Submission
No 348

INQUIRY INTO COAL SEAM GAS

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INQUIRY INTO COAL SEAM GAS

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Submission from: Group Against Gas (GAG) Kyogle

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Contents

Key Points:

- The threats to vital ground and surface water systems and food producing land posed by coal seam gas (CSG) developments are unacceptable. It is crucial that water and food security be prioritised over gas production, particularly when these resources are so scarce in Australia, and when they are under increasing threat from human population growth and climate change.
- The Northern Rivers region is renowned for its natural values, visual beauty and vibrant, innovative communities- industrial CSG development is not compatible with these qualities and would destroy the very essence of our region. This clash of values is epitomised by the proposal to put a gas transmission pipeline right through the middle of one of the region's precious World Heritage Areas.
- The rush to coal seam gas is not about energy security for NSW, it is all about making money from export of gas to overseas markets. The company Metgasco has plans for a 90PJ export facility supplied by Northern Rivers coal seam gas production which would require in excess of 1500 gas wells, whilst it's planned local power station requires 40-55 wells.
- The recent regulatory changes to the rules governing coal seam gas activities in NSW do not adequately address any of the significant risks posed by this industry. Significant overhaul of relevant legislation and regulation is needed to effectively manage the impacts of the CSG industry.
- The health and well being of individuals and communities are being drastically affected by industrial gas production in Queensland and the USA. Northern Rivers residents do not want this industry expanding out of control across our region or state, as evidenced by the many anti-CSG groups that have formed, the thousands of people who have attended anti-CSG events and the opposition from six out of the seven local councils in the region.
- The ecosystem services, biodiversity conservation, tourism and public enjoyment values of public lands are threatened by coal seam gas developments on or

adjacent to these lands. There are significant areas of public lands that are likely to be damaged and degraded by any expansion of the coal seam gas industry in the Northern Rivers and across the state.

Recommendations:

- All CSG activity in NSW should be stopped to allow for comprehensive, rigorous, independent studies into the environmental, social and health impacts of the industry.
- There should be a complete prohibition on any CSG activity on or adjacent to high conservation value lands, wetlands, beneficial use aquifers, residential areas and homes, important food producing areas and public lands.
- Legislative and regulatory changes should be introduced to properly address the threats to the natural environment, local communities, water supplies, food production and human health. The rights of landholders to refuse CSG exploration and production should be enshrined in the *Petroleum Onshore Act 1991.*
- There should be full, independent assessment of the hydrogeological character of any areas that are proposed for coal seam gas exploration, before any exploration or production takes place.
- Any CSG activity should have to comply with all relevant environmental legislation, including chemical use, water management and native vegetation laws. Communities should have the legal right to enforce and challenge environmental laws under which the industry operates.
- The state government should invest in renewable energy alternatives rather than supporting the expansion of the CSG industry, thereby entrenching the state's dependence on fossil fuels and greenhouse gas emitting technologies.

- The NSW government regional land use strategy initiative should be extended to parts of NSW such as the Northern Rivers where there are proposals for significant expansion of CSG production.

Introduction

Group Against Gas (GAG) Kyogle is a community group based in the Kyogle area of Northern NSW and is made up of residents from across the Northern Rivers region. This group was formed by local residents in response to plans for the construction of the proposed Casino to Ipswich gas transmission pipeline and the expansion of coal seam gas exploration and production activities in the region. The group represents a broad cross section of the local community from cattle farmers and local business owners to organic growers and environmentalists. A diverse range of ages are represented from retirees and high school students, to parents with young families who are concerned for their children's futures.

We welcome the opportunity to make a submission to this Inquiry and voice our strong objection to the rapid, unchecked expansion of the coal seam gas industry in our region and across the state. We would like to present to the Committee when it visits our region and we invite the committee members to visit the Kyogle district and see first hand the areas that would be affected by any further expansion of the coal seam gas industry in the region.

Existing coal seam gas activities in the Northern Rivers

At present almost the entire Northern Rivers region is covered by existing petroleum titles or applications (Figure One). Exploration activities are taking place across the region and a 30-45 well gas field and 30MWgas fired power station have been approved in the Casino area. The gas company Metgasco is currently seeking

approval for construction of a pipeline to transport gas out of the region and is looking into the feasibility of supplying some 90PJ of gas to an export processing plant at an as yet undetermined location[1]. There are also preliminary plans to develop another gas-fired power plant in the south of the region, between Casino and Grafton[2].

Community opposition to coal seam gas activities

In the last nine months there has been a massive groundswell of community opposition to this industry in the Northern Rivers region. There are now at least five dedicated community groups active in different locations who are working to raise public awareness about the threats posed by the industry, engage with governments to express community concerns, and seek community input into decision-making processes. These local community groups are forming alliances with environmental organsiations and industry bodies who also have serious concerns about the impacts of coal seam gas activities on the environment, local communities, water supplies, food production and human health. Well-attended rallies and events have been held in major towns across the region, with some 3,000 people attending a rally held in Murwillumbah in May[3].

Groups in the region have taken their concerns to both state and federal governments, with local Grafton beef farmers meeting with their local representative Steve Cansdell, and members of the Keerrong Gas Squad travelling to Canberra to meet with federal environment minister Tony Burke's advisors. Our own group has approached the Member for Lismore Thomas George to speak at our meetings and listen to community concerns, though he has not attended to date. We have also presented a petition of over 1300 signatures to our local federal member Janelle Saffin, requesting that the federal assessment process for the proposed Casino to

[1] Metgasco Quarterly Reports, December 2010, March 2011, July 2011
[2] http://www.echonews.com.au/story/2011/08/04/time-to-get-educated-about-coal-seam-gas/
[3] http://www.echo.net.au/node/81972

Ipswich pipeline be broadened to include impacts on the World Heritage listed Border Ranges National Park.

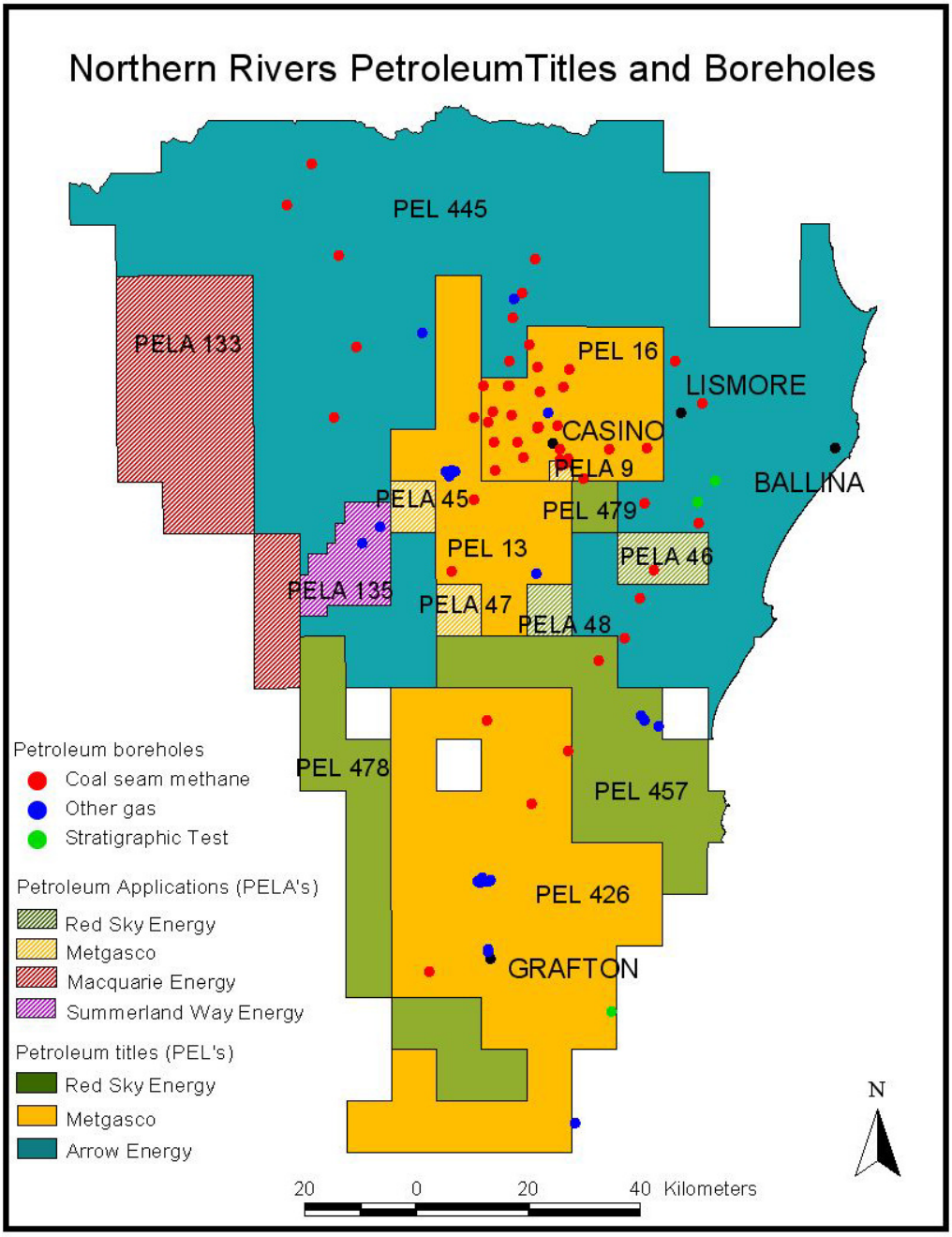

Figure One: Northern Rivers Petroleum Titles and Boreholes

Several group members have compiled this submission and we have attempted to cover the wide range of concerns that the members of our group have in relation to

the coal seam gas industry. Whilst most of the group do not have a background in relevant disciplines, we have been forced to inform ourselves about the science of this industry and its impacts so that we can engage with industry and government and have a worthwhile and informed input into decision-making processes when given the opportunity to do so. In the following submission we have attempted to directly address each of the terms of reference outlined by the Inquiry.

The environmental and health impact of CSG activities

Effect on ground and surface water systems

Groundwater risks

There now exists a large body of evidence that shows that coal seam gas (CSG) activities pose a range of significant threats to ground and surface water systems. The Australian Government's National Water Commission Policy Statement[4] clearly states that there will be a range of serious negative impacts on ground and surface water systems including: depletion of already over allocated connected ground and surface water systems; changes in water pressures and therefore availability; land subsidence over large areas; alteration of natural flow patterns and river and wetland health from release of waste water; cross-contamination of aquifers; and changes in beneficial uses characteristics of aquifers.

