors and other noise generating equipment. These are illustrated in Figures 10.3-10.4 of the EIS. Table 4 of this report shows the results of predicted noise from various drilling activities. The results show that compliance with the noise criteria of 55 dB(A) can only be achieved at a distance of 500 metres from the rig (1500 metres for fracing at maximum level) and 150 metres for earthmoving and percussion drilling (min). The Applicant states that the predicted noise levels may be reduced by up to 7 dB(A) by the use of noise attenuation measures. The placement of hay bales as a barrier around drilling operations has been used to reduce impacts at nearby noise sensitive locations.

The use of noise attenuation measures would result in compliance of most activities with the construction noise criteria at a distance of 200-300 metres.

Hydraulic fracturing is the exception. The Applicant states that fracking only occurs in a single day and for a maximum duration of 10 hours. The Applicant recognises that construction noise does exceed the recommended noise criteria for nearby residences (in particular JD-1 and JD-9) and has implemented a number of measures to reduce the impact of noise. These include:

- > Giving advance notice to potentially affected residences of the extent and timing of work and when noise levels may be high;
- > Limiting concurrent operation of plant during drilling activities;
- > Preparing a noise management plan before drilling starts and optimising the orientation of plant and equipment;
- > Deploying plant with lower noise levels;
- > Maintaining plant to ensure noise emission levels are not exceeded;
- > Monitoring of noisy plant
- > Noise monitoring of operations;
- > Use of hay bay barriers;
- > Reducing vehicle speeds on access roads;
- > Operating within approved hours;
- > Design and grading of roads to reduce truck noise;
- > Maintenance of exhaust mufflers;
- > Location of sites at maximum distance from residences;
- > Setting up of complaints telephone number and log; and
- > Compliance with AS2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites.

These measures are considered appropriate to address the reduction of noise impact on nearby sensitive locations. To ensure these measures are implemented a proposed condition of consent requires the preparation of an Environmental Management Plan which includes a Noise Management Plan. The Noise Management Plan is required to identify potential noise sources, describe compliance with the noise criteria, describe attenuation measures and monitoring and compliance procedures.

Submissions from the public raised drilling noise and noise associated with servicing of the wells as a significant issue. Construction noise is likely to be generated from the construction of the 3 new wells and from redrilling and refracking of the existing wells. To minimise the impact of noise on residences the Applicant will be required to address noise impacts in the Noise Management Plan and comply with the conditions relating to noise limits.

The EPA has addressed noise limits in the General Terms of Approval for the proposed development. The proposed conditions include the noise criteria specified by the EPA. These are a limit of 40 dB(A) during the day, evening and night at the residence closest to the treatment plant, 37 dB(A) for the day and evening period and 35-37 dB(A) for the night time period for residences near the treatment plant. The noise limit for all other residential receivers identified in Figure 10.1 of the EIS is 35 dB(A) for the day, evening and night

time periods. These residential receivers are located near the wells. The conditions also require the implementation of management practices to minimise noise impacts from well maintenance and drilling activities.

Once the wells become operational there is very little noise generated. Noise would be generated during redrilling and refracting activities, and from well maintenance. These activities would generate short-term impacts and in terms of redrilling and/or refracting likely to occur infrequently over the life of the consent. A well may be redrilled or refracted if it is a low producing well to stimulate gas flow or new technology is employed to refract the coal seam or a new coal seam is tapped. As drilling and fracing activities are likely to exceed the noise limits the approval of the Director-General is required. The recommended conditions require the preparation of a Redrilling/Refracting Management Plan to be submitted to the Director-General. In preparing the Plan the Applicant would need to address the environmental performance of the work, compliance with the Environmental Management Plan and performance requirements of the consent conditions. Prior written notification is required to be given to all potentially affected residences and other noise sensitive receivers before work commences. The Department considers these requirements adequately address the potential impacts of redrilling and refracting activities.

The Applicant is required to comply with the noise limits in the operation of the proposed development. In relation to well maintenance, the Applicant is required to apply all feasible and reasonable noise mitigation measures to achieve the noise limit for the area. Where this is not achievable the implementation of management practices which minimises the potential noise impacts is required. The condition also specifies a number of matters, which the management practices should address.

The principal source of operational noise is from the Treatment Plant. The normal operational noise is not impulsive or intermittent, but a constant unvarying noise, mainly from the compressor. The Applicant has undertaken noise modelling of the treatment plant, which indicates that during the night time period the plant complies with the noise criteria during still isothermal conditions but under wind and/or inversion weather conditions compliance cannot be achieved at residences close to the plant. Typically exceedances of the noise criteria are of the order of between 3-5 dB(A) at receiver locations A to C (figure 10.1 of the EIS). Residences more distant from the plant were also above the noise criteria during wind conditions. Compliance was only achieved under inversion conditions.

The Applicant has provided further information on the noise performance of the treatment plant. Measurements undertaken on the night of 3 December 2001 at receiver locations A and C recorded an overall noise level of 44 dB(A) and 42 dB(A) respectively. These levels were recorded prior to some mitigation measures being implemented. Further noise measurement occurred on the morning of 3 April 2002 at 85 Westbrook Road (unattended logger). The recorded L_{90} during that period was 41 dB(A). The Applicant states that the treatment plant was not audible at the logger.

Measures implemented at the treatment plant to reduce the noise impact at nearby residences include:

- > Modification of the connection between the heat exchanger and the TEG skid to remove pump vibration being transferred to the cooling tower;
- > Insulation of equipment (TEG Reboiler, Surge Tank and Contactor Tower);
- > Filling in gaps between the colourbond fence and the ground with sandbagging;
- > Insulation of the compressor housing;
- > Compressor cooling fans pitch have been modified to reduce regenerated noise and the installation of acoustical shrouding on the fans and fan outlets; and
- > Reduction in the running speed of the compressor between 10.00pm and 7.00am.

No noise assessment of the effectiveness of these measures has been presented. The Applicant is of the view the measures are reasonable and feasible to meet the noise criteria of the EPA's Industrial Noise Policy.

A monitoring program has also been implemented by the Applicant with a number of residences close to the plant being asked to log the strength and time of noise incidents. This information is collated and analysed by the Applicant and is intended to link complaints to operational procedures in order to determine noise sources. The Applicant intends to continue this monitoring for the duration of the project. This is a useful means of obtaining information on noise impacts but is not a substitute for a formal noise monitoring system. A proposed condition of consent requires annual performance reporting to the Department and the EPA to show compliance with conditions of consent, the environmental performance of the development and monitoring results.

The EPA's General Terms of Approval include a requirement to implement a noise reduction program for the treatment plant. The required noise levels are 37 dB(A) during the day and evening period and 35 dB(A) for the night period at residential receivers A to M (Figure 10.1 of the EIS). This means a reduction in noise levels at the closest residence by 3 dB(A) during the day and evening and 5 dB(A) at night. The next 3 closest residences would have a noise level reduction of 2 dB(A) at night with the day and evening level of 37 dB(A) unchanged. The Applicant would be required to submit the reduction program to the EPA within 6 months of the date of the consent and to be implemented within the period 6 to 18 months from the consent date.

Noise from the treatment plant was raised in public submissions and by Camden Council. Camden Council also suggested options to address noise reduction by enclosing the areas of the plant responsible for noise and to upgrade the noise attenuation barriers. This has been implemented by the Applicant, however, the effectiveness of the measures has not been assessed. The EPA is concerned that noise levels are unacceptable at the plant and that a noise reduction program must be implemented to reduce the

plant's noise levels. The Department supports the requirement to improve the noise performance of the plant.

The Applicant states that the treatment plant would be relocated to an area more remote from residences. A timeframe of eighteen months has been indicated for the relocation. To ensure the treatment plant is relocated within a reasonable timeframe the recommended conditions require a DA for the new treatment plant to be submitted within 2 years of the date of the consent and that gas production shall cease when the new plant is commissioned.

Noise from the lighting of the gas well flare was raised by the public. As part of the well testing procedures flaring may occur occasionally. No assessment has been made as this is not part of the normal operation of the well. The Applicant has stated that flaring at a gas well site is unlikely to occur in the future as wells are now being connected to the gas gathering network earlier and that the treatment plant is now operational. In the early stages of the project, wells were tested prior to connection to the gas gathering system and flaring was required to dispose of gas being extracted. This situation is unlikely to occur with the drilling of wells LB-1, 2 and 3.

The Applicant has undertaken an assessment of the noise from the flare at the treatment plant. Noise measurements were taken when the flare was large and loud and the compressor was working, and during a maintenance shutdown of the compressor. At the most affected residential receiver the noise from a worse case scenario flare was 36.4 dB(A). The Applicant states that when the flaring occurs with the compressor operating, the dominant noise is from the compressor. The noise level with the flare operating and the plant shutdown was 26.4 dB(A), which complies with the noise level criteria.

The EIS states that there is little discernable difference between normal traffic (background) and traffic associated with plant operations. Road traffic noise monitoring was not undertaken due to the low volume of vehicles generated by the proposal, the high levels of background traffic levels and the low density of residential development. The Department agrees and is satisfied that the development generates low levels of traffic and that the overall road traffic noise is unlikely to change.

