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The Lock The Gate Alliance (LTGA) welcomes the opportunity to make a submission to the Senate inquiry into the impacts of coal seam gas (CSG) extraction on the Murray Darling Basin (MDB).

The emphasis of this submission is on Qld and NSW as this is where the CSG industry is most advanced.

It should be noted that the CSG industry is exempt from the provisions of many pieces of legislation with which other landholders must comply. Significantly for salinity management in the MDB, these include vegetation management legislation. For example, section 25 of the NSW Native Vegetation Act 2003 specifies that "This Act does not apply to the following types of clearing of native vegetation: ….(m) any clearing authorised under the Petroleum (Onshore) Act 1991".

Introduction

Of critical importance to this inquiry is the absence of effective legislation and regulation of the CSG industry.

- The CSG industry is not subject to the *Commonwealth Water Act 2007*. This Act applies to the Murray Darling Basin, 24.5% of which lies in Qld and 56.6% in NSW.[1] The Act's

[1] Crabb, P., Murray Darling Basin Resources, MDBC 1997.

definition (s4) of *'basin water resources'* does not include 'groundwater that forms part of the Great Artesian Basin' (GAB)[2]. Over large areas of Qld and NSW where the CSG industry is established and expanding, the associated water taken as part of the extraction process is therefore outside the Water Act 2007, at least until such time as it is released into a stream within the MDB.

- The CSG industry is outside the National Water Initiative.
- No federal law or regulation specifically addresses the CSG mining industry.
- CSG is not subject to any formal federal review or environmental process in the application phases, other than companies are required to address points in their submissions referencing their compliance to Federal environmental concerns. All Federal requirements for assessment are met by the state-based assessment processes when there is a bilateral agreement.
- The CSG industry is not subject to the water allocation and planning requirements of State Water Acts.
- The CSG industry in NSW is not listed in the Acts under which it is supposedly regulated (e.g., NSW *On-Shore Petroleum Act 1991*).
- In NSW, CSG exploration is not covered by the *Protection of the Environment Operations Act* which defines the operations of the Department of Environment, Climate Change & Water.

Representatives in the Queensland government's environmental assessments group have openly acknowledged that they are not given the opportunity to undertake appropriate review of company submissions. Projects have routinely been announced by the Premier *before* the applications even hit the desk of the reviewers, leaving conditions on the license as the only way in which to regulate the industry. The Department is inadequately resourced to deal with the increasing volume of applications, reviews and amendments; as well as to undertake its compliance and enforcement responsibilities. Of 7 actions put in place by the government, 6 are requirements for self-reporting by the industry itself. The seventh involves making information available to landholders. The Queensland government provides a list of what it does to monitor the industry at www.industry.qld.gov.au/dsdweb/v4/apps/web/content.cfm?id=15795

This is a deplorable state of affairs. This emphasis on self-assessment and self-monitoring lacks transparency and is not a good foundation for community confidence that water resources, the wider environment or individual property rights are adequately protected.

The Queensland government is proud of its "precautionary, adaptive management framework" developed to regulate the CSG industry. LTGA regards these words as mutually exclusive and the phrase as a contradiction in terms. The precautionary principle effectively means 'if in doubt, do not proceed.' Adaptive management is about learning on the job, including from mistakes made.

<u>LTGA contends that some of the risks presented by CSG development to the water and other resources of the MDB may be irreversible. Such risks should be not taken.</u>

[2] http://www.comlaw.gov.au/Details/C2007A00137/Html/Text#param5 accessed 18th October 2011

The economic, social and environmental impacts of mining coal seam gas on the sustainability of water aquifers and future water licensing arrangements

In the Queensland part of the MDB, most CSG is extracted from the Walloon Coal Measures, an aquifer of the Great Artesian Basin (GAB). Although parts of the GAB underlie the MDB, GAB water is not part of the forthcoming MDB Plan. This raises the question of how water will be accounted for and managed when it 'straddles' two different water plans and management frameworks. There are many unknowns regarding the connectivity between ground and surface water sources and a number of studies are underway to fill these knowledge gaps.[3]

Unlike other water users, CSG companies do not have allocation under Water Acts. In Qld, CSG water is considered a waste, regulated under the *Petroleum and Gas (Production and Safety) Act 200.* In NSW, it is regulated under the *Onshore Petroleum Act 1991.* In both cases unlimited take is permitted. Being outside water Acts means the water is not part of the MDB Plan until the extracted water is released (or escapes) into a surface water stream. The chemical characteristics or fingerprint of any such releases and the implications for in-stream aquatic fauna is the subject of DERM's Healthy Headwaters study.