Australia is the driest inhabited continent on Earth and at the heart of the continent's water supply are our underground aquifers. The large volumes of water that must be extracted from the coal seam to facilitate gas flow can result in the lowering of

[4] Australian Government National Water Commission, 'The Coal Seam Gas and water challenge', August 2011.

adjoining aquifers or shallower, alluvial systems[5] [6]. Ross Dunn , a spokesperson for the petroleum industry group APPEA, has said: "drilling will, to varying degrees, impact on adjoining aquifers- the extent of impact and whether the impact can be managed is the question". Dunn goes on to say: "the intent of saying that is to make it clear that we have never shied away from the fact that there will be impacts on aquifers"[7]. Evidence from the Powder River Basin in the Wyoming/Montana region of the USA records drops of up to 200 feet in drinking water wells adjacent to coal bed methane production sites in the USA[8], whilst in Queensland drops of several metres[9] have already been recorded in farm bores. The removal of large volumes of water from the underground water system can also lead to a decrease in base-flow to creeks and rivers that are recharged from groundwater flows[10]. Australians know how precious water is, it is therefore our responsibility to protect and preserve all water resources for the very future that our descendants depend upon.

As a result of connectivity between coal seams and other aquifers containing higher quality water, there is also the risk of inter-aquifer transfer of poor quality water from the coal seam, which would pollute other aquifers and render them unusable for agriculture, town water supplies and stock watering[11]. If cross-contamination occurred, high quality aquifers could be contaminated, or their chemistry altered, through exposure to air, gas, toxic fracking chemicals and drilling fluids, or the release of natural compounds like BTEX, heavy metals and radionuclides that are

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[5] Groundwater (Deep Aquifer Modelling) for Santos GLNG Project - Environmental Impact Statement 31/3/2009 http://www.glng.com.au/library/EIS/Appendices/P2_Groundwater%20(Deep)%20FINAL%20PUBLIC.pdf appendix P2 section 3.4.2

[6] Hillier, J.R. Groundwater connections between the Walloon Coal Measures and the Alluvium of the Condamine River, August 2010

[7] See article on front page of The Sydney morning Herald on the 3rd August 2011 entitled "Coal Seam Damage to Water Inevitable".

[8] Western Organization of Resource Councils (WORC). 2003. Factsheet. *Coalbed methane development: Boon or bane for Rural Residents.*

[9] Four Corners Gas rush program: http://www.abc.net.au/4corners/content/2011/s3141787.htm

[10] Northern Geoscience: Draft report on Hydrogeological investigatiaons Dooralong & Yarramalong Valleys, Wyong NSW.

[11] Mavroudis, D. Downhole Environmental Risks Associated with Drilling and Well Completion Practices in the Cooper/Eromanga Basins, PIRSA 2001

present in the coal seam, many of which are known to have significant human health impacts[12]. There have now been at least four identified instances of toxic BTEX chemicals being found in wells or water monitoring bores at Queensland CSG operations[13]. The company Origin has been unable to explain where the BTEX found in one of its fracked exploration wells may have come from, and maintains that these chemicals are not present in drilling or fracking fluids[14].

The groundwater impacts of CSG activities are of particular concern given the thousands of wells that are planned across the eastern seaboard of Australia, the speed at which they are being constructed, the lack of independent monitoring of well construction and the risk of failure of bore casings and cement bore seals over time under saline groundwater conditions. According to a JP Morgan[15] report into the effects of the CSG industry on water systems in Queensland, there is a significant risk of gas migrating from coal seams to overlying aquifers where a pathway exists. This "process of gas migration usually occurs in areas at a distance from the CSG well where depressurisation is lower. As such, the gas does not flow at high pressure to the surface and instead migrates away from gas fields through natural geological pathways or via artificial conduits such as man-made water bore wells. The build up of gas in water bores can result in large uncontrolled releases of gas which may pose a risk to public health and safety".

Another concern in relation to possible groundwater impacts is drilling of substandard wells and that the longevity of well casings cannot be assured. A former long-term

[12]Loyd-Smith, M. & Senjen, R. (National Toxics Network) 2011, ***Hydraulic Fracturing in Coal Seam Gas Mining:***
The Risks to Our Health, Communities, Environment and Climate
[13] http://www.smh.com.au/environment/toxins-found-at-third-site-as-fracking-fears-build-20101118-17zfv.html, http://www.lngworldnews.com/australia-arrow-finds-traces-of-btex/,
[14] http://origintogether.com/your-questions/faqs/#fraccing
[15] JP Morgan **ESG and the Energy Sector** Water Concerns: QLD Coal Seam Gas Developments Report Summary

hydrologist with the Queensland government has stated[16] that there may be problems with up to five per cent of CSG wells being drilled in Queensland, which would lead to issues of contamination and depletion. Unlike the drilling of water bores in the GAB where an inspector attends every drilling event[17], there is no independent monitoring of the drilling procedures for thousands of gas wells being drilled in the GAB across Queensland. A study by Mavroukis (2001) maintains that the isolation of boreholes drilled for gas extraction from other beneficial use aquifers cannot be guaranteed in the long term due to failure of the cement drill casings. There are many mechanisms present in the underground environment that can contribute to deterioration of the cement that maintains zonal isolation between different underground formations penetrated during drilling. The most significant of these mechanisms is cement carbonation, whereby the cement casings deteriorate as a result of the saline water environment underground. The recent Senate Inquiry hearings into CSG held in Narrabri[18] explored the issue of casing failure and detailed instances where saline underground water has resulted in deterioration of water well casings which led to connection between previously unconnected aquifers and contamination of the GAB. In the long term, this raises serious questions about the possibility of depletion and contamination of beneficial use aquifers and who would be liable for the remediation of failed bores, when in many instances the company responsible for their drilling may be long gone. These types of well failures are now showing up in 50 to 100 year old wells in New York State (USA)[19].

At present, there is insufficient understanding of the interconnectivity between coal seams and other aquifers to know what the full implications of dewatering coal seams will be. The baseline data on existing groundwater levels is currently very limited, and

[16] http://news.ninemsn.com.au/national/8214369/gas-wells-could-leak-chemicals-into-water
[17] Four Corners Gas rush program: http://www.abc.net.au/4corners/content/2011/s3141787.htm
[18] RURAL AFFAIRS AND TRANSPORT REFERENCES COMMITTEE **Management of the Murray-Darling Basin system** (Public) TUESDAY, 2 AUGUST 2011 NARRABRI
[19] Ibid.

whilst some companies are monitoring groundwater draw down, this information is not publicly available and there is no independent monitoring. **We believe that there is an imperative on government to undertake full, independent assessment of the hydro geological character of any areas that are proposed for coal seam gas exploration, before any exploration or production takes place, to ensure that there will be no risk of contamination or depletion of beneficial use aquifers from CSG extraction.** It is vital that any such assessment be truly independent, not undertaken by scientists who have links with, or are resourced by, the minerals industry or mining companies, such as the proposed GISERA research initiative[20] where major research into CSG impacts is being funded by the proponents of the largest CSG project in Queensland.

The cumulative impacts of large-scale projects and large numbers of projects also need to be considered. For instance, the proposal for a large project by the company Eastern Star Gas in the Pilliga region in north west New South Wales covers an important area for recharge of the Great Artesian Basin (GAB), and the Basin is already likely to be seriously impacted by the thousands of wells drilled in regions of the GAB in Queensland. The Australian Government Water Group Advice[21] on EPBC Act referrals for major CSG projects in Queensland clearly states that "it can be concluded from the proponents' modelling that the legacy effects of the CSG developments are considerable, with at least 1,000 years passing before this part of the GAB will return to pre-CSG levels." We believe that governments cannot afford to ignore advice such as this and allow massive projects to go ahead without clearly modeling the impacts they will have on other users of groundwater supplies. Decisions on coal seam gas developments should take into account *all* of the

[20] 'First ever coal seam gas scientific research alliance established', CSIRO website, http://www.csiro.au/news/Coal-seam-gas-research-alliance.html

[21] Retrieved from: http://www.sixdegrees.org.au/sites/sixdegrees.org.au/files/Draft%20Water%20Group%20Response%20on%20EPBC%20Act%20Referrals.pdf

impacts on *all* the affected parties dependent on groundwater including natural areas, other industries and human populations.

Surface Waters

The disposal of the wastewater extracted from the coal seam also represents a major threat to surface water systems. This water is often highly saline- for instance a Queensland company estimates that each mega litre (one million litres) of waste water brings up 5 - 8 tonnes of salt[22], whilst the Queensland government estimates that 126,000 - 216,000 mega litres of produced water will be extracted per year in Queensland gas fields including 630,000 - 1,728,000 tonnes of salt. This water contains residues of the often toxic chemicals used in drilling and fracking processes as well as many other contaminants that are naturally present in coal seams such as heavy metals, BTEX compounds (benzene, toluene, ethyl benzene and xylene), and radioactive substances. There is no totally safe or adequate method of disposal of this toxic water or the massive quantities of salt that result from water treatment processes. Some of the currently used and proposed methods of disposal include irrigation of crops, storage in evaporation facilities, treatment and release of treated waters into waterways, and re-injection into aquifers. All of these disposal methods pose serious risks to either ground and/or surface waters and in some cases soils.

The use of produced water for irrigation of cropping land has been undertaken in other jurisdictions[23], however, there are critical barriers to the use of produced water for crop irrigation and stock watering which include the salinity, sodicity, electric conductivity, pH and toxicity of this water[24]. As the Energy Lab[25] (USA) reports:

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

[23] Produced Water Management Technology Descriptions http://www.netl.doe.gov/technologies/pwmis/techdesc/aguse/index.html

[24] Sessoms, H.N., Bauder, J.W., Keith, K. and Pearson, K.E. 2002. Chemical

"Perhaps the most significant barrier to using produced water for agricultural purposes involves the salt content of the water. Most crops do not tolerate much salt, and sustained irrigation with salty water can damage soil properties." As Sessons notes[26], there are a limited range of crops that can be grown on soils irrigated with produced water, thereby limiting the diversity of produce grown in areas where CSG production occurs if produced water is used in irrigation.

Whilst CSG wastewater can be treated to remove salts by reverse osmosis, this is a costly and energy intensive process and there remains the problem of how to dispose of the concentrated brine or salt residue from the process. It has been estimated that reverse osmosis treatment of brackish water (5000mg/l TDS)[27] costs between AU$330-630 per ML of water[28], with the energy consumption estimated to be some 1 kWhr per .001ML of fresh water produced. In a project such as the proposed Narrabri Gas Field in northwest NSW, based on a rate of water production of .16ML per CSG well, per day (given by the proponent in project documents[29]), the 1100 wells in the proposed gas field would produce up to 176 ML per day[30]. To treat the 176ML produced each day, given the lowest of the above estimates and a treated water (permeate) recovery rate of seventy per cent[31], would cost some $58,080- and use 123,200kWhr of power *per day*. In this project the estimated amount of salt/brine that would be produced each day is in the region of 52 ML, which means over one year some 18,980 ML of concentrate would need to be stored and/or disposed of, for

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Changes in Coal Bed Methane Product Water Over Time**.** Department of Land Resources and Environmental Sciences, Montana State University. Montana: Montana State University.

[25] same as 11 above

[26] Sessons, as 13 above

[27] Aqeeous solutions-experts in water treatment solutions http://www.aqueoussolutions.com.au/desal_faq.htm

[28] Clarke, D. 2008. South Australia's Proposed Desalination Plant. http://www.geocities.com/daveclarkecb/Australia/SaWater.html#Cost%20of%20desalination

[29] The Bohena Coal Seam Gas Project Review of Environmental Factors: Water Treatment and Disposal Project

[30] The Bohena Coal Seam Gas Project Review of Environmental Factors: Water Treatment and Disposal Project

[31] as for 18 above, p.16

each and every year of operation. There is at present *no solution* for the long-term disposal of these salts.