The Department is satisfied that the noise impacts of the proposal at the operational stage, apart from several residences close to the treatment plant are not significant and with the implementation of mitigation measures does not adversely affect the amenity of the surrounding area. The recommended conditions relating to the treatment plant will ensure that in the short-term measures are implemented to achieve a lower noise profile and that it will be required to be relocated in the medium term. In relation to construction activities the impacts are significant but are of short-duration and restricted to residences close to a well. Recommended conditions of consent require the Applicant to implement mitigation measures to reduce the noise impacts and approval to redrill and/or refract a well.

7.2 Vibration Impacts

The EIS adopts various criteria for assessment of vibration impacts. For the proposal the vibration impacts potentially range from physical discomfort to humans to structural damage to buildings. It is stated that if the vibration criteria for the protection of human comfort were met then there would be negligible likelihood for structural damage to buildings. The Applicant uses Australian and German standards for regulation of vibration emissions from normal activities such as operation of the drilling rig.

The maximum levels for ground vibrations are adopted from Australian Standard 2187.2-1993 and an internationally accepted German standard, these are listed in Table 6 below.

Table 6 – Structural Damage Vibration Criteria

Type of Structure	Maximum Peak Particle Vibration Velocity, mm/s			
	AS2187.2	DIN 4150		
		Vibration Frequency		
		< 10 Hz	10 to 50 Hz	50 to 100 Hz
Buildings used for commercial purposes	25	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or use	10	5	5 to 15	15 to 20

The criteria used for human comfort levels are adopted from the Australian Standard 2670. These are listed in Table 7 below.

Table 7 – Human Comfort Vibration Criteria

Type of Building Use	Maximum Acceptable Root Mean Square Vibration Velocity, mm/s
Critical working areas	0.1
Residential – Night	0.14
Residential – Day	0.2
School	0.2
Office	0.4
Workshop	0.8

Construction Impacts

The Applicant states that vibration impacts are likely to be generated by drilling and fracking activities. Drilling is likely to cause continuous and impulsive vibration. The vibration impact of fracking would be impulsive in nature.

Monitoring of vibration impacts from drilling operations were undertaken and the assessment shows that the human comfort criteria would be met at 25

metres. The geotechnical assessment indicates that vibrations from drilling operations are unlikely to have any impacts

Table 8 below shows the results of monitoring of vibration from drilling operations.

Table 8 – Results of Vibration Monitoring

Distance to borehole collar (m)	Depth of borehole (m)	Average peak particle velocity (mm/sec)	Maximum PPV (mm/sec)
4.5	8.0 - 14.0	0.53	0.79
13.0	20.0 – 26.0	0.15	0.37
25.0	26.0 – 29.0	0.15	0.2
50.0	29.0 – 32.0	0.09	0.09
100.0	32.0 – 38.0	0.08	0.08
150.0	38.0 – 44.0	0.06	0.07
300.0	> 44.0	0.04	0.04

The results show that peak particle velocity decreases from 0.79 mm/sec at a distance of 4.5m from the borehole to 0.2 mm/sec 25m from the borehole. At distances from 50m to 150m from the borehole maximum peak particle velocity were in the range of 0.9 to 0.7 mm/sec.

Vibrations may also arise from earthworks and pipeline construction activities. The Applicant states that typical vibration from such activities indicates that structural damage is unlikely beyond a distance of 5 metres from the activity and human comfort criteria would be met at 20 metres. The EIS concludes that construction of the gas wells and infrastructure are unlikely to have any vibration impacts.

Consideration

The criteria used to assess vibration impacts on building structures and human comfort levels are appropriate and accepted by the Department. The greatest impact is likely to be generated by well establishment, in particular from drilling and fracing activities. Monitoring undertaken during drilling of a borehole at Kay Park 1 to the south of (and outside) the project area, shows that the peak particle velocity generated decreases with distance from the borehole and depth of the borehole. At a distance of 25 metres from the borehole the maximum peak particle velocity is 0.2 mm/sec, which is the maximum criteria for human comfort in a residential/school building during the daytime (Table 7). The maximum peak particle velocity generated by drilling activities is 0.79 mm/sec at a distance of 4.5 metres from the borehole. Ground vibration impacts from drilling activities are well below the relevant building structural damage criteria of 10 mm/sec and 5 mm/sec, contained in Australian Standard 2187.2 1993 and the German standard (DIN 4150) respectively. The nearest residential dwellings to a well is approximately 120 and 150 metres distant. Wells JD-1 and JD-9 were drilled prior to the *Petroleum (Onshore) Act* being amended to prohibit the location of a well

within 200 metres of a residence. Based on the monitoring results the maximum peak particle velocity at 100 metres is 0.08 mm/sec and at 150 metres is 0.07 mm/sec, which are below the level for structural damage to a residential building.

Public submissions raised the issue of potential damage to the Camden High School and Cawdor Public School buildings from vibration impacts. Specific concern has also been raised by the owners of two residences within sight of well JD-1, of cracking that has occurred as a result of well drilling. Similar complaints have also been made by owners of 3 water storage tanks in Rotherwood Road, Razorback, outside the PAL 1 area. The Applicant has undertaken a review of geotechnical conditions in the area and conducted monitoring of ground vibration impacts from drilling activities.

The results show that a maximum peak particle velocity of 0.79 mm/sec is generated some 4.5 metres from the borehole, decreasing to 0.2 mm/sec some 25 metres from the borehole and 0.07 mm/sec some 150 metres distant. The generally accepted measure for damage to a residential structure from blasting activities is a peak particle velocity of 5 mm/sec. At levels below this it would be unlikely that damage would occur to a structure from ground vibration resulting from drilling activities. Levels of 2 mm/sec or less are not generally felt/perceived by people.

The consultant states that peak particle velocities in excess of those monitored during percussion drilling to a depth of 50 metres, may be generated by other borehole development activities such as blasting of the casing and hydrofracturing. However, the consultant concludes that the ground vibrations generated by the percussion drilling operations are significantly below the accepted levels that may cause damage to residences or structures. The consultant consider the risk of damage to structures from the monitored drilling operations is very low.

Further, as hydrofracturing occurs at depths of between 700-800 metres and with the overburden consisting of sedimentary rocks there will be no measurable subsidence of land resulting from the operations. It would also be highly improbable that the pressures used during the hydrofracturing would result in any measurable uplift of the land in the area.

The consultants note that the observed cracking in the two residences near JD-1 are relatively minor and less than 5 mm in width. In relation to 535 Old Razorback Road (approximately 160 metres from JD-1) the structure is supported by bored piers, which should be relatively isolated from foundation movements. Cracks noted in the patio area are possibly the result of impact damage. The consultant noted that the cracks in the garage of the residence at 565 Old Razorback Road were unlikely to be the result of foundation movements. The cracks within the residence were considered to be the result of minor foundation movements. The consultant does prefix the conclusions by stating that even if further subsurface investigations and laboratory testing were undertaken, it may not be possible to establish with certainty whether or not cracking is a result of foundation movements. Such cracking may have

been exacerbated by factors such as vibration from earthquakes or other factors.

The consultant considers that cracks on 3 concrete water tanks in the Razorback area were caused by structural defects in the concrete rather than from ground movements. Cracking caused by ground movements are usually inclined or sub-vertical, not horizontal as observed in the subject tanks. In view of the known results of ground vibration impacts from drilling activities, the risk of damage to concrete tanks located some 1-2 km from the nearest well from ground induced vibrations is considered to be very low.

The Department accepts the findings of the consultant's report on ground vibration impacts from drilling activities. The monitored results are well below generally accepted standards and given that residences are located no closer than 120 metres, and 200 metres or more under the *Petroleum (Onshore) Act*, ground vibrations from borehole drilling are not considered to be significant. The consultant notes that monitoring of well casing perforation and hydrofracturing were not undertaken. Although such activities are not likely to result in damage to buildings or structures, the consultant recommends that monitoring of these operations be carried out, as well as impacts from air blasting. The Department agrees and a recommended condition of consent requiring the monitoring of such activities and for the results to be submitted to the Director-General. This would ensure that the vibration impacts of these activities are measured.

The Applicant may undertake further drilling and refracturing of wells to increase production or use new techniques of extracting the gas. The Applicant is required to undertake a condition inspection of residences and structures, which may be potentially affected by drilling and/or fraacing. The inspection is required prior to work commencing and within one month of completion of the work. This would ensure that there are no disputes over damage caused to residences as a result of the drilling work.

The Department is satisfied that, based on the monitoring results, ground induced vibrations from drilling activities are unlikely to have caused the damage to residences adjoining JD-1 and the concrete tanks in Razorback. It is also unlikely that school buildings in the PAL 1 area would be damaged by drilling activities associated with LB-1, 2 and 3.

7.3 Air Quality Impacts

The EIS has assessed potential air emissions from the project. For the construction and development of the wells the major air emission sources are likely to be from preparation of the access road to well sites, drilling of wells and connection of wells to the gas gathering system. It is noted that the majority of the site disturbance has taken place for the development.

In the operation of the development, air emissions are generally associated with compressor engines, gas wastes, fugitive emissions from leaking process equipment and dehydrator vent streams. The EIS identifies odour, nitrogen

oxides, butane, propane and carbon monoxide as the principal emissions to be assessed from operation of the treatment plant.

Various mathematical modelling techniques were used to predict emissions from the development. The EIS also adopted EPA air quality guidelines as the standards to be used for assessment of the proposal.

Dust Emissions

The EPA has adopted a 4 g/m²/month (30 day) level as the standard for dust deposition assessment. For dust emissions greater than this figure, the likelihood of complaints usually increases. The Applicant has adopted a goal of 2 g/m²/month for dust emissions in the project area.