EISs undertaken by major CSG companies leave no doubt that large volumes of 'associated' water will be extracted in order for the gas to flow. Qld DERM estimates range from 126,000 – 216,000 ML/ann. Company EISs put total extraction in the range of 1200-1800GL. EISs also make it clear that groundwater in adjacent aquifers will be affected.[4] The Springbok and Precipice sandstones could take 200 years to recover to their pre-CSG development levels while the Hutton sandstones could take 1,000 years.[5] Draw-down could be as much as the equivalent of 600m of pressure head.[6]

This is relevant because in some parts of the MDB, communities, business operators and landholders currently dependent on GAB water and may need to access MDB water if their existing supplies are depleted by aquifer draw-down. Furthermore, the potential addition of significant volumes of salt to the Basin's streams has implications for Basin salinity targets, environmental watering plans and SDLs in the event that dilution flows are required.

GAB aquifers including the Walloon Coal Measures are connected to shallower alluvial groundwater sources in the MDB. The Condamine – Balonne Water Resource Plan was recently amended to include groundwater, specifically the Condamine Alluvium. This shallow aquifer is highly developed and known to be connected to the Walloon Coal Measures.[7] Anecdotal

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[3] http://www.nwc.gov.au/www/html/975-introduction---groundwater-research-centre.asp

[4] Groundwater (Deep Aquifer Modelling) for Santos GLNG Project – Environmental Impact Statement 31/3/2009, http://www.glng.com.au/library/EIS/Section%206/06%2006%20Groundwater%20%28Section%206.6%29%20FINAL%20PUBLIC.pdf section 6.6.2.5

[5] Groundwater (Deep Aquifer Modelling) for Santos GLNG Project Environmental Impact Statement http://www.glng.com.au/library/EIS/Appendices/P2_Groundwater%20%28Deep%29%20FINAL%20PUBLIC.pdf

[6] Groundwater (Deep Aquifer Modelling) for Santos GLNG Project – Environmental Impact Statement 31/3/2009, http://www.glng.com.au/library/EIS/Section%206/06%2006%20Groundwater%20%28Section%206.6%29%20FINAL%20PUBLIC.pdf section 6.6.2.5

[7] Hillier, John R.,Groundwater connections between the Walloon Coal Measures and the Alluvium of the Condamine River. A Report for the Central Downs Irrigators Limited. August, 2010

evidence from landholders on the Liverpool Plains, together with known GAB recharge processes in the Coonamble Embayment and the high degree of connectivity between ground and surface water sources in the Namoi valley suggest a similar degree of connection in that area. It is extraordinary that the NSW government is allowing CSG development to escalate in that catchment before the Namoi Catchment Water Study, due in March 2012 is completed.

There are clearly implications for MDB water resources and the water licensing and accounting arrangements that need to accompany the MDB Plan.

The National Water Initiative

The NWI is the key plank of Australia's Water Reform agenda. Clause 34 states that

> *"The Parties agree that there may be special circumstances facing the minerals and petroleum sectors that will need to be addressed by policies and measures beyond the scope of this Agreement. In this context, the parties note that specific project proposals will be assessed according to environmental, economic and social considerations, and that factors specific to resource development projects, such as isolation , relatively short project durations, water quality issues, and obligations to remediate and offset impacts, may require specific management arrangements outside the scope of this Agreement."*

The *'special circumstances'* and '*specific management arrangements outside the scope of this Agreement'* are the state legislation, regulations and policies that administer the energy resources and mining industries. The Minerals Council of Australia defines "relatively short project durations" as up to 30 years and the industry as 'temporary users of water' (Melanie Stutzall, MCA, pers comm). This is the life of 3 Water Resource Plans and a generation in a family property.

LTGA contends that the approach is fundamentally flawed. There are currently no published standard conditions and approaches between agencies within some jurisdictions and between some States. There are inconsistencies between jursidictions and across shared aquifers and streams; for example in water quality (criteria, targets, objectives, monitoring and reporting) compliance and enforcement.