A further problem with reverse osmosis treatment is that it does not remove the smaller organic compounds found in CSG water. At present, water that is treated by reverse osmosis is being released into Queensland waterways[32], waterways that are part of the Murray Darling Basin and that are used downstream in NSW for a range of agricultural uses as well as town water supplies. This water is likely to contain organic compounds such as the BTEX group of chemicals that can be toxic in very small amounts and which bioaccumulate in the food chain. This wastewater has been approved for release without any analysis of the cumulative load of organic compounds that are being released into river system and therefore mobilized into natural aquatic systems and subsequently utilized by downstream users[33]. It is worth noting that many of these organic compounds are toxic in minute amounts and bioaccumulate in the food chain[34].

Another option currently in use and proposed for wastewater management is the use of storage and/or evaporation ponds. Some of the risks involved with these options include: spillage onto soil and runoff into waterways from dam leaks and during transport to these facilities via pipeline or tanker; overflow from storages during extreme rainfall events; spray drift onto adjacent lands and waterways; seepage into shallow aquifers; water transport impacts including heavy vehicle traffic with associated noise and road degradation; pipeline impacts such as vegetation clearing, erosion and landscape fragmentation; and animal deaths from exposure to pond water. Even in the early stages of this industry in NSW there have been wildlife deaths in the Pilliga Forest at pond sites, as well as extensive tree death from

[32] Australia Pacific LNG Pty Limited Environmental Authority {petroleum activities} No. PEN100067807
[33] Loyd-Smith, M. & Senjen, R. (National Toxics Network) 2011, Hydraulic Fracturing in Coal Seam Gas Mining:The Risks to Our Health, Communities, Environment and Climate
[34] Ibid

overflows and seepage of wastewater into adjacent vegetated areas. Whilst evaporation ponds are now banned in NSW, it is not clear whether storage facilities, which have the same risks associated with them, will still be allowed. In addition, evaporation ponds in projects that have already been approved will go ahead, such as the large 12-hectare evaporation facility planned for the environmentally sensitive Casino floodplain in northeast NSW[35]. There are also problems associated with the disposal of the drilling muds produced during drilling activities. In many cases these are being stored in temporary holding ponds, such as the new facility Metgasco has recently lodged a Development Application for in the Casino area[36]. Again, there is no satisfactory solution to long-term disposal of these substances.

A wastewater disposal method that is currently being trialled in Queensland CSG projects[37] and carried out in the coal bed methane industry in the US[38] is re-injection of the produced water back into the depleted coal seam aquifer or injection into other aquifers. This process is costly and energy intensive[39] and risks contamination of beneficial use aquifers with toxic or saline wastewater[40]. The US Geological Survey has recently published findings that suggest that re-injection processes canbe linked to earthquake activity[41]. ‘*"Earthquakes induced by human activity have been documented in a few locations in the United States, Japan and Canada,"* writes the USGS. *“The cause was injection of fluids into deep wells for waste disposal and secondary recovery of oil and the use of reservoirs for water supplies."*‘

[35] Metgasco: RVPS and CGP environmental assessment
[36] Temporary holding facility DA 2012/0021
[37] Australia Pacific LNG Project Talinga/Orana Environmental Management Plan http://www.aplng.com.au/pdf/talinga/Talinga_Att_5_Talinga_aquifer_injection_trial_management_plan.pdf
[38] Farag et al 2010, “Potential effects of coal bed natural gas development on fish and aquatic resources” p.7 from http://www.uwyo.edu/wycoopunitsupport/docs/Potential%20Effects%20of%20Calbed%20Natural%20Gas.pdf
[39] Warrence and Bauder, 2008
[40] Australian Government National Water Commission, ‘The Coal Seam Gas and water challenge’, August 2011
[41] http://rt.com/usa/news/fracking-earthquake-virginia-dc-817-061/

A significant concern with all of the proposed methods of wastewater disposal is the possibility that produced water will make its way into natural systems from "overland flow, infiltration or groundwater connections"[42]. This migration has the potential to seriously impact soils, wetlands, fish populations and aquatic ecosystems. These impacts have been detailed in semi-arid environments in the USA[43] similar to the western NSW environment where water is currently released into the ephemeral Bohena creek as part of the Eastern Star Gas pilot production projects[44].

It is vital that safe and environmentally sound processes are developed to deal with the large volumes of wastewater produced in CSG activities before large-scale CSG production goes ahead. It is not adequate that this industry goes into full-scale production before there is sufficient information available to assess the efficacies and impacts of wastewater management procedures. **If wastewater disposal methods that safeguard human health, ground and surface water systems, soils and vegetation cannot be developed, then this industry should not be allowed to expand in NSW.** The threats to water supply from CSG operations are particularly relevant given the increasing pressure that is being placed on our ground and surface water systems from population growth and climate change.

Effects related to the use of chemicals

A range of chemicals are used in the drilling and fracking fluids that are used in CSG extraction processes. A US House of Representatives inquiry into the chemicals used in the industry found that some 2,500 hydraulic fracturing products containing 750 chemicals and other components were used by just 14 companies in CSG

[42] Same as no. 22 above, p.7
[43] Ibid
[44] The Bohena Coal Seam Gas Project Review of Environmental Factors Water Treatment and Disposal Project

operations in the US, and up to 780 million gallons of the products were used in fracking processes[45]. Many of these chemicals are known to be harmful to human health if they become mobile in water or air, whilst for many the health effects are unknown as the chemicals used are not publicly disclosed or the data on their effects is insufficient to adequately assess their health and environmental impacts[46]. Many of the chemicals that are being used in fracking processes in the USA have been identified as having serious harmful health effects, including on the skin, eyes and kidneys; respiratory and gastrointestinal systems; brain and nervous systems; immune and cardiovascular systems; endocrine system or could cause cancer, mutations or birth defects[47].

In the Australian context there is a similar lack of information and disclosure relating to the chemicals used in fracking in this country[48], despite the fact that some 10-40 per cent of wells in Queensland are likely to use the fracking process[49]. The National Toxics Network[50] reveals that of the twenty-three most common chemicals present in fracking fluids in Australia, the National Industrial Chemical Notification and Assessment Scheme (NICNAS) have assessed only two, and these have not been assessed for use in fracking processes. Given that some forty per cent of the fluids used in fracking processes remain within the ground after the process is completed[51], **it is imperative that there is full disclosure of all chemicals used by CSG companies and that these chemicals be subject to comprehensive environmental and health hazard assessment by the industrial chemicals**

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[45] http://democrats.energycommerce.house.gov/sites/default/files/documents/Hydraulic%20Fracturing%20Report%204.18.11.pdf

[46] Doctors for the Environment Submission to the Senate Inquiry into Impacts of CSG on the Murray-Darling Basin

[47] http://www.endocrinedisruption.com/files/Oct2011HERA10-48forweb3-3-11.pdf

[48] [48]Loyd-Smith, M. & Senjen, R. (National Toxics Network) 2011, ***Hydraulic Fracturing in Coal Seam Gas Mining:***
The Risks to Our Health, Communities, Environment and Climate

[49] http://www.abc.net.au/environment/articles/2011/03/22/3169602.htm

[50] as for 35 above

[51] Coal Seam Hydraulic Fracturing Fluid Risk Assessment. Response to the Coordinator-General Requirements for Coal Seam Gas Operations in the Surat and Bowen Basins, Queensland. Golder Associates 21 October 2010

regulator, NICNAS. **In addition, there should be a thorough investigation of the ecotoxicology of these chemicals and their long term environmental fate** as well as the cost of remediation and clean up and disposal of any hazardous substances associated with the fracking process.

Effects related to hydraulic fracturing

According to Dr Jim Underschultz of the CSIRO[52], there are two major concerns related to hydraulic fracturing (fracking)- the chemicals used in the process and the inducement of fractures in formations outside the coal seam. If the fracture is not contained within the coal seam but extends into the aquifer above, there is a consequent likelihood of connectivity between previously unconnected aquifer formations and contamination of beneficial use water supplies from migration of fracking fluids and toxic substances and gases present within the coal seam. The risks posed by the chemicals used in fracking have been detailed above, and as a substantial amount of fracking fluid remains in the ground, there is a serious risk of harm to aquatic ecosystems, wildlife, human health and domestic stock should these chemicals contaminate ground and surface waters.

The US EPA[53] has detailed a range of impacts following the use of fracking processes in coal bed methane extraction in the USA. These impacts include:

- Explosive levels of hydrogen sulfide and methane under buildings and inside homes
- Death of vegetation (possibly due to seepage of methane and decreased air in root zones)

[52] http://www.abc.net.au/environment/articles/2011/03/22/3169602.htm
[53] U.S. Environmental Protection Agency. August, 2002. *DRAFT Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs.* EPA 816-D-02-006. Chapter 6. Water Quality Incidents. (http://www.epa.gov/safewater/uic/cbmstudy/docs.html)

- Increased concentrations of methane and hydrogen sulfide in domestic water wells
- Cloudy well water with increased sediment concentrations following hydraulic fracturing
- Strong odours and black coal fines in water wells
- Brown, slimy well water that smelled like petroleum
- Decrease in well water levels and surface water flows following hydraulic fracturing
- The discharge of produced water creating new ponds and swamps that were not naturally occurring in particular regions

I note that these impacts are from coal bed methane extraction processes, not shale gas extraction processes, and are therefore relevant to the Australian context. I make this distinction because some industry proponents[54] have been quick to disassociate themselves from the harmful impacts of the US gas industry by saying that all the impacts are related to shale gas production, not coal seam gas production which is not what they are involved in here in Australia. The above quote makes it clear that this claim is untrue.

There is now widespread concern that fracking processes have resulted in higher incidences of earthquakes in the regions where it is undertaken, including a higher prevalence of earthquake swarms[55]. The risks posed by hydraulic fracturing have been sufficient to cause France, South Africa and the United Kingdom to ban this process, and it is now banned in some states of the USA.[56]. Whilst the current regulation banning fracking in NSW is welcomed it is insufficient. This process should be banned indefinitely as it just poses too great a threat to precious groundwater supplies. In a continent as dry as Australia that relies so heavily on ground water

[54] pers. comm.. Henderson, P. CEO of gas company Metgasco, during public forum in Casino
[55] http://rt.com/usa/news/fracking-earthquake-virginia-dc-817-061/
[56] http://www.rodale.com/fracking-ban

resources for food and fibre production as well as town water supplies, we cannot afford to jeopardise our groundwater resources.