The EPA has adopted the Air National Environment Protection Measures (NEPM) standards for dust particulate matter as interim goals for the assessment of particulate matter. The relevant EPA standards for particulate matter emissions annually and over 24 hours, and total suspended particulates annually, are 30 µg/m³, 50 µg/m³ and 90 µg/m³, respectively. The Applicant has adopted the 24 hour particulate matter less than 10 microns in diameter standard of 50 µg/m³ as the primary dust concentration criteria. The NEPM standards state that this criteria can be exceeded on no more than five days in a single year.

Odour Impacts

The EIS has adopted the EPA's Draft Odour Policy guidelines as the appropriate odour performance criteria. The EPA requires the prescribed odour performance levels to be infringed no more than 1% of the time, that is, compliance is required for 99% of the time. Exceedance of the performance criteria would result in an unacceptable loss of amenity to the adjacent community. The Applicant has adopted the performance criteria of 6.0 OU/m³ for the development. Under the EPA guidelines the criteria for a single residence (population of 2) is 7.0 OU, urban population of 10, 6.0 OU, urban population of 30, 5.0 OU and for urban populations of 125 to 2000 an OU ranging between 4.0 to 2.0. The EIS states that 6 OU is an appropriate level for the development and means that no more than 5 households are expected to be potentially affected from an odour emission incident.

Gaseous Pollutants

The EIS has adopted various standards for assessment of gaseous pollutants from the treatment plant. These air quality goals originate from various sources, including the EPA, WHO, US EPA, NEPM and the Victorian EPA. The criteria for the development are listed in Table 9 below.

Table 9 – Air Quality Standards for Gaseous Pollutants

Pollutant	Standard	Averaging Time
Carbon Monoxide	108 mg/m ³	15-minute maximum

	31 mg/m ³	1-hour maximum
	10 mg/m ³	8-hour maximum
Nitrogen Dioxide	320 µg/m ³	1-hour maximum
	103 µg/m ³	Annual mean
	256 µg/m ³	1-hour maximum
	200 µg/m ³	1-hour maximum
	60 µg/m ³	Annual mean
Pollutant Standard		
	(TLV-TWA)	Corrected Value
Methane	n/a	n/a
Ethane	n/a	n/a
Propane	1800 mg/m ³	60 mg/m ³
Butane	1900 mg/m ³	63.3 mg/m ³

The Threshold Limit Value (TLV) provides some indication on the potential health risks associated with exposure to certain compounds, but they cannot be used to assess ambient air quality levels. The Victorian EPA has been using ground level concentration criteria based on the TLV as indicators of ambient air quality. The NSW EPA has also used this method of assessment on specific occasions. The EIS has applied the Victorian EPA method to arrive at a corrected value as the criteria for air emissions from the project. In relation to methane and butane a TLV is not applicable as the limiting factor is the available oxygen.

Existing Air Quality

The existing air quality is typical of a predominantly rural setting, which is free of visible plumes. The EIS has considered Oxides of Nitrogen, Nitric Oxide and Carbon Monoxide as the relevant measure of air quality for the project area. The assessment of existing air quality has been extracted from the most recent EPA data on the Sydney Air Shed and the nearest monitoring location.

Table 10 below shows the maximum 1-hour results from the Liverpool monitoring site for the calendar year 1997.

Table 10 – Daily 1-hour Maxima for NO_x, NO and CO

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NO _x	18.5	18.5	21.8	30.2	39.7	63.0	31.1	39.9	21.9	23.0	27.9	19.4
NO	16.5	16.4	20.4	28.3	37.0	59.0	28.3	37.0	19.1	20.6	24.2	17.8
CO	2.4	2.4	2.3	4.7	6.1	9.0	5.1	5.4	2.9	-	-	1.5

No local or regional air quality data is available on levels of particulate matter or total suspended solids. The EIS states the primary source of airborne particulate matter is expected to be sourced from the operation of the project.

Consideration

Dust Emission

The Applicant has used US EPA's ISCST3 dust dispersion model to predict potential dust emissions from drilling and construction activities. The ISCST3 model predicts ground level dust concentrations as a function of distance from the dust emission source. The model takes into account the source characteristics in terms of relative location, elevation, dust emission rates and the particle size mass distribution of the dust plume from the source. The model is considered to be the industry standard for predicting particulate plume dispersions and its use is recommended by the EPA.

The EIS identified initial development works (road construction), well establishment, construction activities and truck movements along unpaved internal haul roads as being the major sources of dust emission. The modelling adopted various scenarios for generation of particulate matter from these activities. The short-term impacts modelled were drilling, bulldozing and grading, and the long-term impacts were movements along unpaved roads. The cumulative impact of these activities was also modelled.

The predicted maximum ground level concentrations of particulate matter generated from the short term impacts of well establishment were less than $1 \mu\text{g}/\text{m}^3$ over a 24-hour period. The maximum ground level concentration for truck movements along unpaved roads was predicted to generate $4.4 \mu\text{g}/\text{m}^3$ and the cumulative impact of well establishment and truck movements was $4.8 \mu\text{g}/\text{m}^3$. The assessment criteria adopted for dust deposition over a 24-hour period is $50 \mu\text{g}/\text{m}^3$. The predicted results are therefore well below the air quality criteria for dust generation. The Applicant states that dust generated from well drilling and construction is well within accepted air quality criteria.

To minimise the generation of dust from unpaved internal access roads the Applicant has used water recovered from the wells for dust suppression. The Applicant has stated that best management practices for site operations will be adopted and that an Air Quality Management Plan will be developed as part of the Environmental Management Plan for the project.

As the majority of the wells have been drilled the dust impacts from the operation of the wells is considered to be minor. The only significant work at an operational well site would be from redrilling and/or refraccing activities. However, generation of dust from such activities is considered to be minor given the modelling undertaken by the Applicant, which shows such activities are within the air quality criteria adopted for the project. Similarly, site preparation and drilling of new wells at site LB-1, LB-2 and LB-3 would generate dust, but the impacts are considered to be low in view of the modelling undertaken. Impacts on the nearest residence is considered to be minor given the distance (not less than 200 metres) between the dwelling and the well site. The management and mitigation measures adopted by the Applicant are considered to be appropriate.

Proposed conditions of consent require the Applicant to ensure that the emission of dust from the site and access roads are minimised, that trucks carrying loads that may generate dust are covered, and measures are employed to minimise dust from soil stockpiles. The Applicant is also required to promptly rehabilitate disturbed sites to minimise wind erosion dust. The application of water generated from the wells is permitted to be used as a dust suppression measure. The Department is satisfied that dust emission has been adequately considered by the Applicant and that operation of the project is unlikely to result in significant impacts from dust on the air quality in the area or on the local community.

Gaseous Air Emissions

The Applicant has used the AUSPLUME modelling program to assess the potential air quality impacts of the operation of the treatment plant. The model has been endorsed by the NSW EPA and the Victorian EPA. The model uses meteorological data to define the conditions for plume rise, transport, diffusion and deposition. Modelling was undertaken for the treatment plant (dehydrator and compressor) and the flare stack.

The modelling undertaken shows that the ground level concentrations for butane, propane and carbon monoxide during normal operation and flaring are within the air quality criteria adopted for the proposal. The EIS states that no off-site impacts are expected from butane, propane or carbon monoxide emissions.

Odour Impacts

Odour impacts have been assessed for fugitive emissions from the odour dosing plant and from an unignited flare (gas venting to the atmosphere). The modelling undertaken indicated that potential exceedances for odour may occur up to 200 metres from the treatment plant. Based on certain meteorological condition exceedance of the adopted 6 OU odour criteria could occur over the long term. Based on Camden meteorological data the modelling predicted odour impacts up to 200 metres to the north of the plant (8.7 OU at 200 metres distance), 100 metres to the south and west (7.7 OU and 11.4 OU, respectively, and up to 50 metres from the east (9.7 OU). Using Campbelltown meteorological data odour impacts could be expected up to 100 metres to the north and east and up to 50 metres from the west. Further modelling undertaken by the Applicant indicates that the 6 OU criteria would be met at the three nearest potentially affected residence. The EIS states that no adverse loss of the existing residential local air quality is expected.

Public submissions have raised the issue of problems with leakage of odourant from the plant and the presence of strong gas odour away from the plant. Camden Council also raised the issue of odour not being adequately assessed. The Applicant has noted that odour complaints have been received in the past due to problems with the handling of the gas odourant tertiary butyl mercaptan. A review of the odour complaint register shows a total of 12 complaints were recorded between June 2001 and January 2002.

Of these the Applicant notes that some complaints were not related to the plant and some were made by passers-by and not at the nearest potentially affected residences. An accidental discharge of odourant occurred in June 2001, which was carried by the prevailing wind in a north easterly direction. Following this incident a number of actions were implemented to ensure that accidental discharges did not occur again. The Applicant has also made a number of changes to equipment to control fugitive odorous emissions. Control measures, including a hood enclosing the odourant tank and a carbon filter bed around the tank have been implemented. Other process modifications have also been employed to minimise odour emissions.

The Applicant has indicated the treatment plant is a temporary facility and will be relocated within 18 months to a more appropriate location. The implementation of long term control solutions is considered by the Applicant to be unreasonable and uneconomic in view of this. The Applicant has implemented some control measures and management processes. The consultant report also recommends continuation of the diary reporting system at the nearest potentially affected residences and monitoring of site related odour emissions. A timeframe of 2 years is given for lodgement of a DA for the new treatment plant and for production of gas to cease on the commissioning of the new plant.