Most states' legislation confers discretionary power on Ministers and/or chief executives and relationships and interactions with other Acts are complex . Large CSG projects may be designated 'state significant' in which case a streamlined and very favourable assessment process will apply under the Queensland *State Development and Public Works Organisations Act 1971* or Part 3A of the *Environmental Planning and Assessment Act 1979* in NSW. Legislation and regulation requires that developments be assessed on their own merits/impacts, not cumulative ones - another serious flaw in the system. The *SD&PWO* Act lacks an Objects clause and does not include penalties for providing false or misleading information. This adds up to a very poor standard of governance and public accountability.

Water quality is a significant issue. Governments have a responsibility to the public to ensure confidence in the quality of our water. Water quality is mentioned in 5 NWI clauses. (7, 34, 61i, 79iib, 98).

Clause 7 of the NWI cites the *National Action Plan for Salinity And Water Quality (NAP) , Natural Heritage Trust (NHT)* and *National Water Quality Management Strategy (NWQMS).*

These programs involve significant investments of public money as well as huge investments of time and in-kind contributions by landholders, Landcare and regional NRM groups. The true value of implemented eg NHT projects is considerably more than the government's cash contributions. LTGA believes it is economically and ecologically inefficient to permit activities that undermine the efficacy of these efforts and to knowingly permit activities that undermine resource condition targets agreed to and endorsed by state and federal governments. All users should be required to comply with the same legislation and regulations. Failure to ensure this effectively subsidises those with licenses to pollute, permits to clear native vegetation not available to other landholders and to undertake other environmentally damaging activities with substantial costs to society at large.

Clause 61i refers to studies and recommendations to examine effective market and regulatory mechanisms, to enhance the operation of water markets and manage changes in usage patterns, channel capacity constraints and water quality issues. LTGA notes that after 2 biennial assessments, the NWI does not yet include standards for water quality and believes the mining and energy sectors' absence from the NWI represents an unfair competitive advantage.

Clause 79 refers back to clause 35. Water quality is a very significant and a serious omission from the 'environmental and other public benefit outcomes' described in clause 35. Water quality is intrinsically and economically valuable as water treatment costs clearly demonstrate. Water quality is also fundamental to many other, wider NRM outcomes and its deterioration has clear implications for downstream users. Water quality must form a key component of the NWI and all water users and all sectors of the economy must be engaged.

Clause 98 focuses on knowledge and capacity building. LTGA supports research into a better understanding of catchment processes that impact on water quality; groundwater and its dependent ecosystems, and of the inter-connections between aquifers and ground and surface water resources. Developments that interfere with poorly understood processes should not be permitted as the risks may be irreversible.

Metering

LTGA agrees with the old adage "you can't manage what you don't measure."
All water extractions, at all stages of coal seam gas-well development must be metered <u>and</u> reported.

The sustainability of prime agricultural land and Australia's food task.

Australia is a significant producer and exporter of agricultural commodities that feed tens of millions of people and our farmers are among the worlds' most efficient. This is remarkable when one considers most of our soils are old, eroded and nutrient deficient and our weather patterns and hydrology extremely variable. Nevertheless, there are a few areas in Australia where soils are regarded as among the world's best. These include the Darling Downs, Liverpool Plains and north western plains in the Moree area – areas targeted by CSG projects.

The global population is growing rapidly and it is predicted that we will face food shortages in the near future. In this context, the loss of good quality agricultural land has serious implications for food security and even global security if food shortages become more frequent.

Farmers' most important asset –their soil – is at risk from CSG developments. The storage of large volumes of associated water awaiting treatment or reuse, potentially contaminated with many toxic substances, is a serous risk. This water may contain 5-8 tonnes of salt/ML.[8] If untreated CSG water comes into contact with high clay content soils, such as those on the Darling Downs and Liverpool Plains, the soil becomes impervious to water. Plant roots cannot penetrate and the soil becomes useless for agriculture.[9] With evaporation no longer a preferred disposal method due to the risks of dam wall-failure and spills after intense rainfall events, concern is increasing that re-injected water could contaminate adjacent aquifers bearing higher quality water that is allocated to other users. While 'make good' provisions exist in Queensland, it appears the onus will be on landholders to prove CSG development as the cause.

Farmers with CSG infrastructure on their land lose control of their businesses and day-to-day property management. Parts of their farms will be put out of production for 20-30 years. With each gas well occupying 1 hectare plus all-weather access roads, 'flow-back water' storage ponds, gas and water pipelines, compressor stations, and potentially CSG water storage dams, brine ponds, workers camps and office buildings, the interference and disruption can be very significant. Hundreds of extra vehicle movements mean properties will be at increased risk from the introduction and spread of new weeds, adding to business costs.