Effect on Crown Lands including traveling stock routes and State forests

Under the present minerals exploration regime in NSW even those public lands set aside for conservation such as State Conservation Areas, National Parks and water catchment Special Areas are not exempt from mining activities and infrastructure. In the Pilliga forests gas wells and associated infrastructure are proposed for a State Conservation Area (SCA), in the Northern Rivers a proposed major gas pipeline route passes right through the World Heritage listed Border Ranges NP, exploration drilling has recently commenced at Putty adjacent to World Heritage listed Wollemi NP, and exploration activity is planned for Special Areas in the Sydney, Illawarra and Hunter water catchments. Mining is also allowed in State Forests which effectively privatizes these areas which are supposed to be multi purpose areas for public enjoyment as well as providing a state owned timber resource. There are extensive areas of public lands in the Northern Rivers that would be under threat if CSG production were expanded in the region.

Projects such as the massive gas field planned for the State Forests and the SCA in the Pilliga region pose a range of threats including loss and fragmentation of vital habitat in an already heavily cleared region; increased spread of noxious weeds and feral pests and predators; and increased threat from bushfires. Gas field developments in natural areas threaten wetland ecosystems and important fauna habitats and effectively turn our remaining bushland remnants into industrial zones, with threats to wildlife from loss of habitat and food resources, high numbers of truck movements, industrial noise and pollution of land and waterways. Traveling stock routes (TSR's), which are already being targeted for pipeline developments and CSG exploration in NSW are particularly vulnerable. They should be protected from CSG

developments as they represent important wildlife corridors and refuges for plant and animals in otherwise cleared agricultural landscapes.

The type of industrial development involved in CSG extraction is completely inappropriate for these areas of public lands and totally compromises and threatens the natural values, ecosystem services and biodiversity reservoirs they preserve and maintain for current and future generations. **It is critical that high conservation value areas, drinking water catchments and water supplies, important vegetation remnants and corridors (including TSR's), wetlands and public lands, be properly protected from all CSG activities- we call on the government to ban all CSG activity on or adjacent to such areas.**

Nature and effectiveness of remediation required under the Act

The infant CSG industry in NSW has already been the subject of significant public scrutiny in relation to remediation of mining activities. Indeed, in an environment of inadequate regulation and lack of any significant independent monitoring, it has been largely up to the public to oversee the activities of this industry. Members of the public have exposed a number of instances where gas companies have failed to comply with the conditions detailed in environmental review documents (Reviews of Environmental Factor's). In the Pilliga Forests there have been examples of drill ponds being unlined, which has lead to seepage of toxic substances into surrounding bushland, and unfenced, which has resulted in deaths of native animals. Warrick Jordan, Campaigns Manager for the Wilderness Society, says[57] "In the Piliga Scrub, where exploration has started, we've found water dumped directly into creeks, produced water left in unlined ponds so it gets soaked straight back into the ground." In the Casino area there have been instances of abandoned drill sites being left un-remediated, with torn liners allowing seepage into surrounding areas and no removal

[57] http://www.mamamia.com.au/news/coal-seam-gas-gasland-and-fracking-making-farmers-uneasy/

of drilling fluids as required by REF's[58]. There have also been discovery of a number of leaking gas wells in the Northern Rivers region by members of the public[59].

These examples highlight the fact that both the nature and effectiveness of remediation under the Act is grossly inadequate; as are the assessment, approval and compliance protocols that currently exist. **Government should develop a strict legislative and regulatory framework for this industry to ensure proper preventative measures, environmental assessments, strong regulations and enforcement mechanisms are in place to ensure there are no adverse effects on the environment and communities and an independent authority should monitor these regulations.** It should not be up to the public to monitor CSG operations and it is not sufficient that the industry be allowed to regulate itself as is happening in Queensland- there should be independent compliance monitoring of all regulations. In addition, there should be much greater involvement of both local communities and the environment department at all stages of the assessment and approvals process for CSG exploration and production.

Given the risks outlined throughout this submission, we believe that all CSG activities should be stopped until full, independent studies can be conducted into the impacts of the industry on the natural environment, surface and groundwater systems, food production, human health and local communities. It will only be possible to design adequate properly legislation and regulation for this industry if the full impacts are properly detailed in a systematic way.

[58] http://www.northernstar.com.au/story/2011/06/13/gas-chief-admits-company-at-fault-over-storage-pon/
[59] http://www.northernstar.com.au/story/2011/03/01/leaking-coal-seam-gas-concerns/

Effect on greenhouse gas and other emissions

Whilst industry proponents promote the CSG industry as a clean and green alternative to coal, there is considerable doubt as to the accuracy of this statement[60]. The use of conventional natural gas for electricity production has been shown to generate about half[61] [62]of the greenhouse gas emissions of coal at the point of combustion. However, outside of the power plant emissions are much higher for gas than for coal[63] as a result of fugitive emissions and production and transport processes[64]. There has been no comprehensive, independent analysis of the full life cycle emissions of coal seam gas, with any figures that are currently used coming from CSG[65] industry proponents. **To properly ascertain the greenhouse emissions of CSG it is necessary for a fully independent study into the life cycle emissions from the industry to be undertaken that takes into account extraction, compression, leaks, pipeline transport, liquefaction, shipping, regasification, transportation and generation.** Fugitive emissions are an important consideration because "methane is 25-times worse than CO2 over a 100-year period. [ ] When its impact is considered over a 20-year period — which is a reasonable timeframe given our proximity to climate change tipping points – the climate change force [of methane] is 72-times greater than carbon dioxide.[66]"

Crucial to the argument around emissions is that we should not be comparing the emissions of CSG to coal- we should be comparing them to renewable energy

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60 Readfearn, G. Cloud over CSG emissions from: **http://www.brisbanetimes.com.au/environment/cloud-over-csg-emissions-20110818-1izx1.html; :** Fugitive emissions: what is the real footprint of coal seam gas? http://theconversation.edu.au/fugitive-emissions-what-is-the-real-footprint-of-coal-seam-gas-2940

[61] Readfearn etc

62Fugitive emissions: what is the real footprint of coal seam gas? http://theconversation.edu.au/fugitive-emissions-what-is-the-real-footprint-of-coal-seam-gas-2940

[63]Parkinson, G., 2011, *Is CSG cleaner than coal?*

[64] Senator Milne, 2011, Question and Speech - is coal seam gas as polluting as coal?

[65] As for 47 above

[66] Fugitive emissions: what is the real footprint of coal seam gas? http://theconversation.edu.au/fugitive-emissions-what-is-the-real-footprint-of-coal-seam-gas-2940

sources. Coal seam gas is still a fossil fuel, and even if it emits less than coal it still adds a significant amount of greenhouse gases to the atmosphere- some forty times the amount generated by solar and wind technologies. **By rushing into full scale gas production we are locking ourselves into a continued dependence on fossil fuels when we should be investing most of our resources in making the switch to renewables now, as we will have to do so anyway when the gas runs out in a few decades time.**

Relative air quality and environmental impacts compared to alternative fossil fuels

The major air quality concerns in relation to coal are the emission of toxic gases during combustion and the particulate pollution from airborne coal dust. Whilst CSG does not have these particular air pollution issues associated with it, there are issues with the toxic gases that are emitted at drill sites, compressor stations, and evaporation ponds, and when leaks occur during transport. In addition, "during various stages of gas exploration, production and maintenance, gases are vented directly into the air rather than contained or flared. Venting can release large volumes of toxic gases"[67].

When gas wells and compressor stations are located close to places of human habitation there can be serious risks to human health from methane, hydrogen sulfide and volatile organic compounds (VOC's)[68]. Exposure to VOC's (which are released from drilling and fracking fluids, during gas separation processes and from wastewater evaporation[69]) can lead to a range of serious health effects such as headache, loss of co-ordination, and damage to the liver and kidneys"[70]. VOC's can also result in formation of "ground-level ozone, a known respiratory irritant with

[67] GC Monitor, 'Gassed' : http://gcmonitor.org/downloads/gassedreport.pdf
[68] Dr's for the Environment submission to the senate inquiry into the Impacts of coal seam gas on the Murray-Darling Basin
[69] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1817691/pdf/ehp0115-a00076.pdf
[70] Ibid

detrimental effects on lung function"[71]. There have been reports from residents in the Tara area in Queensland of serious health impacts associated with commencement of CSG drilling in close proximity to their homes. These effects have included ear and nosebleeds, headaches, nausea, vomiting and skin rashes[72].

Other air pollution impacts include an instance in Queensland where there were reports from local residents of serious health impacts following the use of CSG wastewater for dust suppression along roads in the area[73]. Residents living in the vicinity of gas wells also report that the high levels of noise pollution from drill sites and compressor stations operating all night are resulting in sleep derivation and stress related illnesses[74]. There is also a risk from airborne pollutants when gas wells blow out and there is an uncontrolled discharge of gas, coal seam water and drilling/fracking fluids into the air and across the landscape. Blowouts such as this have occurred this year in the Dalby region of Queensland[75] and at Camden [76]in NSW.

Additional environmental risks- increased threat of fire

Coal Seam Gas extraction also poses significant threats of bushfires, both from increased ignition sources and fuels at the surface level, as well as underground fires in dewatered coal beds. Reports from the US highlight the high incidence of well fires and explosions, which can cause significant damage to the environment, and risk

[71] As for 51 above
[72] Orr, D, (Tara resident) July 2011, pers. comm.
[73] http://www.couriermail.com.au/business/claims-of-illnesses-and-cover-up-as-d-day-looms-for-coal-seam-gas-projects/story-e6freqmx-1225941426413
[74] Ibid
[75] **Arrow Energy caps coal seam gas well blowout near Dalby that was spewing gas and water** http://www.couriermail.com.au/business/coal-seam-gas-well-blowout-near-dalby/story-e6freqmx-1226060860912
[76] FORMAL WARNING GIVEN TO AGL OVER COAL SEAM GAS BLOW OUT http://nsw.greens.org.au/content/formal-warning-given-agl-over-coal-seam-gas-blow-out

human lives and property[77]. If coal seam gas developments go ahead in areas such as the Pilliga forests in north west NSW, a region that is prone to rapidly moving, high intensity burns, there is a serious threat of catastrophic fire as a result of the massive increase in ignition points and fuel load that a gas field comprises. The US Energy[78] Justice Network informs us that the EPA has reported "the spontaneous combustion and continued burning of completely dewatered coal beds [ ]. When water is pumped out of coal seams, coal becomes exposed to oxygen, and coal fires are possible. This can occur spontaneously, or from lightning strikes or ignition by grass fires or wildfires. The areas most likely to be the site of a coal fire are along the edges of basins where coal is close to the surface and oxygen can most easily enter the coal when water is removed."

The economic and social implications of CSG activities

Legal rights of property owners and property values

At present the legislation under which CSG extraction takes place in NSW and Queensland does not provide the landholder with the right to refuse access to their land or to prohibit extraction activities from occurring on their land. There has been widespread outcry from landholders in these states at the injustice of this situation. The whole process imposed on landholders has many drawbacks including:

- the superior negotiating skills of the mining company;
- agreements made with a landholder bind all future owners;
- many agreements have been signed without independent legal advice;
- landholders are often under an unreasonable time pressure to reach agreement;
- finalisation of disputed agreements proposals may take considerable time

[77]Riverkeepers: Fractured communities: Case Studies of the Environmental Impacts of industrial gas drilling
[78]From http://www.energyjustice.net/naturalgas/cbm#173

whilst in the meantime coal seam gas mining activities may commence;

- in Queensland, mediators are often Mining Registrars who are involved in the mining industry, not necessarily having an understanding of farming activities;
- a landholder's legal costs associated with a protracted dispute are payable by the landholder who in many cases may not be able financially to mount an adequate defence;
- it is doubtful if the ongoing financial loss of an organic producer certification would be realistically compensable;
- consultation with local landholders by coal seam gas companies is in many cases a sham with little time allotted for evaluating proposals;
- loss of privacy and security are realistically not quantifiable, nor are the deleterious effects of continual noise, dust and road traffic;
- the reduction in land values and environmental impacts affect other neighbouring landholders who are not parties to any compensation provisions that may appear in an access agreement;
- if long term damage is done to land and water resources, the company may no longer be operating and it will be impossible to make any claim on them for remediation or compensation.