The General Terms of Approval recommended by the EPA and included in the recommended conditions requires the Applicant to not cause or permit the emission of offensive odours from the premises and to ensure that the carbon filter bed around the odourant tank operates satisfactorily. A recommended condition of consent requires the filter to be replaced prior to breakthrough. A requirement of the Environment Protection Licence that would be issued by the EPA is for the Applicant to undertake regular monitoring of mercaptan emissions. The measure, frequency and method of sampling would be discussed with the EPA. The Department is satisfied that adequate measures are in place to ensure that odour impacts are minimised and that the odour emissions from operation of the treatment plant can be managed. In the medium term the plant would be relocated, removing a potential odour source from the area.

Nitrogen Oxides

The modelling for nitrogen oxide emissions predicted exceedances of the adopted air quality criteria at 50 metres and 100 metres from the treatment plant during operation of the flare stack. The exceedances, based on the Camden meteorological data, ranged from 431 to 483 $\mu\text{g}/\text{m}^3$ at 50 metres and from 324 to 396 $\mu\text{g}/\text{m}^3$ at 100 metres. The results using the Campbelltown data were of a similar range. The adopted air quality criteria for nitrogen oxide emissions over a 1-hour maximum is 256 $\mu\text{g}/\text{m}^3$. The EIS states that the results were caused by the conservative nature of model establishment, using a worst case emission rates. The Applicant notes that all well locations are located a minimum of 100 metres from a residence, and provided this buffer is maintained, then no adverse impacts would arise. The results show that NO_x emissions at nearest potentially affected residences in the vicinity of the

treatment plant comply with the air quality criteria. The Applicant states that there are no significant cumulative effects of the long term operation of the treatment plant and short term flaring operations at a completed well. Based on the modelling there are no significant increases to existing local or regional NO_x levels as a result of the normal operation of the treatment plant.

The operation of the flare stack at the treatment plant is not a regular operation, occurring only as a result of an unexpected equipment failure, rejection of gas by AGL resulting in a backlog in the throughput, or slow pressure build up from the wells. On these occasions the gas would be flared until the problem had been fixed or normal production resumed. The use of a flare at a completed well site may occur if the well was not connected to the gas gathering system and there is a build up of gas, which needs to be vented. As no residences are within 100 metres of a well site there are considered to be no off-site impacts.

The proposed conditions of consent include EPA general terms of approval which requires the Applicant to undertake monitoring of air emissions at various points in the treatment plant, specifies the pollutants to be monitored and the load limits at which the pollutants may be discharged. These requirements would be included in the Environment Protection Licence, which the EPA would grant for the operation of the proposal. The Licence is intended to regulate the emission of pollutants, odour, waste and water pollution.

The EIS states the products handled, processed or stored at the project sites are not toxic and any release of the products (methane, butane or mercaptan) in the open would not have any or cause any health impacts. The release of the products in a confined environment would likely cause suffocation or asphyxiation. However, this would only affect any employee working in a confined space at the treatment plant. The operation of the plant would have no impacts on the surrounding area or affect the health of the community.

7.4 Groundwater Impacts

The EIS has identified land subsidence, impacts on groundwater resources, water disposal and groundwater contamination as potential impacts on groundwater. The major groundwater resource in the project area is the Hawkesbury Sandstone aquifers, which are located at a depth of between 60 and 100 metres. The groundwater in this aquifer is typically of low salinity and within drinking water guidelines, and can be characterised as excellent quality water. The Wianamatta Shale overlies the Hawkesbury Sandstone. Groundwater aquifers in the Shale formations typically have a high level of salinity and are considered to be poor quality water. The aquifers in the Wianamatta Group are relatively shallow.

Land Subsidence

Depressurisation of subsurface rock formations may cause subsidence of the land surface. To extract the methane gas the coal seams are fractured and

depressurised by extracting water from the seams. The depressurisation of coal seams and overburden in the La Trobe Valley open cut mines in Victoria have resulted in land subsidence of up to 2 metres.

The consultant's report on assessment of groundwater impacts of the proposal considers that given the depth of the coal seams (between 700 to 800 metres) and the general competence of the overlying strata, it is not expected that land subsidence would be a significant problem.

Impacts on Groundwater Resource

There is the potential for cross contamination of groundwater through the boreholes penetrating the potable water aquifers into over/underlying formations that contain saline water. There is the possibility of saline waters rising through uncemented spaces in the borehole casing into a fresh water aquifer or in the long term through casing corrosion. The consultant considers the risk can be managed through well construction techniques.

Water Disposal

The groundwater extracted from the coal measures have been of variable salinity, ranging from brackish to saline. Disposal of such water to surface water receptors is likely to be environmentally unacceptable. The Applicant has employed various measures for disposal of the groundwater, irrigation to surrounding pasture, dust suppressant, evaporation or disposed of off-site. Water used for irrigation is diluted to achieve a salinity level of 500-800 $\mu\text{S}/\text{cm}$.

Groundwater Contamination

There is the potential for groundwater contamination by the various industrial liquids and chemicals used in the drilling and fracking operations. The reinjection of groundwater may also result in the contamination of groundwater.

Consideration

Construction impacts are related to the disposal of groundwater from the drilling and fracking operations in the establishment of the well. Fracking of the well involves the injection of a sand and water mixture to fracture the coal seams. Once the seams are fractured and the hydraulic pressure reduced, water and methane gas then flows through to the borehole base. The amount of water injected into a well is dependent on the physical properties of the coal seam formation and the success of the fracking operation. The EIS states that on average 650,000 litres of water is injected into a well and approximately 65% of the water is recovered. The water recovery rate ranges from 8% to 203%.

The recovered water is tested for salinity prior to disposal. The disposal methods are by evaporation, removal to a licensed water disposal site,

irrigation and dust suppression. For waters to be disposed by irrigation to pasture and use as dust suppressant, the water is diluted as necessary to achieve a salinity level of between 500 to 800 $\mu\text{S}/\text{cm}$. The Applicant states that this level is consistent with NSW Agriculture quality limits for water salinity. The salinity guidelines state that water with a salinity measure of 800 $\mu\text{S}/\text{cm}$ is good quality low salinity irrigation water suitable for most conditions. Water with a measure between 800 to 2300 $\mu\text{S}/\text{cm}$ should be used on well drained soils with good leaching potential, and waters over 2300 $\mu\text{S}/\text{cm}$ are not suitable for irrigation. The average level of salinity in water recovered from wells is around 1800 $\mu\text{S}/\text{cm}$. The EIS notes that although the water is suitable for irrigation, the water was becoming relatively saline.

To ensure that recovered water that is used for irrigation and dust suppression purposes does not increase the salinity of the receiving land or pollute waters from runoff, a recommended condition of consent sets an 800 $\mu\text{S}/\text{cm}$ level as the maximum salinity level for waters being disposal by these methods. A submission from NSW Agriculture stated that the dilution of recovered water to between 500-800 $\mu\text{S}/\text{cm}$ would satisfy its concerns about irrigation of saline water onto pasture.

The Applicant has undertaken water quality testing of recovered waters from several wells in the Johndilo field during November 1999 and February 2000. The testing undertaken was for a range of compounds, nutrients and metals. The sampling showed there were elevated levels of boron, iron, lithium and chromium levels in the first sample collected, all exceeding the ANZECC guidelines for irrigation water. Over the 3 samples collected the trend has been a reduction in boron and iron levels. However, there has been increases in sodium, fluoride and alkalinity levels over the 3 samples. The Department of Land and Water Conservation notes that the high levels of some trace elements in the recovered water may have the potential to adversely impact on soil and surface water if incorrectly disposed of. Concern is also raised that offsite transport through flooding or spray drift may be detrimental or harmful to the surrounding environment.

The EIS does not state whether any soil testing has been or will be carried out to determine the existing salinity of the irrigation sites, or the capacity of the soils to receive the waste water. The Applicant states that apart from the initial recovery of water following the fracking activities, the normal operation of the well does not generate a large quantity of waste water. The application of waste water for irrigation or dust suppression would be dependent on the quantity recovered and this has varied from well to well. The Department of Land and Water Conservation has recommended that a salinity management strategy be developed as part of the Environmental Management Plan for the proposal. This should include soil sampling and monitoring to ensure that an unacceptable build up of soils does not occur. The EPA's general terms of approval also note that the monitoring of land and receiving waters to determine the impact of waste water application may be required.

The recommended conditions of approval include a requirement to prepare a Water Quality Management Plan as part of the Environmental Management

Plan. The Water Quality Management Plan requires the Applicant to provide details of a soil sampling and monitoring program to address the build up of salts in the soil and the implementation of regular testing of waste water for compounds, nutrients and metals. These measures would ensure that the water quality of the recovered water is tested and monitored.

Contamination of the groundwater aquifers has been identified as a potential impact. This could arise from the use of chemicals in the drilling and fracing process and cleaning of the borehole. The chemicals commonly used are hydrochloric acid, potassium and calcium chlorides, sodium carbonate and guar gel. The EIS states that these chemicals break down easily and are incorporated into the coal seam formation waters, potentially increasing or decreasing the pH of the water over a short time period. There are no long term impacts as the well establishment operation is of short duration (less than 4 weeks). The Applicant states that the chemicals used are not an environmental hazard. Short-term impacts may arise from regular wellhead maintenance or redrilling/refracing operations.