The social and economic benefits or otherwise for regional towns and the effective management of relationships between mining and other interests.

Access and impacts on farm operations are emotive issues and landholders see great inequities in the laws applied to agriculture and NRM on the one hand and to the mining and energy sector on the other. Landholders who have diversified into eco-tourism are appalled that cherished landscape values on which they have built sustainable new enterprises can be destroyed and their businesses decimated. There are compelling social reasons why all legislation (not just Water Acts), regulations and policies must apply equally to all.

Farmers and other stakeholders in involved in Landcare, Bushcare, WaterWatch etc are appalled by the double standards and lament the waste of time, effort and money that goes into on-ground environmental works and stewardship initiatives, all too quickly undone by the implementation of gas projects.

Similarly, communities have invested huge amounts of time and money developing Catchment Action Plans (NSW) and Regional NRM Plans (Qld). Planning for mining and energy projects does not involve anything like the same level of grassroots consultation and engagement, but comes in over the top and makes achieving government - endorsed targets extremely difficult.

Community concerns go well beyond calls for appropriate compensation. Landholders' farms, businesses and lifestyles will be fundamentally and adversely changed – for decades. Their health, and that of their families and staff will be affected by fumes and dust. They will be subjected to unreasonable noise from hundreds of vehicle movements and heavy machinery operating around the clock, seven days a week.

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[8] Arrow Energy: Water and Salt Management, June 2010. http://www.arrowenergy.com.au/icms_docs/73090_Water_and_salt_management_brochure.pdf

[9] Water For Profit: Effect of water quality on micro-irrigation maintenance. http://www.growcom.com.au/_uploads/21514water_quality_micro-irrigation.pdf#System_maintenance

The experience of many landholders who have dealt with companies operating on their land has been overwhelmingly negative. Tara landholder, Peter McGowan has written extensively about his own and neighbours' experiences including health effects, intimidation by gas company staff and the decline in property values. [10]

Initial agreements and compensation arrangements between gas companies and landholders may have seemed fair and reasonable, but many have found that the development escalated well beyond what was agreed upon – without consultation. For example, an initial agreement for one gas pipeline and an agreed payment soon became multiple pipelines plus several gas wells plus associated access roads, with no discussion about an increase in the payment. (Kane Booth, pers comm.) Similarly, agreement for a single well at an agreed annual fee may soon become many wells plus the associated infrastructure, again with no consultation or discussion about an increase in the annual fee.

Property values inevitably fall.[11] There are very few buyers interested in a gas-field property (or one nearby). Real estate agents are finding properties close to gas developments extremely difficult to sell (Vince O'Brien, Elders, Roma , pers comm.) and banks are already refusing business loans to farmers because of falling farm values.

The wider community is increasingly angry that the costs of the significant impacts of mining and energy developments are borne by society at large while the profits are privatised and go to well-paid executives and company shareholders. The royalties are not returning to the regions in the form of increased funding for local governments, with significant implications for the maintenance of council roads.

Members of affected communities often mention the "arrogant" attitude of mining and energy company representatives. Not surprisingly, they resent not being treated as real people with legitimate concerns. EISs make it clear they are regarded merely as "sensitive receptors" in an industrialised landscape.

Many mining and energy developments operate with a largely non-resident 'fly-in, fly-out' (FIFO) workforce meaning many of the economic benefits of the project do not flow into the local economy. Only 11% of respondents to a recent survey of Queensland mining towns felt the industry has a positive effect on their lives. Significantly, even some FIFO workers reported dissatisfaction. Unaffordable housing can make it impossible for the whole family to relocate meaning enforced separations from loved ones. Some FIFO workers find themselves unable to participate in or contribute to either the community they work in, or the one in which they live.[12]

FIFO work forces have a number of social impacts on the towns close to these mining or gas developments. They are subject to rapid community and economic growth due to the expansion of the resources sector, leading to demographic changes. Local housing markets are dramatically affected with shortages of accommodation, a reduction in housing affordability and increases in

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[10] http://westerndowns.group-action.com/news-from-the-gas-patch/

[11] http://qcl.farmonline.com.au/news/state/agribusiness-and-general/general/csg-ripples-felt-in-rural-property/2085883.aspx?storypage=0

[12] http://www.couriermail.com.au/news/queensland/survey-shows-mining-booms-negative-impact-in-queensland/story-e6freoof-1226079369316

(town) property values and rents. High rates of pay for those in the mining and energy sector create a new social hierarchy in which local residents, especially blue collar workers, may feel inferior. Local businesses and farmers cannot compete and find it difficult to attract and retain local staff.