In May 2010, Queensland Minister for Mining Stephen Robinson was forced to propose new laws in an attempt to "better protect landholders' rights when their land is accessed for coal seam gas exploration"[79]. Across NSW there has been widespread demands from landholders and farming industry groups asking for increased rights for landholders. The Greens Senator Larissa Waters recently tabled a bill in Federal Parliament[80] that would make legislative provisions for landholders to "refuse the undertaking of coal seam gas mining activities on their land without prior

[79] See the Sydney Morning Herald, May 17th 2010, http://news.smh.com.au/breaking-news-national/qld-plans-new-land-laws-20100517-v75x.html

[80] Landholders' Right to Refuse (Coal Seam Gas) Bill 2011

written authorization". It is clear that the current arrangements for access of CSG companies to private land heavily favour the companies and provide very few substantive rights to landholders. Given this imbalance, and the range of likely negative impacts of CSG activities on land and water resources and quality and amenity of rural life, we feel that it is imperative that landholders' rights be augmented. **We call on the NSW government to give landholders the right to refuse companies from accessing their land for CSG exploration and production by amendment of the *Petroleum (Onshore) Act 1991.***

Local farmers, residents and landholders have heard personal testimony from South East Queensland residents living in the vicinity of gas fields that their respective properties have become "unsaleable"[81] as a result of CSG mining, even though the CSG mining was not even taking place on *their* land. Despite indications that the *prospects* of CSG mining can temporarily increase land values in an economically struggling region[82], the *actual* outcome of CSG mining inevitably results in a fall in real estate values. CSG mining results in proliferation of wells and associated infrastructure across rural landscapes, and the evidence consistently shows that people do not want to live in or near a gas field.

Food security and agricultural activity

At a public meeting (attended by 300+ people) in Casino, NSW on Thursday 11th August 2011, concerns were raised by local farmers about the risks of CSG contaminating their produce. Food and water security concerns such as this are the foundation of much of the opposition to the coal seam gas industry in rural regions across the state. Leading Australian researchers, such as the CSIRO, urge us to remember: "groundwater resources in Australia underpin a range of agricultural and

[81] As cited at public meeting on 15th August 2011 at Lynchs Creek Community Hall.
[82] As described in personal conversation to the author by real estate agents in Casino NSW, during June, 2011.

mining industries"[83]. Agricultural production, particularly in inland NSW, relies heavily on the already over allocated water systems of the Murray Darling Basin and the Great Artesian Basin and other aquifers, and any depletion or contamination of these water systems will have a huge impact on food production. The Australian Government's department of Geoscience Australia says that coastal aquifers are an increasingly important resource and that: "Continuing population expansion along Australia's coastal fringe, combined with significant reduction in rainfall in many coastal catchments, has led to an increasing dependency on coastal groundwater resources"[84].

The loss of valuable arable land as a result of the spread of CSG wells, wastewater storage ponds, treatment facilities, pipelines and access tracks is also having a severe impact on the food producing capabilities of regional Australia. Some of NSW's most valuable and productive agricultural regions are currently under threat from CSG developments, including the Moree Plains, the Liverpool Plains, and the Northern Rivers. In addition to the loss of land taken up with gas infrastructure, CSG developments can add to erosion issues on farms, result in silting of streams and rivers, cause stock fatalities and disrupt water flows[85] [86]. There is already a massive proliferation of CSG developments destroying the best food producing areas of Queensland such as the Darling Downs, we have the opportunity in NSW to stop the industry from taking over our vital agricultural lands. Members of Kyogle GAG who are beef and dairy farmers are very concerned about the impacts coal seam gas could have on their best pastureland and waterways. Over many years they have improved their farming practices to take better care of the land and water and make their farm production more environmentally sustainable, yet their land is

[83] As viewed by author on August 30th 2011, http://www.csiro.au/science/Groundwater-hydrology.html
[84] As viewed by author on August 30th 2011, http://www.ga.gov.au/ausgeonews/ausgeonews201009/inbrief.jsp
[85] http://theconversation.edu.au/coal-seam-gas-a-risk-to-food-security-485
[86] http://www.aph.gov.au/Senate/committee/rrat_ctte/murray_darling/submissions/sub07.pdf

at risk from gas companies who are able to come onto their properties without landholders having a right to refuse access, and they don't even have to comply with all the legislation that farmers must adhere to, such as the Native Vegetation Act, the Water Management Act. Where there is a nexus between agriculture and mining, in areas where CSG is located, we are forced to choose between - **we strongly urge the State Government to prioritise our food and water security of NSW over CSG production by properly protecting all valuable food production areas and beneficial use water systems from CSG activities.**

Regional development, investment and employment, and State competitiveness

A recent report into the impacts of mining developments on regional Australia by Professor Kerry Carrington from QUT[87] highlights the fact that there is at present no mechanism whereby the economic benefits from royalties paid by mining companies can go back into the communities and regions that disproportionately bear the burden of mining development. Carrington's report details many of the detrimental effects that rapid, poorly planned mining expansion has had in Queensland and Western Australia, including the lack of local job creation with routinisation of fly in, fly out workforces; degradation of transport corridors and other local infrastructure; increased demand on social and health services and massively inflated rent prices.

The vast majority (often considered to be greater than 90%) of workers employed by CSG mining are employed specifically for the construction phase of CSG mining[88]. This means that despite claims that CSG mining is a good employer, the reality is that real, ongoing, and reliable employment is reserved for very few people. The actual skills needed for constructing CSG infrastructure are generally specialised,

[87] Fly IN Fly Out Inquiry from: http://www.abc.net.au/rn/lifematters/stories/2011/3301265.htm
[88] "Employment is typically largest during construction phase" reports the Chamber of Minerals and Energy of Western Australia in January 2005, for further details see: http://www.peopleforthefuture.com.au/files/files/20_FIFO_Report.pdf

meaning that CSG workers are predominantly fly-in/fly-out contractors, with little if any interest in the living environment of the communities where they are working[89]. Some of the problems in areas where the workforce is predominantly transient include: 2-3 times higher violent crime rates; 2.5 times higher mortality from accidents/ fatigue related incidents; and bad behaviour of workers under the influence of alcohol[90].

In addition, the presence of transient workers (in what are typically close-knit regional communities) destabilises pre-existing networks of reliable, inter-dependent economic relationships and can have other indirect and often unrecognised consequences on existing community life. For example the jealousy generated by outsiders seemingly (and actually) making large amounts of money from one's local and often child-hood landscapes and territories; intimidation caused by highly trained people belittling (by inference if not overtly) the skills and expertise of local people; and a general disregard for local standards of practice, economic regulation, trans-generational realities, and expressions of normality. These feelings of jealousy, intimidation and general disregard, then translate into behavioural and psychological expressions of dysfunction within the families affected by CSG mining[91]. In real terms, this means increased rates of domestic violence, self-harm, and child abuse- as disempowering behaviours of disempowered peoples.

Doctors for the Environment[92] have detailed the increasing incidence of solastalgia and other mental health problems in communities affected by mining activities.

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[89] See for example The Central Telegraph, 25th March 2011, http://www.centraltelegraph.com.au/story/2011/03/25/farmer-sick-csg-workers-camp/

[90] Carrington, K., Fly IN Fly Out Inquiry from: http://www.abc.net.au/rn/lifematters/stories/2011/3301265.htm

[91] See for example The Sun Herald, June 24th 2011, http://www.heraldsun.com.au/business/business-smarts/moneys-good-but-fly-in-fly-out-mine-workers-sex-lives-suffering-experts-warn/story-fn7j1dox-1226081548539

[92] **Submission to the Rural Affairs and Transport References Committee Inquiry** into management of the Murray Darling Basin – impact of mining coal seam gas **27 JUNE 2011** Submission from Doctors for the Environment Australia Inc. http://www.dea.org.au

Solastalgia is described as "*the distress that is produced by environmental change impacting on people while they are directly connected to their home environment*". The stresses from uncertainty and lack of control over land; water and air pollution and water shortages; permanent degradation and loss of productive agricultural land; loss of livelihood and landscape amenity; community disruption from transient workers and the pressures of negotiating with powerful mining companies, are leading to increased levels of stress related illnesses, depression and feelings of powerless amongst landholders who are often already under intense pressure from the impacts of extreme weather events such as droughts or floods[93].

The introduction of a mono-economy into regional townships dramatically impacts the diversity of pre-existing economic involvement in that town and region. Over many years economic networks develop and grow into what is often a fragile though functional web of interdependent economic citizens. In regional settings these economic networks are critically interdependent and especially vulnerable to outside influences, such as CSG mining. Given that the overwhelming majority of CSG employment is required for the construction of mining infrastructure, one can easily see that an influx of employees and employment opportunities will necessarily be limited to those skilled in CSG infrastructure construction which leads to a drain of skilled workers from other industries. Time and time again, local businesses collapse because they are simply unable to compete for the staff[94]. Employees are too often, though understandably, drawn to the immediate benefits of working in a temporary CSG mining industry, while in the long-term, local businesses consequently shut down. In the end a community is likely to be left with closed businesses and the abandoned aftermath of CSG extraction.

[93] Ibid
[94] Ibid

Some mining companies acknowledge the social impacts of mining as evidenced by the following statement from a Santos executive: "Positive and negative social impacts will typically be experienced by a community if the nature, magnitude, timing and duration of a social change are more than they are able and willing to manage"[95]. However, this statement really misses the mark in terms of who is responsible, placing the responsibility for "negative social impacts" squarely on communities rather than companies and government, and exemplifies the arrogance and belligerence with which such companies view the impact of their industry on Australian communities. It is increasingly clear that governments are not managing the social change impacts of mining on regional communities and companies are not being required to take responsibility for reducing these impacts.

There is an urgent need to direct serious resources to address infrastructure, services, social and community issues being experienced by mining regions and to make any use of non-resident workforces more sustainable. NSW has the opportunity to properly plan for these impacts before there is any further expansion in the CSG industry in this state. The federal government is currently undertaking an inquiry into the impact of fly-in, fly-out workers[96] on regional communities, chaired by Toney Windsor, the member for New England, whose electorate is affected by CSG exploration. It would be valuable for the state government to take note of the outcomes of this Inquiry so that NSW does not end up with the problems being faced in Queensland and Western Australia's mining regions.