Contamination of groundwater may occur from the reinjection of recovered water into the well. The reinjection of water into a well is one of the approved methods of disposal of waste water. The EIS states that this method of disposal is unlikely to be used as the amount of water generated is relatively low and that disposal by irrigation or dust suppression has adequately coped with the volumes recovered. The EPA and Department of Land and Water Conservation has raised concerns with this method of disposal of waste water. A recommended condition of consent requires the Director-General's approval to dispose of water by this method and be supported by a detailed feasibility study. This would address any concerns about the contamination of groundwater aquifers.

The EIS also describes the various measures, which are employed to manage surface water runoff during the well site preparation stage through to wellhead installation. All runoff is collected and either stored in a well site dam or storage tank. The Applicant has prepared a Soil and Water Management Plan for the management of runoff from the site. The recommended conditions also require a Soil and Water Management Plan to cover the construction of the 3 additional wells and the operation of the development. The Plan has to comply with the accepted stormwater management guidelines published by the Department of Housing and the EPA. The Department considers that the issue of surface water runoff has been adequately addressed by the EIS.

The operation of the development is unlikely to generate significant impacts on groundwater. Once the gas wells are operational only residual amounts of waste water is generated. All groundwater is captured by a plumbing system attached to the wellhead and contained in a 4500 litre farm tank. The smaller tank is emptied on a regular basis to a larger holding tank. The water is disposed off by irrigation or for dust suppression after testing for salinity levels. Process water collected at the treatment plant is stored in a holding

tank and disposed by a licensed waste water contractor for disposal at an authorised waste water disposal facility.

The EIS has identified land subsidence from the depressurisation of the coal formations as a potential impact from the operation of the development. Once fluid in the coal seams is withdrawn there is the possibility of land subsidence occurring. Land subsidence is not considered to be a significant problem given the depth of the coal seams (700-800 metres) and the competency of the overlying strata. The Applicant's geotechnical consultant recommends that further studies be carried out on the matter of subsidence. A recommended condition of consent requires the Applicant to implement a program to monitor any potential land subsidence effects from the long term extraction of gas and water in the PAL 1 area.

The Hawkesbury Sandstone aquifer has been identified by the Department of Land and Water Resource as a significant groundwater resource in the Sydney Basin. This aquifer is separated from the coal seam formations by the Narrabeen Group, a 400 metre thick strata with low permeability. The Narrabeen Group is considered by the geotechnical consultant to be an effective hydraulic barrier between the Hawkesbury Sandstone Aquifer and the Illawarra Coal Measures. The presence of this barrier is one of the reasons why the amount of waste water recovered is low. The cross contamination of aquifers by the wells is a potential impact from the construction and operation of the proposal. This could arise from leakages in the borehole wall casing or in the long term from corrosion of the casing wall.

The EIS states that the Applicant has undertaken procedures to ensure that the wells are effectively sealed to prevent cross contamination of the groundwater aquifers. The procedures include the detailed documentation of the well geology and casing/cementing procedures, pressure cementing of the borehole casing, testing of the quality of the zonal isolation and monitoring of gas and water flow rates. The Department of Land and Water Conservation considers that the methodology utilised in wells completed to date is appropriate for the isolation of overlying aquifers that contain good quality groundwater and the prevention of cross contamination from saline sources. However, the Department of Land and Water Conservation notes that the well casing maintenance methodology to ensure the integrity of the well isolation components in the long term has not been provided. A recommended condition of approval requires the Applicant to provide details of the well maintenance procedures to ensure the integrity of the well isolation components to prevent the cross contamination of groundwater.

The loss of water from farm dams and a watercourse near gas well LB-7 has been raised in public submissions. The objection contends that since drilling commenced on the Logan Brae site, and in particular well LB-7, the water in Matahill Creek has disappeared and 2 farm dams have not been able to hold water due to leakages. The Applicant states that the leakage/lack of water in the dams and watercourse are not related to the drilling of gas wells on the adjoining property. The EIS has addressed ground vibration impacts from drilling and fracking activities and concluded that the vibration impacts

generated are well below those, which would cause damage to a residential building.

Leakage of groundwater into the gas wells has also been discounted by the EIS. The wells utilise an effective cement casing to prevent the cross contamination of groundwater and it is unlikely that any groundwater could leak into the boreholes. The Department of Land and Water Conservation has advised it is satisfied with the well isolation methodology utilised by the Applicant.

The issue of land subsidence has been addressed and it is unlikely given the depth of the wells and the competency of the overlying strata that fracking of the coal seams would result in fractures in the overlying strata or surface land subsidence.

The Department is satisfied that the Applicant has adequately addressed all potential impacts from construction and operation of the proposal on structures in the vicinity of the gas wells. It is the Department's view that the leakage of the farm dams and loss of water is not a consequence of the drilling of the gas wells. To ensure that impacts on structures are considered by the Applicant the recommended conditions of consent require the preparation of a Condition Report on residences and structures that may be potentially affected by drilling and fracking operations, the monitoring of ground vibration impacts from all drilling, blasting, fracking and air blast activities, and the implementation of land subsidence monitoring.

7.5 Transport Impacts

The main access road for the development sites is Cawdor Road, a narrow 2-lane rural road carrying low volumes of traffic. Cawdor Road provides access from Camden South to Mt Hunter to the west and Cawdor to the south. The road has recently being upgraded and traffic lights installed at Burragorang road due to the relocation of Camden High School to the Cawdor area.

Traffic surveys were conducted in October and December 2000 to determine background traffic levels prior to construction work commencing and during the drilling of wells on the Logan Brae property. The surveys were conducted between 6-7.00am and 5.00pm over a 5-day period (Monday to Friday) and collected information on total vehicles and percentage of heavy vehicles. The traffic surveys were carried out at the intersection of Westbrook Road and Cawdor Road and the intersection of Cawdor Road and Old Razorback Road. The majority of traffic associated with the development use these roads for access to the wells, site depot and treatment plant.

The survey results showed very low volumes of traffic during the weekday daytime period (averaging 450 vehicles) and heavy vehicles making up 6-7% of the traffic at the Cawdor Road/Old Razorback Road intersection. There was very little difference in the volumes and proportion of heavy vehicles between the 2 survey periods. Traffic flows along Westbrook Road, the access road to the treatment plant averaged 180 vehicles with heavy vehicles

representing approximately 10% of traffic flows. Again there was little difference between the 2 survey periods. There were similar results for traffic flows on Cawdor Road/Westbrook Road intersection with total traffic flows averaging 550-650 vehicles and heavy vehicles representing less than 9% of the total flows.

The Applicant has estimated traffic generated by construction activities to represent between 0.8% and 1.5% of the existing traffic volumes in the area. Traffic volumes are expected to be much lower during the operation of the development.

Consideration

The majority of traffic generated by the proposal occurs during the well establishment phase. The EIS estimates that during the first 12 months of a well approximately 500 vehicle movements are generated with heavy vehicles making up 25% of the total. Approximately 75% of the traffic is associated with the drilling/fracking and production phases. Once the well becomes operational and starts producing gas, traffic volumes are reduced with well maintenance and inspection generating 25% of the traffic flows.

Traffic generated by the proposal is likely to be minor and generally associated with maintenance and inspection activities. The existing road network is capable of accommodating the additional traffic, given the existing light daytime traffic flows. The EIS states that the Applicant has also made improvements in the management of construction traffic since the early phase of development. It is anticipated that the cumulative impact of traffic generated by the 3 new wells would be significantly less than that experienced during the completion of previous well sites.

The installation of the gas gathering system and pipeline has resulted in minor delays to local traffic, however these are of short duration. Such disruptions to traffic flows are unlikely to occur during the operation of the proposal as no additional pipelines along roads are required to serve the 3 new wells.

Public submissions raised the interference of truck movements with the dropping off and picking up of school children. The traffic surveys conducted indicate that there are no significant differences in traffic flows outside the Cawdor Public School that are associated with the proposal.

The Department is satisfied that the traffic impacts have been addressed and that the operation of the proposal is not likely to have a significant impact on traffic flows in the area. To address traffic management issues a recommended condition of consent requires the Applicant to prepare a detailed Transport Management Plan. The Plan has to address all potential traffic and transport impacts associated with the proposal and identify measures to limit traffic movements in the PAL 1 area. The Plan also requires the Applicant to restrict traffic movements during school drop off and pick-up times.

7.6 Safety Impacts

The Applicant has undertaken a Quantitative Risk Assessment (QRA) and a Hazard and Operability Study (HAZOP) of the risk factors of the project. The QRA (preliminary hazard analysis) examined the risks and hazards associated with the assessment phase. The facilities included the gas gathering system from the wells to the treatment plant, the treatment plant and associated LPG and odourant storage, and the steel pipeline from the treatment plant to the AGL main in Menangle Road, Camden. The QRA assessed the project as complying with all relevant risk criteria, except the steel pipeline in the vicinity of Camden High School. A number of recommendations were made by the QRA. The Applicant states these have been incorporated into design modifications or changes to operational procedures of the project or considered by the subsequent HAZOP study.