The overwhelmingly male FIFO work forces are mostly housed in work camps. Alcohol-fuelled male-on-male violence is often associated with this form of accommodation and has been studied in detail.[13] The study found these communities are more than twice as violent as the state average and are under-resourced. They lack enough police, medical facilities and other emergency and human services to cope.

FIFO workers' contracts usually stipulate 12 hour shifts that inhibit workers' participation in local community activities and service clubs. The culture is an extremely masculine one in which excessive drinking and displays of aggression are considered normal and even 'cool'. In some regions, many locals feel invaded or threatened by up to a thousand men living nearby and some deem visiting local clubs and pubs unsafe due to alcohol-fuelled violence. More young local women than young men leave such towns, further entrenching the masculine culture.

A study (Petkova 2009 cited by Carrington et al) of the social impact of the mining boom on six towns in the Bowen Basin (primarily serviced by a non-resident workforce living in temporary accommodation and work camps), found that while economic benefits for the companies were substantial, 'the multiplier effects in remote towns were much smaller than anticipated as most mine-related jobs were created off site in major urban centers and regions.' The study also reported socio-demographic impacts associated with commute mining operations, such as an increase in single men, increased rates of drug and alcohol abuse, motor vehicle accidents and crime rates and a decline in community organizations. Sexual and domestic violence is another problem acknowledged as related to resource boom communities.

Other related matters including health impacts.

Greenhouse gas (GHG) emissions

GHG emissions are relevant to this inquiry because, as the prolonged drought and recent floods have demonstrated, the MDB is vulnerable to the impacts of climate change and urgent action is needed to mitigate both the effects and costs of climate-related damage. Estimates of the cost of the 2011 Queensland floods range from $11 billion[14] to $30 billion.[15] The costs of flooding in Victoria in 2011 range from $676 million[16] to over $2 billion.[17] There are also undoubtedly significant costs to the health system arising from the stress-related conditions that accompany prolonged drought and follow the trauma of serious flooding.

CSG should not be confused with natural or "conventional" gas, traditionally associated with oil fields. "Unconventional" gas is a newer resource extracted from tight sands, shales or coal deposits that are too deep to mine economically. It has a different (significantly heavier) GHG footprint.

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13 Carrington, K., McIntosh, A., and Scott, J. *Globalization, Frontier Masculinities and Violence: Booze, Blokes and Brawls*, British Journal of Criminology Advance Access published February 9, 2010

14 http://www.theaustralian.com.au/news/nation/financial-cost-of-queensland-floods-put-at-6bn-and-rising/story-e6frg6nf-1225985224605

15 http://www.news.com.au/business/counting-cost-of-queensland-floods/story-e6frfm1i-1225988393452

16 http://news.ninemsn.com.au/national/floods/8244392/victorias-floods-cost-676m

17 http://www.theage.com.au/victoria/victorian-damage-bill-to-hit-2bn-20110125-1a4cf.html

The CSG industry repeatedly claims that gas-fired power stations emit up to 70 per cent less greenhouse gases than existing coal-burning plants. This figure does not include the emissions involved in producing the gas – the drilling, fracking, compressing, pumping, liquefying and transporting the gas; nor the loss of carbon-storing forests and woodlands cleared to make way for wells and pipes.

To export CSG, liquefaction is required. Full life cycle analyses show that the ultimate benefit is far less and in some cases results in higher CO_2 emissions than coal fired power generation.[18]

The total domestic emissions per year from the first three LNG projects approved in Queensland amount to 24.14 million tonnes of CO_2 equivalent (Mtpa CO2-e).[19] [20] [21]

Over the next three years, the CSG industry alone will increase Queensland's emissions by 21%. The emissions from combustion of the exported LNG from just these three projects will emit 136 Mtpa CO2-e which will not show up in Australia's GHG accounts. This represents a 2-3% increase in total global emissions.

It should be noted that no detailed studies are available into the GHG emissions of the Australian CSG industry. For this reason, LTGA has used research into the GHG emissions from another unconventional gas (shale gas) conducted by Professor Robert Howarth et al. It is our understanding that the production and extraction techniques involved are similar and that similar infrastructure is also used.