[95] Page 23 *Santos GLNG Final Report: Social Impact Assessment*, 15th February 2009, http://www.glng.com.au/library/EIS/Appendices/Z_Social%20Impact%20Assessment%20FINAL%20PUBLIC.pdf

[96] See ABC New England North West News, 26th August, 2011, http://www.abc.net.au/news/2011-08-26/csg-inquiry-prompts-plea-for-aquifer-protection/2857200/?site=newengland&section=news

Expansion of CSG activities in an area such as the Northern Rivers is likely to reduce the diversity and variety of the regional economy and negatively impact a range of industries that are integral to the region, including beef and cattle farming, sugar cane production, as well as orchardists, nut producers, organic farmers, artisan farmers, and nature based tourist activities and accommodation. The whole appeal of this region is the productive land, scenic landscapes, clean waterways and large areas of remaining natural areas- these values are likely to be massively degraded by expansion of CSG activities in the region. There is widespread opposition to the CSG industry from people across the region and there is an urgent need for communities to have a say in how the region is developed. **We call on this Inquiry to extend the present regional land use strategy initiatives to our region so that we, as a community, get to have an input into the planning of the future regional development of the Northern Rivers.**

Royalties payable to the State

As detailed above, the current mining royalties regime does not direct money received by state governments back into regional communities to address the cumulative social and infrastructure impacts of mining developments. Moreover, there remains the question of whether the government is inherently compromised regarding CSG[97] in relation to royalties. That is, given the government's ownership of CSG resources (on behalf of The Crown) and the royalties they receive upon its extraction, in combination with its representation of the interests and wellbeing of the citizens of NSW- what is the government's priority? If government is receiving significant income from CSG developments there is a serious risk that their interest in protecting the interests of the environment and communities of the state may be compromised. The royalties currently received are inadequate to properly address

[97] See for example The Sydney Morning Herald, 30th August 2011, http://www.smh.com.au/environment/buyers-not-told-of-proposal-to-drill-for-coal-seam-gas-20110829-1jii5.html#ixzz1WT95ZHpT

the impacts of this industry, they should be increased and a portion of the income mandated to directly address any negative impacts of the industry. In addition the existing five year royalty free period should be abolished.

Local Government including provision of local/regional infrastructure and local planning control mechanisms

A significant impact of the CSG industry that is often ignored is the impact on local public infrastructure – especially roads. Our NSW inquiry should be aware that each CSG well requires literally hundreds of trucks, each in excess of 20 tones, for standard construction and operations[98]. Notwithstanding the particulate and chemical pollutants that trucks bring[99] to an area, is the economic impact of physically accommodating such vehicles on our roads. The roads we refer to are the smaller regional roads, of communities throughout regional and remote NSW. Local councils usually maintain these minor roads, without support from state or federal government. In simple terms, it is the ratepayers of a region who are the primary funders for the roads that are supposed to carry these CSG mining trucks. There should be adequate provisions for CSG companies to recompense local council for maintenance of all public roads, major or minor, which are used by those companies for the construction and maintenance of their wells, pipelines and other infrastructure.

It is unacceptable that local Government and local communities are currently largely excluded from planning and approval processes for CSG activities. In the Northern Rivers region, six out of the seven local councils have asked for a general moratorium on CSG extraction, with Murwillumbah council going further and imposing a moratorium on any CSG activity on council land. We believe that local

[98] As shown for example in the documentary *Gasland*, by Josh Fox, 2010.
[99] As discussed in interviews with human health experts in the documentary *Split Estate*, by Bullfrog Films, 2011.

councils and communities should have more input into planning and assessment approvals processes for CSG activities.

The role of CSG in meeting the future energy needs of NSW

Nature and extent of CSG demand and supply

According to APPEA[100], 'the CSIRO has [] estimated eastern Australia's CSG resources to be more than 250 trillion cubic feet, enough to power a city of 1 million people for 5000 years." The resource in Queensland has been rapidly developed over the last decade, with around 4,000 wells at present and an expansion up to some 40,000 wells planned for the future. Whilst some of this gas is being used for domestic supply to generate electricity and power gas appliances, the majority of it will be converted to LNG for export overseas. The industry is less developed in NSW where three small CSG production projects (AGL's Camden and Gloucester Gas Projects, Metgasco's Casino Gas project) and a pilot production project (Eastern Star Gas's Narrabri Project) for local power generation have been approved and are in various stages of construction, whilst there is widespread exploration activity taking place across the 25 per cent of the state covered by licenses.

Whilst the rhetoric and spin from governments and industry relating to the expansion in gas production is based on the need for Australia to reduce its carbon emissions

[100] http://www.appea.com.au/industry/csg.html

by moving away from coal to gas for electricity generation[101][102], a look at where the demand is coming from for the headlong rush into gas production tells a different story. Coal seam gas from all of the major gas fields that have been approved in Queensland in the last year (APLNG, GLNG, QCLNG Projects- totalling 18,650 wells) will be piped to Gladstone for processing into LNG and shipment to Asian markets[103][104]. These figures make it clear that the main driver for CSG expansion is the profits that are available from export of CSG from Australia to large overseas markets.

Relative whole-of-lifecycle emission intensity of CSG versus other energy sources

As detailed in an earlier section of this submission, the figures usually given for the greenhouse gas emissions of CSG are emissions at the point of combustion, which are about half that of coal. When comparing emissions of different types of gas, CSG is likely to have significantly greater fugitive emissions than conventional gas because it 'generally uses far more wells than "conventional" gas, and it is the drilling and development to production of those wells where the most fugitive emission take place'[105].

There have been no independent studies yet done on the full life cycle emissions of CSG, but investigations in the USA on non-conventional gas production suggest that the emissions from this type of gas may in fact be worse than those of coal[106]. Whilst

[101] 'State premiers turn up heat on Greens over their reservations about coal seam gas' http://www.theaustralian.com.au/national-affairs/greens-gas-campaign-off-target-says-origin-energy/story-fn59niix-1226117999751

[102] Santos website, http://www.glng.com.au/Content.aspx?p=55
[103] Ibid
[104] APLNG website: http://www.aplng.com.au/
[105] Fugitive emissions: what is the real footprint of coal seam gas? http://theconversation.edu.au/fugitive-emissions-what-is-the-real-footprint-of-coal-seam-gas-2940

[106] Howarth, RJ 2010 Preliminary Assessment of the Greenhouse Gas Emissions from Natural Gas obtained by Hydraulic Fracturing

the particularities of emissions from shale gas production detailed in these studies are different to those of coal seam gas production, it indicates that the combustion emissions figures alone are not an accurate indicator, and highlights the imperative that an independent investigation into Australian CSG industry emissions should be undertaken as a matter of urgency.

Dependence of industry on CSG for non-energy needs (eg. chemical manufacture)

As the CSG industry is not yet developed in NSW there are not likely to be any other industries that are dependent on it for non-energy needs.

Installed and availability costs of CSG versus other stationary energy sources

Beyond Zero Emissions (BZE) has developed a comprehensive plan[107] that outlines how Australia can move to a zero emissions energy future over a ten year period with transition to one hundred per cent renewable energy sources that are "proven technologies that are already commercially available and that have already been demonstrated in large industries." The plan details how 24-hour base load energy supply can be provided from a "mix of wind turbines, concentrating solar thermal with storage, small-scale solar, and contingency capacity from biomass and existing hydroelectricity." We believe that governments should be moving rapidly to renewable energy technologies instead of locking in a dependence on fossil fuels for several more decades by encouraging the establishment of a whole new generation of gas infrastructure.

[107] Beyond Zero Emissions: Zero Carbon Australia Stationary Energy Plan http://beyondzeroemissions.org/

At a recent community sustainability forum held in Lismore, 250 Northern Rivers residents came together to look at ways communities and governments could move to a more sustainable way of living. The focus group discussing energy issues at this forum agreed that two of the main objectives for the region should be

1."To make the Lismore area self sufficient in renewable energy sources as quickly as possible;

2. To make the Lismore area carbon neutral [] by reducing green house gas contributions as quickly as possible, [] stopping coal seam gas development, and minimizing, and eventually ceasing our demand for fossil fuels."[108]

The Northern Rivers has one of the highest take up rates of roof top solar schemes and has been a leader in the development of renewable energy initiatives such as the Nimbin Community Solar Farm Project[109]. GAG Kyogle believes that the people of this region want to move straight to a renewable energy future, not go via a thirty year dependence on greenhouse gas emitting CSG production.

Proportion of NSW energy needs which should be base load or peaking supply and the extent to which CSG is needed for that purpose/ Contribution of CSG to energy security and as a transport fuel

Government and industry are fond of repeating the mantra that gas is the clean and green transition fuel that we must have to transition to a low carbon economy and reduce greenhouse gas emissions, and that we need CSG to ensure the energy security of New South Wales and Australia. However, as mentioned earlier, the reality is that the majority of the rapid expansion in CSG exploration and production across the eastern seaboard is geared towards export to overseas markets, not domestic supply.

[108] **Key Focus Area - ENERGY Notes**
[109] http://www.rpc.com.au/projects/solar_farm.html

For instance, in the Northern Rivers region, the company Metgasco has approval to construct a gas fired power station (Richmond Valley Power Station)[110], with the required 2.3PJ per year supplied by 40 CSG wells and/or 15 'conventional' gas wells (Casino Gas Project). Metgasco is also proposing to supply some 90PJ of gas from the Northern Rivers to an export facility at an as yet undisclosed location. Given the number of wells required to supply the domestic power station, in excess of 1500 wells would be required to supply 90PJ for export. So, that is 40-55 wells for domestic supply, and at least 1600 wells for export- and the company has the audacity to tell local residents that we need to develop this resource to secure the energy future of NSW!!

The interaction of the Act with other legislation and regulations, including the Land Acquisition (Just Terms Compensation) Act 1991

Coal seam gas exploration and mining companies would have us believe that they must comply with a wide range of legislation[111], however the Environmental Defender's Office NSW[112] has recently put out a discussion paper that highlights the deficiencies in current legislation and regulation governing CSG activities in NSW. The EDO paper states, "when it comes to mining and water use, the extraction of coal and gas has been prioritised, while the laws designed to regulate and protect the State's water quantity and quality have been overridden and are inadequate. Mining activities have long been privileged over other land uses and the protection of the environment." At the federal level, Greens Senator Larissa Waters[113] has commented, "The federal government has ticked off on three of the four major Queensland projects under its outdated national environmental laws, which don't

[110] Metgasco Ltd, RVPS and CGP environmental assessment
[111] http://www.agl.com.au/about/ASXandMedia/Pages/AGL-Hunter-Mike-Moraza-CSG-Industry-tightly-regulated-7March2011.pdf
[112] '*Discussion Paper on Mining Law in New South Wales'*
[113] http://larissa-waters.greensmps.org.au/content/media-release/greens-welcome-nsw-coal-seam-gas-inquiry

require the impacts on groundwater, food security or the climate to be considered."