The QRA noted the steel pipeline exceeded the risk criteria for schools (Camden High School location). The Department's Risk Criteria for Land Use Safety Planning guidelines specifies an individual fatality risk of 0.5 per million per year for schools. The cumulative individual fatality risk of the pipeline at 5 metres (the minimum separation distance between the pipeline and the Camden High School property boundary) is estimated to be 0.65 per million per year for proposed future operations. The QRA recommended relocation of the pipeline to the opposite side of Cawdor Road. This would reduce the individual fatality risk from 0.65 per million per year at 5 metres to 0.46 per million per year at 10 metres. The QRA also suggested the provision of a higher level of protection such as encasement of the pipeline to reduce the risk level. The Applicant also notes the steel pipeline has been designed to operate at higher pressure specifications, however, it is currently operating at a lower pressure.

As recommended by the QRA, the Applicant undertook a HAZOP study of the works. The study examined the works and operations from the wellhead to the AGL gas distribution network. The study was based on the assessment phase of the development. A number of items were excluded from the study, these included the wellhead and borehole equipment and operations, and the drilling and commissioning of the wellhead, and the AGL gas meter. The compressor and LPG tank at the treatment plant was not included as these were standard supplied item. The operation of gas flares at the wellhead was also excluded.

The overall results of the HAZOP study indicated that the gas gathering system and the treatment plant was capable of being operated safely and effectively. The major recommendations of the HAZOP study covered the potential from fires and explosions, release of material, occupational hazards and operations, operability of the plant and design review. The EIS states that all the recommendations from the HAZOP study have been adopted in design modifications or addressed in operating procedures.

The EIS concludes that the proposal presents a low level of risk to the environment and community. The recommendations of the QRA and HAZOP

study have been implemented and the Applicant is confident the production phase of the development can operate with minimal risk.

Consideration

The Department has reviewed the QRA and HAZOP and notes they were carried out in accordance with the Department's Hazardous Industry Advisory guidelines. Although the studies were carried out on the assessment phase of the project the Department considers the studies are relevant and appropriate for consideration of the operation of the plant and production of methane gas.

The QRA has considered all possible events that may arise from operation of the proposal. The main hazardous materials handled, stored or processed at the site are coalbed methane gas, LPG and ethyl mercaptan. The principal hazardous material that is present throughout the system is methane gas, either in its pure form or enriched with butane and odourised. The coalbed methane gas is predominantly 93% methane and although a flammable gas, it is relatively difficult to ignite requiring a strong ignition source. It is non toxic but can present as an asphyxiant hazard in a closed environment. If released in the open it is unlikely to be a significant asphyxiation hazard. Its main hazard is if it were released and ignited.

The QRA identified three potential hazards, heat radiation/direct fire, asphyxiation, and overpressure/projectiles. The only events that were quantified in terms of individual fatality risk were a jet fire from the plastic or steel pipelines. The cumulative individual fatality risk from the underground plastic pipeline at the nearest residence (20 metres) was estimated at 0.18 per million per year. For the steel pipeline the estimated risk criteria for residences at 20 metres and 2.5 metres was 0.29 and 0.32 per million per year, respectively. The Department's guidelines specify a risk frequency for residential developments of 1 per million per year. Therefore there are no increased hazards or risk to residences from operation of the pipelines. The risk to residences adjoining a well site and the treatment plant from release of methane gas or a fire is considered to be negligible in view of the distances involved. The nearest residence to a well is approximately 120 metres (JD-9) and 160 metres (JD-1). The nearest residences to the treatment plant are approximately 260 metres and 300 metres distant.

The QRA noted the specification of the steel pipeline between the treatment plant and the AGL network is designed to operate at a pressure of 10.2 MPa. However, during the operation of the proposal it will only operate at a lower pressure of 1.05 MPa. The QRA recommends a new QRA and HAZOP study be undertaken if the treatment plant and steel pipeline is to operate at the higher pressure. The recommended conditions of consent restrict the operation of the pipeline to 1.05 MPa and requires the Applicant to seek the Director-General's approval to operate at a pressure above 1.05 MPa. The application would need to be accompanied by a Final Hazard Analysis and a HAZOP study. The Applicant has stated the section of pipeline between the treatment plant and the AGL network is unlikely to operate at a higher pressure as the treatment plant is to be relocated closer to the Moomba-

Sydney gas pipeline and the Duke Energy Eastern Gas Pipeline. The Applicant is also required to report to the Director-General on implementation/adoption of the recommendations of the QRA.

The HAZOP undertaken of the operation of the proposal indicated the gas gathering system and the treatment plant could be operated safely. This would be contingent on the training and diligence of the plant operators and the development and implementation of operating procedures. The study made a number of recommendations in relation to the design and operation of the proposal. The Applicant states that these have been implemented or adopted. The recommended conditions of consent require the Applicant to report to the Director-General on the implementation of the findings and recommendations of the HAZOP study.

Public submissions raised concerns about leaks or explosions, gas well flaring, the plastic piping system and health problems. The QRA has assessed the proposal in terms of potential risk of the gas gathering system and the treatment plant from fire and other events. The proposal complies with the Department's guidelines on Hazardous Industries and there are no unacceptable risks from the wells, gas gathering system or the treatment plant. The HAZOP study on the operation of the proposal concluded the proposal could operate safely and a number of recommendations were made on design and operation/procedural matters. The Department is satisfied that the risk assessment of the proposal has been adequately carried out and there are no unacceptable or increased risks to residents or school children in the PAL 1 area.

The EIS has addressed the concerns raised about the health impacts of the proposal. The dust generation levels of the construction and operation of the wells and treatment plant are very low and unlikely to have any adverse impact on the health of the community. The operation of the proposal is likely to generate low to negligible dust levels and these are unlikely to cause or aggravate asthma conditions. Off-site health impacts from the proposal are considered minimal. Methane gas is non-toxic and only becomes a health hazard if released into a confined space, acting as an asphyxiant. LPG is similar to methane being non-toxic and only of concern if released in a confined space. Mercaptan is used as an odourant and if released would present as an unpleasant odour. It is of low toxicity and would only be a health problem if much larger quantities were handled. The Department considers the EIS has adequately addressed the health impacts of the hazardous materials handled, stored or processed on the site.

7.7 Flora and Fauna Impacts

An assessment of the flora and fauna has been undertaken for the PAL 1 area to determine the potential impacts of the proposal on the local ecology and to develop suitable management procedures. The assessments investigated the well sites, the gas gathering system and pipeline routes and the project areas. In the PAL 1 area the native vegetation has been significantly disturbed, particularly by agricultural activities. With a decline in

agriculture in the Cawdor area in the past ten years, regrowth of native vegetation has occurred along with the spread of noxious weeds. Grazing is the dominant land use in the area, along with some fodder crops. Increasingly the area has become attractive for rural-residential development, which has impacted on agricultural activities and the local ecosystem. Remnants of the original vegetation occur as mostly scattered stands of trees or single trees.

The Applicant has undertaken several flora and fauna impact assessments of specific components of the proposal. The assessments concluded that no threatened species, populations or communities were identified and the eight-part test for threatened species did not require the preparation of a Species Impact Statement. The development was unlikely to have any significant impact on the remnant vegetation.

The PAL 1 area contained several ecological communities, which are scheduled as threatened under the Threatened Species Conservation Act. These are the Cumberland Plain Woodlands and Sydney Coastal River Flat Forest. The Cumberland Plains Woodland comprises 2 communities, the Shale Plains Woodland that generally occur on the flat sandy plains of the Cawdor Valley and the Shale Hills Woodland which occurs on the steeper slopes and ridges of the Cawdor area. The Sydney Coastal River Flat Forest are not widely distributed in the area and occur exclusively along or close to watercourses.

A number of threatened fauna species have been identified as occurring in the broader region. However, flora and fauna surveys carried out on the development sites have not identified any examples of endangered fauna or suitable habitats for endangered fauna. The well sites and associated infrastructure have not been located within sensitive plant communities such as woodland, rainforest or riparian areas.

The EIS states that the proposal are unlikely to have a significant impact on vegetation and fauna communities as the development sites avoid any significant vegetation, the size of any surface disturbance is relatively small and access roads and the gas gathering system utilise existing farm tracks or boundary fence lines where possible. The proposal is unlikely to have any significant threatening processes.

Consideration

The operation of the proposal is unlikely to have any significant impact on fauna and flora issues. The potential impacts would have been the greatest at the time of establishment of the wells and the gas gathering system. The EIS states a number of measures have been implemented to reduce impacts on flora and fauna. These are incorporated in the Environmental Management Plan and cover areas such as rehabilitation, weed control, site selection and soil and water management.

The National Parks and Wildlife Service notes that the vegetation in the vicinity of the proposed wells LB-1, 2 and 3 is part of the Shale Hills

Woodland, a component of the endangered Cumberland Plains Woodland community. The location of the wells and the gas gathering system avoids the vegetation and the Service is supportive of this approach. The Service suggests that during the construction stage measures be taken to clearly delineate the work area and establish a barrier to those areas to be avoided. Any rehabilitation and revegetation of disturbed areas should use locally sourced indigenous species. The recommended conditions of consent require the Applicant to prepare and implement a Vegetation and Landscape Management Plan. The Plan would address retention of existing mature trees, revegetation and landscaping. The Department considers that all flora and fauna issues have been addressed by the EIS.

7.8 Visual Impacts

The PAL 1 area's visual catchment relates to the topography and history of the area. The development area is situated on the Cawdor Valley floor at the foot of a series of hills to the west and south known as the Razorback Range. The majority of the area to the north is relatively flat. The landscape reflects a long history of vegetation clearing and grazing, resulting in scattered trees and pasture land. There are isolated stands of remnant or regrowth eucalypt woodland.