Research from Cornell University now indicates that the emissions footprint for unconventional shale gas is significantly higher than previously thought. **"**The GHG footprint of shale gas consists of the direct emissions of CO2 from end-use consumption, indirect emissions of CO2 from fossil fuels used to extract, develop, and transport the gas, and methane fugitive emissions and venting […] for both conventional and shale gas, the GHG footprint is dominated by the direct CO2 emissions and fugitive methane emissions."[22]

A significant amount of the water used in the fracking process "returns to the surface as flow-back within the first few days to weeks after injection and is accompanied by large quantities of methane […] far more than could be dissolved in the flow-back fluids, reflecting a mixture of fracture-return fluids and methane gas."[23] Howarth et al state that "Between 0.6% and 3.2% of

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[18] Comparative Life Cycle Air Emissions of Coal, Domestic Natural Gas, LNG, and SNG for Electricity Generation http://www.lcacenter.org/InLCA2006/Jaramillo-presentation.pdf

[19] Santos Petronask GLNG project 7.2 million tonnes per annum http://www.glng.com.au/library/EIS/0c Executive Summary (Section ES) FINAL PUBLIC.pdf ;

[20] Australia Pacific LNG Project Environmental Impact Statement Executive Summary http://www.dip.qld.gov.au/resources/project/aplng/eis-executive-summary.pdf

[21] Queensland Curtis LNG Project (BG/QGC) http://qclng.com.au/uploads/docs/Queensland_Curtis_LNG_Project_IAS.pdf

[22] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page 2**. Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[23] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale

the life-time production of gas from wells is emitted as methane during the flow-back period."[24]

"More methane is emitted during "drill-out," the stage in developing unconventional gas in which the plugs set to separate fracturing stages are drilled out to release gas for production."[25] Using data and methodologies involved in 2 different studies (EPA 2007 and Wood et al. 2011) Howarth et al estimated that between 0.33 and 0.62% of total well production is emitted as methane during the drill-out stage. [26]

"After completion, some fugitive emissions continue at the well site over its lifetime. A typical well has 55 to 150 connections to equipment such as heaters, meters, dehydrators, compressors, and vapor-recovery apparatus. Many of these potentially leak, and many pressure relief valves are designed to purposefully vent gas. Emissions from pneumatic pumps and dehydrators are a major part of the leakage […] GAO (2010) concluded that 0.3% to 1.9% of the life-time production of a well is lost due to routine venting and equipment leaks."[27]

"Additional venting occurs during "liquid unloading." […] Empirical data from 4 gas basins indicate that 0.02 – 0.26% of the total life-time production of the well is vented as methane during liquid unloading (GAO 2010)."[28]

Howarth et al "give a range of 0% (i.e. no processing, for wells that produce 'pipeline ready' gas) to 0.19% of gas produced as our estimate of processing losses." [29]

"Further fugitive emissions occur during transport, storage, and distribution of natural gas. Direct measurements of leakage from transmission are limited, but two studies give similar leakage rates in both the U.S.[…] and in Russia. Direct estimates of distribution losses are even more limited."[30] The more conservative of 2 studies quoted by Howarth et al "use this 1.4% leakage

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formations. A letter. **Page 3**. Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[24] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page 3**. Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[25] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page 3**. Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[26] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page 3**. Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[27] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page 5**. Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[28] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Pages 5-6.** Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[29] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page-6.** Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[30] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page-6.** Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-

rate as the likely lower limit" but noted comment by Revkin and Krauss (2009) "government scientists and industry officials caution that the real figure is almost certainly higher."[31]

"Summing all estimated losses, we calculate that during the life cycle of an average shale-gas well, 3.6 to 7.9% of the total production of the well is emitted to the atmosphere as methane. This is at least 30% more and perhaps more than twice as great as the life-cycle methane emissions estimated for conventional gas of 1.7% to 6%." [32]

LTGA reiterates that if this is the case with shale gas, there is every likelihood it is the same with coal seam gas since many of the same processes, techniques and infrastructure are involved.