One of the major failings in legislation governing CSG extraction is that it is based on 'make good' provisions and adaptive remediation instead of the 'precautionary principle' and ecologically sustainable development (ESD). The EDO report[114] suggests that the legislative regime should be changed in a number of ways to make the industry conform to ESD principles, including:

i) The purpose or objective of the legislation should clearly stipulate that social, cultural, economic matters etc. must be managed within sustainable boundaries

ii) Decision-makers under the legislation must exercise their powers and functions so as to achieve that purpose or objective.

iii) Legislation should bind discretion through specific criteria or benchmarks that the decision-maker must be satisfied have been met before granting approval.

It is clearly evident that the current legislative regime under which CSG extraction is carried out is not addressing the range of significant environmental and social issues posed by the industry. For instance, despite being a large user of water, CSG projects that have been approved under Part 3A of the *Environmental Planning and Assessment Act 1979* in NSW are exempt from State Water Acts- approvals under the *Water Act* or the *Water Management Act 2000* are not required. Under Section 75U of the *Environmental Planning and Assessment Act 1979*, water use approval under section 89, water management work approval under section 90 or activity approval under section 91 of the *Water Management Act 2000 (NSW)* ceased to apply. This has constrained the ability of the *Water Management Act 2000* to achieve its objectives in relation to mining.

[114] EDO NSW:' *Discussion Paper on Mining Law in New South Wales'*

The National Water Commission has issued a formal position statement on the Coal Seam Gas industry in Australia calling for industry, governments and planners to adopt a precautionary and more integrated approach to managing water-related impacts of coal seam gas developments. The Commission stated that if not adequately managed and regulated, the coal seam gas industry risks having significant, long-term and adverse impacts on adjacent surface and groundwater systems. The National Water Commissioner[115], Chloe Munro, has said that the Commission believed coal seam gas developers should operate under the same rules as other water users because "if not adequately managed and regulated, the industry risks significant, long-term and adverse impacts on surface and groundwater systems." **We call on the government to ensure that coal seam gas exploration and mining be made subject to all relevant environmental legislation, including the native vegetation and water management laws, and that the community should be given standing to ensure that it has full legal rights to challenge and enforce environmental laws under which coal seam gas companies are operating.**

It is clear that amendments also need to be made to both the *Mining Act 1992* and the *Petroleum (Onshore) Act 1991* to ensure better environmental standards, including:

i) Broader definition of environmental impact

ii) Recognition of the importance of previous environmental performance of the titleholder

iii) Improved mine rehabilitation practices

iv) Introduction of statutory requirements for environmental reporting

v) Clarification of definitional issues

In NSW where a decision under mining law is to be made on whether to approve an exploration application, there is merely a requirement to "take into account" the need

[115] see for instance in the Sydney Morning Herald 6th December 2010

to protect natural resources. Similarly, there is an open discretion as to whether environmental studies are done, conditions imposed or mining sites rehabilitated. For major mining projects, the planning legislation has also given Ministers wide discretion in recent years. Legislation should adopt a "maintain or improve" requirement so that projects do not go ahead unless they can scientifically demonstrate a neutral or positive environmental impact. This would be especially relevant in the case of coal seam gas extraction and waste disposal techniques. The polluter pays principle should be enshrined in any amended legislation.

In some instances where environmental approvals are required for projects to proceed, such as under the federal EPBC Act, it appears as though governments are beholden to industry, as highlighted by the following newspaper article[116]: "The Federal Government was forced to water down its environmental conditions on a $15 billion coal seam gas project for Queensland after the company threatened to walk away. Evidence of the threat came as the Government's own National Water Commission raised fears of long-term impacts from the multiple projects planned for the Surat Basin. A letter dated October 16th from Queensland Gas chief executive Catherine Tanna to Federal Environment Minister Tony Burke said the conditions placed on the company's plans were too severe."We have indicated to your officers that we have significant concerns with the proposed conditions relating to coal seam gas water management, offsets and the timing of various approvals," Ms Tanna said. "In their proposed form, these matters present sufficient difficulty to prevent my recommending the project to the BG Group board for a final investment decision." Two weeks after the letter, the BG board approved the project, on which the Federal Government had placed 300 environmental conditions.'

[116] The Courier Mail on 5th December 2010
http://www.gasland.com.au/2010/12/courier-mail-federal-cave-in-on-gas-restrictions/

Land Acquisition (Just Terms Compensation) Act 1991

Our understanding of access arrangements for CSG exploration and production is that they are governed by the Petroleum (Onshore) Act 1991 and the Pipelines Act 1967 (which confer the right to explore but not the automatic right of entry onto private property) and that the Land Acquisition (Just Terms Compensation) Act 1991 is not applicable as the land is not actually acquired for CSG activities. Under these Acts (Petroleum Onshore and Pipelines) an access agreement must be negotiated with the landholder. The process is commenced by the service of a notice of the company's intention to obtain an access agreement. A generic agreement may be offered by the company as a starting point and any reasonable initial legal advice needed by the landholder is payable by the company. Both the *Mining Act 1992* and the *Petroleum (Onshore) Act 1991* contain provisions that may be included in an agreement. If agreement cannot be reached in 28 days, a request may be made for an arbiter to be appointed. The "elephant in the room" is the fact that the landholder will ultimately be forced to enter into an agreement with the mining company by an arbiter- there is no right to opt out of the process and any fees paid to the farmer for gas wells are unlikely to adequately compensate for damage to land and water resources, disruption to on-farm activities, air and noise pollution and other impacts that are likely to accompany CSG developments

Regulations

As further encouragement, the coal seam gas industry has been allowed to become largely self-regulating and governments have generally become reliant on information supplied by the industry itself. Environmental regulation has been ineffective and the responsible agencies lack the resources to undertake many compliance and

enforcement responsibilities. The EDO[117] discussion paper raised a number of issues and provided a comprehensive set of responses relating to monitoring and enforcement of mining law. Licence approvals and licence conditions were seen to be inadequate, as too were levels of monitoring, and there was broad concern about a lack of enforcement action. There is a perceived lack of proportionality between the seriousness of the offence and the penalty. The improvements that were suggested included:

i) Monitoring, enforcement and compliance efforts must be properly resourced.

ii) There is also a need to ensure compliance well after mining operations have finished. Using environmental bonds as security is a good way of ensuring that the funds are available for environmental rehabilitation work.

iii) Initiate an independent performance audit of compliance and enforcement activities in relation to mining in NSW, including consideration of adequate resourcing. The audit should be conducted by the NSW Auditor-General and/or NSW Ombudsman, with the results made public.

iv) Increase ongoing monitoring and responsiveness to community reporting, to identify breaches of conditions of mining operations.

v) Establish a process to independently audit mining operators' performance against Environmental Assessment predictions, statements of commitment, Subsidence Management Plans and mine site rehabilitation.

vi) Adopt a tiered enforcement framework for mining and planning legislation, to ensure breaches of mining approvals and conditions result in punishment that deters misconduct. The framework should include categories of serious offences, mid-range (strict liability) offences and minor (absolute liability) offences.

vii) Planning laws should give prosecutors and courts a wider range of innovative enforcement tools as in other environment and pollution laws. These tools

[117] '*Discussion Paper on Mining Law in New South Wales'*

should include orders to pay investigation costs; undertake works for environmental benefit, including fund environmental organisations; complete audits, training and financial assurances; publicize offences or notify certain people; and remove any monetary benefit of the crime.

viii) Provide the Planning Minister with powers to suspend or revoke mining approvals for breaches of conditions. In addition, establish a process for landowners to apply to revoke their consent to land access if mining operations breach conditions.

ix) Increase resourcing for relevant compliance and enforcement divisions in order to improve rates of audits, investigations and prosecution.

x) Review the adequacy of noise impact guidelines.

xi) Introduce compulsory environmental bonds.

The impact similar industries have had in other jurisdictions

In jurisdictions where the industries are more advanced, mining for coal bed methane and other unconventional gas has had significant and adverse impacts on health, water quality, groundwater levels, air quality, geological stability, public safety, farmland, bushland, wildlife, livestock, rural community life and citizens' trust in their respective governments. Given that past performance is often the best predictor of future performance, the state of play in areas where the industries are more mature is an indication of where NSW is headed unless significant changes to legislative and regulatory regimes are introduced as a matter of urgency.

It is impossible for anyone to document the full extent of the impacts of CSG mining, or of unconventional gas mining in general. The main difficulties are twofold: first, the mining industry is not transparent about its activities; and second, eyewitness reports suggest that affected individuals are often too frightened of repercussions to come forward with their experiences. Having said that, it *is* possible to document *some* of

the adverse impacts using independent reports, video footage, independent laboratory test results, government and mining company documents, and eyewitness accounts from those brave enough to go public. It is important to note, however, that the following set of impacts is not exhaustive.

Impacts of CSG mining in Queensland, Australia

Water pollution

CSG mining in Queensland has already resulted in a number of incidences of water contamination. Some examples are:

- The National Toxics Network reported[118] in June this year that permits are provided for the release of wastewater produced in association with the fracking process. As an example, they cited a permit[119] for Australia Pacific LNG Pty Ltd, which allowed the release of 20 megalitres (ML) per day of treated water, for 18 months, into the Condamine River (which is part of the Murray-Darling Basin[120]). Toxins listed in the permit included radionuclides as well as persistent bioaccumulative toxic substances, for example nonylphenols, Bisphenol A (BPA), chlorobenzenes, bromides, heavy metals such as lead, cadmium, chromium and mercury, and BTEX. There was no requirement for an assessment of the cumulative load or the potential to contaminate sediment, plants, aquatic species and/or animals prior to release. Although release limits were included for the listed compounds, the majority of these were not based on the ANZECC water guidelines[121] as

[118] http://ntn.org.au/wp-content/uploads/2011/07/NTN-CSG-Report-July-2011.pdf
[119] Schedule C, Australian Pacific LNG Pty Ltd Environmental Authority (petroleum activities) No. PEN100067807
[120] http://en.wikipedia.org/wiki/Condamine_River
121 http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_ quality

many of the chemicals were not listed in the guidelines or were marked as having insufficient data to set a water quality guideline.

- Energy company AGL was forced to investigate after NSW Greens MP Jeremy Buckingham filmed a 'soapy residue' erupting from a gas well near Glen Alpine. [122]
- When QGC fracked their Myrtle 3 well, near Dalby, in 2009, it connected the Springbok aquifer to the coal seam below, the Walloon Coal Measures. QGC reportedly used 130 litres of THPS, a biocide, in the fracking process[123], allowing the possibility of contaminating the Springbok aquifer.
- The ABC reported last month[124] that BTEX chemicals were found in a monitoring bore at Arrow Energy's fields near Dalby in southern Queensland. Arrow Energy's press release[125] confirms that the company detected traces of benzene, toluene and xylene in five of 14 shallow bores at Arrow's Tipton West and Daandine gas fields, approx 25 kilometres from Dalby. The samples were taken over three days from 14 purpose installed monitoring bores constructed around CSG dams.
- Eyewitnesses report that during the Queensland floods of early 2011, ponds associated with gas mining in the Surat basin gas fields were covered by floodwater. While no testing of downstream water quality was possible, it is reasonable to assume that pond contents were released into the general floodwaters. The blog comment below[126] is an example of these reports:

"… in the Surat basin gas fields I have photos of evaporation ponds going under floodwater & of course concentrated salts flushed out….another photo of a drill rig & camp going under in a flood in these parts earlier in the month. The landowner asked

[122] http://macarthur-chronicle-campbelltown.whereilive.com.au/news/story/agl-study-shows-gas-well-leak-to-be-harmless/
[123] http://www.abc.net.au/news/2011-02-21/farmers-count-cost-of-coal-seam-gas-rush/1951670
[124] http://www.abc.net.au/news/2011-08-30/more-tests-at-csg-site-after-carcinogens-find/2861614
[125] http://www.arrowenergy.com.au/icms_docs/102322_Arrow_Energy_advises_of_monitoring_results.pdf
[126] http://larvatusprodeo.net/2011/01/01/queensland-floods/#comment-254722

them not to drill there- showed them the debri from previous floods against the trees. Of course these CSG companies know more than any local landowner."