Most of the area on which wells are located and the route of the gas gathering system is cleared land used for pasture or cropping. The built environment mainly consists of residences, sheds, farm dams, poultry farms/horse studs and associated infrastructure, schools, roads and electricity lines.

The EIS has undertaken an assessment of the visual impacts of the proposal, based on the type and duration of the activity. The assessment criteria for temporary impacts is outlined in Table 11 below.

Table 11 – Visual Impact Assessment Criteria

Activity	Duration	Nature of Activity	Nature of Impact
Drilling associated activities	Short term	Mobile	Temporary – visible
Establishment of wellhead	Short term	Transitory	Permanent – visible
Installation of gas gathering system	Short term	Transitory	Temporary – visible
Construction of the treatment plant	Medium term	Stationary	Permanent – visible
Gas Flaring	Short term	Stationary	Temporary - visible

The visual impact of drilling activities and the gas gathering system is considered to be minor due to the temporary and short term nature of the

activities. These activities would involve the movement of a number of vehicles and equipment of all shapes and sizes. The impacts would likely be restricted to those living closest to the activities and only for the duration of the construction activity.

The proposal has two flare stacks, one at the treatment plant and one on the Johndilo property. Usage of the flare for gas burning or flaring only occurs when the treatment plant is shut down or for burning off gas from wells that are not connected to the gas gathering system. Flaring at the treatment plant only occurs for short periods (usually less than 12 hours) but usage of the field flare may occur over days or weeks depending on the well. The EIS considers flaring at night is intrusive in nature because it can be seen for several kilometres.

The visual impacts of construction of the project are transitory and have no lasting adverse impacts. The construction sites are rehabilitated on completion of the wellhead.

Permanent visual impacts are associated with the wellhead infrastructure and the treatment plant. The completed wellhead usually occupies a small footprint (8 x 3 metres). The visible components are a pump, piping and condenser contained within a steel and wire mesh enclosure of up to 2.5 metres high. The EIS noted that where the wellheads are adjacent to a stand of trees it is not overly obtrusive. However, this is not the case for all wells, and such wells are in stark contrast to the surrounding landscape.

The treatment plant occupies a compound of 1 hectare in area. The main facility is located on the eastern side of the site and towards the rear. The 6.1 metre high flare stack is located towards the rear of the western side and is separated from the LPG storage tank on the Westbrook Road frontage by a centrally located water retention dam. The bulk of the plant and the wire mesh boundary fencing is leaf green in colour.

The EIS considers the visual impacts of the well sites to be relatively low due to the small footprint of the wellhead structures. The LPG tank and the flare stack components of the treatment plant are the most visible features. The LPG tank does intrude on the surrounding landscape due to its bulk and colour. Flaring of gas at night would have a significant impact, however, this is not a regular operation at the plant and would only occur in the event of a shut down of the plant for maintenance or the rejection of gas by AGL. The rest of the treatment plant is not considered to be obtrusive and its location near a substantial stand of trees assists in blending the plant with its surroundings.

Consideration

The initial well drilling and establishment activities are likely to be highly visible for the duration of the construction period of up to 4 weeks. However, these impacts are temporary and once the wellhead has been completed the site is rehabilitated resulting in a relatively small scale permanent structure. The

Applicant has adopted various measures to reduce the impacts of the well construction activities. These include reviewing and reducing the number of vehicles and equipment, minimising the activities to as brief a period as possible, restricting the spacing of wells to a minimum distance of 700 metres, reducing/replacing the use of black beam water pumps, connection of the well to the gas gathering system as soon as possible to reduce the need to use the field flare, provision of understorey planting and site rehabilitation as soon as possible. The planting of further screening trees on the eastern and western side of the treatment plant is also proposed to further reduce its impact.

Public submissions raised concerns about the visual impacts of the treatment plant and the wells, and the use of the flare. The location of the treatment plant in a rural area has introduced an intensive industrial activity to the area. However, the Applicant has undertaken some landscaping work and located the plant near existing trees to reduce its impact. The treatment plant will be relocated in the medium-term and the landscaping work undertaken and proposed is appropriate. The Department is satisfied that the EIS has adequately addressed the visual impacts of the proposal. The proposed conditions of consent require the Applicant to implement a Vegetation and Landscape Plan. The landscaping of the site would assist in reducing the visual impacts of the proposal.

The Heritage Office commented that careful consideration needs to be given to new uses and intensification of land uses on the Logan Brae and Johndilo properties in view of their historical and aesthetic heritage significance. The EIS has considered the heritage significance of the area and noted that three historic landscape units have been identified in a study undertaken for Wollondilly Council. The historic landscape units reflect the early history of clearing, grazing and agricultural uses associated with the settlement of Sydney and New South Wales. The development sites are not located on or near any listed heritage item in the area. It is submitted that the construction of the development has no impact on the heritage items. The proposal may have potential impact on the curtilage of an item and the wider historic cultural landscape. The EIS states that the impacts are likely to be minimal given the small and unobtrusive nature of the individual components. The impacts from operation of the proposal are likely to be minimal and the Department notes that the Applicant is committed to ensuring future wells are located at an appropriate distance from a heritage item so that the fabric and curtilage is not compromised. The recommended conditions of consent require approval from the Heritage Office for the excavation of an archaeological relic.

The Heritage Office requested the removal of LB-9 and 10 due to their visual impact on the proposed Camden Park State Heritage Register boundary and the Remembrance Highway. The wells are located close to the road and are currently operational. The Department does not agree with the Heritage Office on the closure and dismantling of the wells. The actual footprint of the wells is small in area and the wellhead infrastructure of pumps and pipes are coloured leaf green to blend in with the surroundings and are no more than 2.5 m high. The visual impact of the wells is considered to be minor, however, the recommended conditions require the Applicant to prepare a Vegetation

and Landscaping Management Plan which would address the landscaping of the development.

7.9 Socio-economic Impacts

The EIS provides an economic and social profile for the Camden and Wollondilly local government areas. The population of Cawdor was 160 persons in 1986 and estimated to have grown to 189 by 1994. The population is estimated to be approximately 240 persons at present, based on an annual growth rate of 3.6% between 1986 and 1994. The actual population may be higher due to recent developments in the nearby residential areas. The population generally comprises the traditional farming community and recent arrivals pursuing a semi rural lifestyle, commonly on rural-residential allotments. There are no shops in Cawdor, only a primary school, church and hall. The area is increasingly being considered to be the outskirts of Camden.

The main agricultural activities being carried out in the area are grazing and cropping. The main agricultural enterprises are dairy farming, cattle and sheep grazing, poultry farming, horticulture and horse studs/training. An Agricultural Lands Study of the Wollondilly Shire undertaken in 1993 indicated that 56% of the land use in Cawdor was rural-residential and 44% livestock grazing. The agricultural potential of the area is good but the productivity is low as the use of the land changes from agriculture to rural residential.

The EIS states that the proposal has contributed to the economy of the local and broader community by the use of local employment and contractors and purchase of goods and services from local businesses. The capital investment of the project to date has been in excess of \$20 million and created 30 jobs. The economic impacts of the proposal are an estimated 150 indirect jobs in the service and construction sectors by the use of contractors and purchase of goods and services. The EIS justifies the high employment ratio multiplier due to the capital intensive nature of the construction phase.

The Applicant states that the proposal would have short term impacts on the local community from site establishment and construction activities. The EIS states Impacts such as noise, dust and traffic are likely to be limited as mitigation and management measures are employed. The long term social impact of the proposal is likely to be the perception of an industrial activity in the semi-rural area and the potential disruption to the ambience of the area and resulting land use conflicts. The Applicant states that the environmental controls and monitoring implemented for the proposal would provide long term protection of the environment and residential amenity.

The EIS has examined the potential impact of the proposal on property values. These are divided into short term and long term impacts. The issues, which need to be considered in short term impacts, include the length of time, loss of productivity and damage or interference caused by the operations and the repair of damage. Issues to be addressed in longer term impacts include the area of land, length of time, restrictions on access, damage caused, loss of development potential, and frequency of access to the land. The Applicant

states that the mitigative measures employed have been designed with these issues in mind. These measures are the selection of well sites that are the least obtrusive, reducing the amount of activities at a site to the minimum; early rehabilitation of a construction site, and the use of non-reflective and appropriately coloured hardware. With the implementation of these measures the proposal would not significantly impact on property values in the area.

Consideration

The Department considers the proposal would have a positive economic impact on the local and regional economy by local employment and purchase of goods and services. There would be indirect job creation from local contractors and businesses used by the Applicant. There may be potential conflict in land use with rural residential development in the area. However, this is unlikely to be an issue for the proposal given the distances between the wells and treatment plant and existing residences. The Department acknowledges there is unlikely to be any significant impact off-site or at the nearest residence.

7.10 Statutory Approval Process

The existing (and proposed) infrastructure of 25 wells, gas gathering system, treatment plant and steel pipeline was approved under the *Petroleum (Onshore) Act*. The Applicant is currently operating the proposal under a Petroleum Assessment Lease. The Petroleum Assessment Lease grants the lease holder the exclusive right to prospect for petroleum and to assess any petroleum deposit on the land in the lease. To obtain a Petroleum Production Lease the Applicant is required to obtain development approval for the proposal. A Petroleum Production Lease would give the lease holder the exclusive right to conduct petroleum mining operations on the land in the lease.