Howarth et al conclude that "methane dominates the GHG footprint for shale gas on a 20-year time horizon,[33]" the one we should be most concerned about given the urgent need to reduce emissions. "At this time scale, the GHG footprint for shale gas is 22% to 43% greater than that for conventional gas."[34] This is "at least 20% greater than and perhaps more than twice as great as for coal when expressed per quantity of energy available during combustion."[35]

In 2010, "the US Council of Scientific Society Presidents wrote to President Obama, warning that some potential energy bridges such as shale gas have received insufficient analysis and may aggravate rather than mitigate global warming. And in late 2010, the US Environmental Protection Agency issued a report concluding that fugitive emissions of methane from unconventional gas may be far greater than for conventional gas." [36]

Air quality

Experience and investigations in USA & Australia in the vicinity of gas drilling including fracturing in coal, shale or other seams has revealed serious toxicity to communities by toxic volatile organic compounds (VOCs), polycyclic-aromatic hydrocarbons (PAHs), heavy metals (eg uranium, lead, mercury) and other compounds naturally present in coal seams. They maybe brought to the surface via leaks to the atmosphere or in the associated CSG water. These

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EtAl-2011.pdf

[31] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page 6.** Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[32] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page7.** Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[33] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page 7.** Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

[34] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page 7.** Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

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[36] Howarth,R W., Santoro, R., Ingraffea, A. Methane and the greenhouse-gas footprint of natural gas from shale formations. A letter. **Page 2.** Accessed from http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf

substances can and do contaminate air, surface water and underground water systems. Typical releases include BTEX (benzene, toluene, ethyl benzene and xylene). Of the compounds typically released:

- 25% were carcinogenic
- 37% affect the endocrine system
- 52% affect the nervous system
- 40% affect the immune system
- 100% affect the respiratory system.

(Note: Many compounds affect several systems whether drunk in contaminated water or inhaled).

In QGC's application to amend their Environmental Authority Number PEN 100020207[37] schedule B Air Emissions, confirms they are doing no air chemical monitoring, only dust, particle and odour monitoring. Given the presence of VOCs and PAHs, the National Toxics Network considers this inadequate.

Water quality

Water quality has particular relevance to the relationship between ground and surface water sources. The way in which water is used and managed has quality implications for other water users. Connectivity between coal seams and shallower groundwater sources; and surface water streams are known to exist in some areas where CSG development is occurring (ie Condamine Alluvium), and considered likely (and the subject of detailed study) in the Namoi valley. Groundwater experts are not prepared to categorically rule out the possibility of detrimental impacts.

CSG companies may be authorised to release treated associated water to rivers and streams. Treatment by reverse osmosis removes salts and membranes remove some other contaminants but not all. Discharge limits for each contaminant are set by the regulator (DERM in Qld).

Environmental Approval PEN 100067807granted to Australia Pacific LNG Pty Ltd (Origin) includes a table of chemical compounds to be released in treated water and the water quality limits and monitoring requirements for each (weekly). Many of these substances are known to be bio-accumulative. A few of these are covered in the table below.[38]

In total, at a release rate of 20ML per day, Origin is authorised to release the following from its Talinga facility into the Condamine River over an 18 month (547.5 days) period:
(Note that this is for one site and one company only.

Chemical compound	**Release rate/day**	**Total (release rate x 20ML x 547.5 days)**
Uranium	20g/ML	219KG
Toluene	800g/ML	8760KG (8.76 tonnes)
Xylene	600g/ML	6570KG (6.57 tonnes)
Ethylbenzene	300g/ML	3285KG (3.285 tonnes)
Benzene	1g/ML	10.95KG

37 http://anti-mining.com/environmental_authorities/ea-index.html

38 Full document at http://anti-mining.com/environmental_authorities/ea-index.html

Cyanide	80g/ML	876KG
Lead	10g/ML	109.5KG

Release limits were included in the Environmental Authority but most are not based on the ANZECC water guidelines, either because they were not listed in the guidelines, or were marked as having insufficient data to set a water quality guideline.[39]

The National Toxics Network notes there is no discussion of the persistence of the chemicals listed, nor their breakdown products or even how much of the contamination is expected to be absorbed to sediment, let alone their final fate. NTN believes the extent of permissible contaminants and the tonnage of BTEX is totally inappropriate for release to a natural water course, particularly given governments' much publicised banning of BTEX in fracking chemicals (Dr Mariann Lloyd-Smith, pers comm).

NOTE: A detailed analysis of all the contaminants authorised for discharge to the Condamine river, including the extent to which some are above safe limits can be found at http://www.nwc.gov.au/resources/documents/KH_complete_submission.pdf

Hydraulic fracturing (fracking)

In areas where the controversial hydraulic fracturing (fracking) process is used, there is serious and unquantified risk of groundwater being contaminated, either by fracking fluids, by saline associated water contaminated with the chemicals naturally present in the coal seam entering a freshwater aquifer, and / or by the gas itself.