Consideration

Several public submissions raised concerns about the approval process for the existing operations and that no environmental impact statement was prepared. The existing operations were approved under the *Petroleum (Onshore) Act* by the Department of Mineral Resources. Under that Act the operation proposed to be carried out under a Petroleum Production Lease is considered to be an activity under Part 5 of the *Environmental Planning and Assessment Act*. Part 5 of the *Environmental Planning and Assessment Act* requires an environmental impact statement if the proposal is likely to significantly affect the environment. The DMR, being the determining authority under Part 5, did not require the Applicant to prepare an environmental impact statement for the Petroleum Assessment Lease. The environmental impacts of the proposal were considered in a Statement of Environmental Effects. Under Part 5 an EIS is required where the activity is likely to significantly affect the environment. The decision as to whether the activity significantly affects the environment is one for the determining authority, the DMR, to consider.

The non-compliance with the 200 metres separation distance between a well and a residence was raised in submissions. Under the *Petroleum (Onshore) Act* no prospecting or mining operations may be carried out on land within 200 metres of a residence unless the owner has given consent. Currently two wells are less than 200 metres from a dwelling, JD-1 and JD-9 are approximately 160 and 120 metres from the respective wells. These wells were drilled prior to an amendment to the *Petroleum (Onshore) Act* which clarified the 200 metre separation distance. At the time JD-1 and JD-9 were drilled the *Petroleum (Onshore) Act* prohibited works “*within 200 metres of the principal residence of the owner or occupier of any such land*”. On this basis the wells complied as they were not less than 200 metres from the principal dwelling on which the wells were located. The *Petroleum (Onshore) Act* was subsequently amended to clarify and require a 200 metre separation distance between the well and a dwelling-house, 23 of the 25 wells comply.

The Department’s assessment of the proposal does not raise any significant issue on environmental or safety grounds to restrict the continued operation/production of gas from these wells. However, the DMR has advised that a Production Lease could not be granted for JD-1 and JD-9 as they do not comply with the 200 metre separation distance requirement in section 72 (1) (a) of the *Petroleum (Onshore) Act*. The Applicant would need the consent of the owners of the dwellings that are within 200 metres of the wells to enable their continued operation under a Production Lease.

Wollondilly Shire Council has raised concerns regarding the safe distance between residences and the gas equipment. Further, Council has resolved not to approve any dwellings within 200 metres of a gas well. Submissions have raised concern at the Wollondilly Council resolution and the impact on future development rights of land within 200 metres of a well. The Department has reviewed the Quantitative Risk Assessment and the Hazard and Operability Study of the proposed gas gathering system, steel pipeline and treatment plant. The studies have indicated that the proposal was capable of being operated safely and there was minimal risk with the operation phase of the development. The recommended conditions of consent establish noise limits for the development generally, and lower limits for the treatment plant to be achieved within eighteen months of the consent date. Proposals to redrill and/or refracture a well require the preparation of a Management Plan and the Director-General’s approval, and a Condition Report on potentially affected residences and structures. These measures would ensure that environmental impacts are considered prior to the work commencing. The Department notes that the 200 metre buffer adopted by Wollondilly Council has no statutory basis and that there are no significant environmental impacts from the continued operation of the proposal. The *Petroleum (Onshore) Act* prohibits the location of a well (and other mining related works) within 200 metres of a dwelling unless the owner has given consent. The Department considers that the impacts of the development can be managed through the proposed conditions of consent, which set performance criteria as well as reporting and monitoring requirements.

Several submissions requested the imposition of a condition to restrict wells to a distance of 200 metres from the property boundary. The *Petroleum (Onshore) Act* requires a minimum distance of 200 metres from a dwelling, not the property boundary of the land on which the well is located. The proposal is for 25 wells (existing and proposed) which were approved under the *Petroleum (Onshore) Act*. The proposal is for the production of gas from the existing wells. There are no powers for the Department to override an existing approval under other legislation or impose conditions which would be contrary to another Act.

The approval process for new wells was raised in public submissions. The proposal is for a total of 25 wells, of which 5 have not yet being completed or drilled. Any new well within the PAL 1 area would require approval from the DMR under the *Petroleum (Onshore) Act* or a new development application under the *Environmental Planning and Assessment Act 1979*. The recommended conditions of consent permits the redrilling and/or refracking of an existing well with the approval of the Director-General.

7.11 Commission of Inquiry

Camden Council and Wollondilly Council's submissions requested the Minister call a Commission of Inquiry under section 119 of the *Environmental Planning and Assessment Act 1979* into the proposal. Camden Council was concerned that the proposal has significant issues for the community and that the exhibited environmental impact statement has not provided sufficient information for a proper environmental impact assessment of the project. Wollondilly Council resolved on 11 February 2002, and Camden Council on 11 March 2002, to request the Minister to hold an Inquiry.

Consideration

Under section 119 of the Act the Minister may direct an Inquiry be held into all or any of the environmental aspects of the proposed development. The Department in this assessment report has considered all the environmental impacts of the proposal. The key issues are noise, dust, odour, vibrations, groundwater, air quality and safety. These have been adequately addressed by the environmental impact statement. The proposal is for the continued operation of the existing wells, gas gathering system, treatment plant and pipeline. The only components, which have not yet being constructed, are the three new wells LB-1, 2 and 3.

The Department is satisfied that the operation of the proposal is unlikely to have any significant environmental impacts. The recommended conditions of consent include performance criteria to address noise, odour and air emissions; the preparation and implementation of an Environmental Management Plan for the construction and operation of the proposal; require the monitoring and reporting of noise, vibration, air and water quality; and reporting on risk assessment, environmental performance and environmental audit. The EPA has issued its General Terms of Approval for the proposal and these cover air quality, noise and odour monitoring and reporting. There

are no outstanding environmental impact matters, which warrant the establishment of an Inquiry or require further investigation.

7.12 Prohibited Development

The steel pipeline connecting the treatment plant with the AGL gas network (intersection of Park Street and Menangle Road, Camden) is routed through land that is zoned Rural, Special Uses – Cemetery, Open Space, Industrial, and Residential. Under the Special Uses, Open Space, and Residential zones the development is prohibited development. However, under section 76A(8)(c) of the Act, if part of State Significant development is prohibited, then that part may be carried out with development consent.

Consideration

The route of the steel pipeline traverses land on which the proposal is prohibited because of the zoning of the land. The risk assessment of the steel pipeline indicated that it complied with the Department's Hazardous Industry guidelines for individual fatality risk. The estimated individual fatality risk for residences at 20 metres and 2.5 metres from the pipeline were 0.29 and 0.32 per million per year, well below the guideline of 1 per million per year. However, the criteria for was exceeded for schools, being 0.65 per million per year 5 metres from the Camden High School boundary. The guidelines specify a risk factor of 0.5 per million per year for an educational land use. The Applicant has stated that the encasement of the pipeline adjacent to the school and its relocation to the opposite side of the road has resulted in compliance with the Department's guidelines. The Applicant notes that similar pipelines run through many urban areas and elsewhere as part of the gas reticulation system. As the pipeline route that is prohibited comprises only a small part of the total route, its approval under S.76 A(8)(c) is appropriate and justified. When the treatment plant is relocated the section of pipeline between Westbrook Road and Menangle Road will be decommissioned and abandoned. The Applicant anticipates the location will take place within the next two years. It is recommended that the Minister agree to approve that part of the development that is prohibited under the Special Uses, Open Space, and Residential zones.

8 SECTION 79C CONSIDERATION

Section 79C of the Act 1979 sets out matters that a consent authority must take into consideration when it determines a development application. The Department has assessed the development application in the context of section 79C of the Act having regard to the heads of consideration (see Appendix B). The Department is satisfied that the merits of the proposed development warrant approval subject to the recommended conditions of consent.

9 CONDITIONS OF CONSENT

The Department has prepared a set of recommended conditions of consent for the proposal. The recommended conditions cover 4 matters - environmental management, performance reporting, environmental performance and environmental monitoring.

These conditions are required to:

- > Provide the performance criteria and standards for operation of the proposal;
- > Minimise any adverse environmental impacts associated with the proposal;
- > Provide for the on-going environmental management of the development; and
- > Provide for the regular monitoring, auditing, and reporting on the development.

The recommended conditions require a development application to be lodged for the new treatment plant within two years of the date of the consent and for production from the existing treatment plant to cease when the new plant is commissioned. The consent requires the approval for any well that has not been drilled or completed within five years of the date of the approval to be surrendered.

The conditions include the General Terms of Approval from the Environment Protection Authority.

The Applicant has agreed to the draft conditions of consent.

10 CONCLUSION

The Department has assessed the DA and the submissions on the DA, and is satisfied that the proposal has several benefits.

It would:

- > Exploit a significant resource within the Sydney Basin;
- > Provide an additional supply of natural gas to the Sydney market; and
- > Provide employment and economic benefits to the local and regional economy.

These benefits should be considered against the potential impacts of the proposal, particularly the potential noise, odour, traffic and safety impacts. However, after assessing these potential impacts in detail, the Department is satisfied that they can be mitigated or managed, and that with good environmental management, the proposal would comply with all the relevant environmental standards and criteria.

11 RECOMMENDATION

It is recommended that the Minister:

- (i) Consider the findings and conclusions of the Department's Assessment Report for DA –15-1-2002-i;
- (ii) Grant consent to development application DA –15-1-2002-i, as submitted by Sydney Gas Operations Pty Ltd, subject to the conditions set out in the instrument of consent; and
- (iii) Sign the instrument of consent.