The chemicals used in the fracking process include carcinogens, mutagens, endocrine disruptors, substances linked to cardiovascular and blood disorders, kidney, liver and gastrointestinal damage, respiratory diseases, brain and nervous system conditions, reproductive, skin and eye disorders and developmental problems in children.[40]

The CSG industry frequently states that the chemicals in fracking fluids are found in everyday, household items on any supermarket shelf, *implying* but never actually stating that this therefore makes them safe. According to APPEA, 23 chemicals are used in the fracking process in Australia.[41] The National Toxics Network has called for a moratorium on the use of fracking chemicals on the grounds that only 2 of 23 chemicals used in the process have ever been tested by the national industrial chemicals regulator (NICNAS), making assertions about their safety extremely hard to justify.[42] Ingredients include acetic and boric acids, bleach, caustic soda, detergents, polish and hydrocarbon derivatives. They should not be inhaled, ingested or even handled by sensitive people.

An estimated 30% to 70% of the fracking fluid resurfaces, bringing with it toxic substances naturally present in underground oil and gas deposits. This is pumped into storage dams.

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39 Lloyd-Smith, M., and Senjen, R. *Hydraulic Fracturing in Coal Seam Gas Mining: The Risks to Our Health, Communities, Environment and Climate* National Toxics Network briefing paper, April 2011

40 http://www.endocrinedisruption.com/chemicals.fracturing.php

41 http://www.appea.com.au/images/stories/mb_files/APPEA_fraccing_chemicals.pdf

42 http://ntn.org.au/2011/02/21/call-for-moratorium-as-report-finds-fracking-chemicals-have-never-been-tested-for-safety/

Sometimes, nothing is recovered – all the fluid stays underground.[43]

In the US, there are thousands of documented cases of drinking water supplies being contaminated by fracking fluids and gas even though they are separated by tens or even hundreds of metres of rock.[44] Cases of contamination have also been reported in Australia.[45]

Conclusion

CSG developments are having significant negative impacts on the natural resources of the MDB and its communities. Many of the risks are not quantified and some, including those posed to water quality, may be irreversible. Regulatory failure is effectively subsidising environmental damage, socialising those costs and exporting many of them downstream and into the future. This is unacceptable to a growing number of Australians.

LTGA advocates:

- An immediate moratorium on approvals coal seam gas mining projects (including exploration, production, extensions of existing projects, etc.) until both the long and short-term physical, social, economic and environmental impacts of these industries has been fully assessed.

- A "level playing field" ie: the withdrawal of all levels of government from financial investment in the fossil fuel extraction industry in all forms: direct participation (e.g. ownership, joint ventures, etc.), tax incentives/breaks, subsidies, etc. Government financial involvement raises a conflict of interest with government's role in ensuring the well-being of all its citizens.

- That a suitably empowered body conduct a comprehensive review of all water, natural resources, minerals and energy resources, land-use and land use planning legislation, regulation and policies, to ensure legislative reform and amendments achieve consistent outcomes; legal requirements to protect water quality; statutory water quality objectives, targets and reporting obligations; and equity for all sectors of the economy and community.

- Limiting the impact of existing licenses/agreements by the immediate establishment of an independent authority to monitor and ensure compliance by companies that are engaged in CSG mining with the conditions of their licenses/agreements at all stages of implementation, to enforce these agreements and ensure that appropriate, available penalties are applied, including reparation of damage, full compensation to those damaged and the cancellation of licenses for repeat or severe breaches (definitions to

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43 The Endocrine Disruptor Exchange http://www.endocrinedisruption.com/chemicals.introduction.php

44 Scientific American, 17 Nov 2008 http://www.scientificamerican.com/article.cfm?id=drill-for-natural-gas-pollute-water

45 ABC-TVs Four Corners "The Gas Rush" broadcast February 2011.

be established).

LTGA further believes urgent steps must also be taken:

- for water quality to be included in the 'public benefit outcomes' described in clause 35 of the NWI;
- to amend Clause 34 to ensure all sectors of the Australian community and economy are included equally in the NWI framework.

Thank you for the opportunity to make a submission to this important inquiry. If you have queries or require clarification of any points, please contact LTGA secretary, Ms Sarah Moles as above.

LTGA looks forward to attending a regional Committee hearing and to reading the Committee's final report.

Yours sincerely,

Drew Hutton,
President
Lock the Gate Alliance, Inc.