Health issues

CSG mining in Queensland has been linked to a number of health issues. Members of Kyogle GAG attended a recent landholders' meeting in Lynch's Creek, NSW, where the speakers included a mother from the Queensland gas fields whose children had developed asthma, as well as a variety of other symptoms, since drilling began in their area. This is a quote from a Tara resident, distributed by GetUp:

> "When my son first started developing the headaches, we thought he had a tumour. We were just so scared. He had CT scans and everything and it was all clear. Then we started looking into impacts of coal seam gas development as they had just started drilling in our area and - the headaches, the nosebleeds, skin rashes that some people in the area have - it's all consistent with what other people are experiencing. We know a local lady who lives within 200 metres of a gas well. She and her son both became quite ill - they were even passing out. Her young son's the same age as my boy and he was bleeding from the nose as well as the ears. This got us thinking as well as researching the impacts, because it was at the same time as coal seam gas came to our town, Tara. It's just scary. A lot of people won't come forward because they're worried about repercussions from the people working in the industry, so they won't speak out." Debbi, Tara.

These illnesses have arisen since gas mining began in the area. While there is no proof that mining activities caused the illnesses, there is a clear mechanism by which CSG mining could cause these kinds of health problems, and the timing is consistent with a connection between them. The mechanism is this- residents of gas fields inhale air containing airborne toxins produced by nearby gas mining activities. They also drink local water, which may contain water-borne toxins, also produced by gas mining activities. It's not always possible to know what's in the water or the air, because laboratory tests are expensive and often no one knows what to test for. But where tests are done, gas mining activities have often been shown to release air and

water-borne toxins into the environment. Some of these toxins are detailed in the preceding sections. See also the section below on gas mining impacts overseas.

Gas leaks and Dalby blowout

A Qld government investigation[127] of 58 gas wells in the Tara area found 45% were leaking in some capacity. "Four (7%) of the gas wells were leaking at a rate at or above ten percent of the lower explosive limit (LEL) of methane... One (2%) of the gas wells tested was found to be leaking above the LEL (lower explosive limit) of methane."

On May 22, 2011, there was a gas blowout at Arrow Energy's Daandine field 25 kilometres west of Dalby. The incident occurred at about 9 a.m. but was not reported to Tom O'Conner, the landowner, until 2 p.m. The gas and water reached 100 metres into the air and the following day was still at 40 metres. It was the fourth incident on the O'Conner property.[128]

Erosion of natural values in construction areas

Gas mining activities in Qld have already resulted in widespread, extensive, clearing of vegetation to construct roads, well pads, storage ponds and other infrastructure. As a specific example, the construction of liquefication plants and port facilities has seriously affected the natural environment near Gladstone. The area is part of the

[127] Qld Dept of Employment, Economic Development and Innovation (2010) Investigation report: Leakage testing of coal seam gas wells in the Tara rural residential estates' vicinity.
[128] http://lockthegate.org.au/media/display/3430

Great Barrier Reef World Heritage Area and a significant amount of mangrove vegetation on the island is being cleared to make way for three LNG processing plants. Dredging in the harbour, and the noise of construction work, affects the local dugong sanctuary as well as a pod of threatened Indo-Pacific dolphins that used to be regular visitors[129].

Disruption of communities and the lives of individuals

Kyogle GAG has heard the personal stories of a multitude of affected residents of gas fields. The stories are too numerous to list, but themes include:

- increasing distrust in within communities
- fear of violence from fly-in, fly-out workers with no social connections to the community, and who don't even shop at the local businesses
- long-time landholders (and more recent) selling up and leaving the area
- disrupted sleep because of noise from compressor stations
- disrupted lives as normal activities are put on hold in order to deal with mining activities
- people who can no longer stay for long periods on their property because they get headaches or feel sick there

In his evidence to the Senate inquiry into the management of the Murray-Darling Basin[130], Stephen Doyle, the chairman of the St Vincent de Paul Queensland Social Justice Committee, commented on his organisation's experience of the impact of gas mining activities. "We are also concerned about the disruption of the social fabric of local communities caused by the influx of large numbers of transitory workers—and there has been publicity lately about fly-in fly-out workers, predominantly male, not families, coming into these communities. It certainly does affect the social fabric of

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[129] http://lockthegate.org.au/media/display/4449

[130] Commonwealth of Australia, Senate Rural Affairs and Transport References Committee (2011). Inquiry into the Management of the Murray-Darling Basin. Brisbane, 20th July. Transcript, p48

those communities, and people are right to be concerned about it. There is pressure on health and education services." He later adds, "There should be equitable compensation to landholders on a community-wide basis. It appears that a lot of the [access] agreements are being negotiated individually and this is causing a great deal of concern and suspicion among landholders as to 'what sort of deal the bloke down the road got as compared to what I am getting'. It leaves them pretty unsatisfied about the justice and transparency of the whole issue."

In the same session, a mining company representative claimed to "engage with the community", in order to minimise disruption from mining activities. The Chair, Senator Bill Heffernan, replied[131], "Then why did we visit a place the other day where a person has gone to the trouble of building a new house and has been informed that 200 yards down the paddock there is going to be a well? Why did I strike a bloke yesterday in Dalby who has pleaded with the gas company that he can feel his walls vibrating from a huge compressor station that is somewhere within his property—it must be, because the walls are vibrating—and he has been told, 'We have tested it and it is okay, mate. You should have built your house out of solid concrete or something,'-is that a fair thing?

Erosion of citizens' trust in government

Accounts from residents of the Queensland gas fields make it quite clear that the locals have lost faith in the ability, or willingness, of the government (of any political persuasion) to protect their interests in the face of the mining industry. Many describe spending precious (unpaid) days writing submissions, gathering signatures for petitions, writing and telephoning their local representatives, only to find that it was to no avail. Many residents have taken to non-violent direct action, for example at the

[131] Commonwealth of Australia, Senate Rural Affairs and Transport References Committee (2011). Inquiry into the Management of the Murray-Darling Basin. Brisbane, 20th July. Transcript, p41

Tara Blockade[132]. As Queensland residents communicate their experiences to those in proposed gas fields in NSW, this attitude is spreading south. Kyogle GAG is aware of a large number of normally apolitical people, including grandmothers, mums, local businesspeople and farmers who are attending non-violent direct action workshops, in preparation to defend their homes and farms from gas field development. Where previously they might have relied on the government for this protection, they now believe they have no choice but to do it for themselves.

Other impacts

Some other impacts already felt in Queensland include: lowering of bore water levels; reduction in the area of productive farmland available for food production; and loss of wildlife and biodiversity due to clearing of vegetation.

The impact of unconventional gas mining overseas

Because the unconventional gas mining industry overseas is more advanced than in Queensland, there is substantially more documentation of the impacts. Kyogle GAG is a volunteer organisation, and members have had to take time out from their usual full-time commitments to prepare this submission. Given these constraints, it is impossible to cover more than a fraction of the documented impacts of unconventional gas mining overseas. Instead, this submission provides an overview, by giving a selection of examples, with a focus on the US.

Much of the unconventional gas mined in the US is in shale formations (for example the Marcellus Shale), but it is also mined from coal beds and sandstone (as in Wyoming and Colorado)[133]. The impacts from different forms of non-conventional gas extraction are very similar. In September 2010, “Riverkeeper”, a New York-based

[132] http://www.kateausburn.com/2011/05/14/tara-the-frontline-of-a-coal-seam-gas-war/
[133] Michaels, C., Simpson, J., Wegner, W. (2010) Fractured Communities: Case Studies of the Environmental Impacts of Industrial Gas Drilling. Riverkeeper, NY.

clean water advocacy group, released a report[134] (attached) entitled "Fractured Communities: case studies of the environmental impacts of industrial gas drilling". In it, they document hundreds of case studies involving known and documented adverse impacts of gas mining, including well blowouts, explosions, drinking water contamination, illegal discharges, surface water spills, improper wastewater treatment, stray gas migration, illegal operations, permit violations and so on. There is not room here to mention them all. Below are a few summarised examples. With references supplied in the attached document.

Well blowouts, stray gas migration, and explosions

- An incidence of gas migration caused a house to explode in March 2004 in Jefferson County, resulting in three fatalities.
- On April 1, 2010 both a tank and open pit used to store hydraulic fracturing fluid caught fire at an Atlas well pad. Flames were at least 100 feet high and 50 feet wide, with the plume of black smoke visible for miles. Residents had been complaining of noxious odours at the site for days before the fire.
- In October 2007, pressurization of the surface casing in a newly drilled gas well caused an explosion inside a residence and impacted a private water well.
- On June 3, 2010 gas well blowout in Clearfield County, Pennsylvania, about 100 miles outside Pittsburgh, sent at least 35,000 gallons of wastewater and natural gas spewing into the air for 16 hours.
- In June 2010, an explosion at a gas well in West Virginia sent seven injured workers to the hospital.

[134] Ibid.

- On December 15, 2007, high-volume hydraulic fracturing operations conducted by Ohio Valley Energy Systems Corp. caused an explosion inside a home in Bainbridge, Ohio. The structure was damaged significantly.
- In July 2009, a resident was evacuated because of a gas leak from an East Resources well.
- In November and December 2007, residents of Walnut Creek in Millcreek, PA were evacuated from their homes for over two months because recently drilled gas wells in the area caused a gas migration. Natural gas levels in and around homes were found to be at explosive levels.

Water contamination

- In August 2010, Pennsylvania Dept of Environmental Protection (PA DEP) found that Talisman Energy was responsible for a November 2009 spill that sent over 4,200 gallons of hydraulic fracturing flow back fluid into a wetland and a tributary of Webier Creek, which drains into the Tioga River, a coldwater fishery.
- In August 2010, PA DEP found Atlas Resources responsible for allowing hydraulic fracturing fluids to overflow from a wastewater pit and to contaminate a high-quality watershed in Washington County.
- At a drilling pad with three gas wells in Troy, PA, Fortuna Energy illegally discharged flowback fluids into a drainage ditch and through a vegetated area, eventually reaching a tributary of Sugar Creek.
- In June 2010, the West Virginia DEP released a report concluding that in August 2009 Tapo Energy discharged an unknown quantity of a “petroleum-based material” associated with its drilling activities into a tributary of Buckeye Creek in Doddridge County. The spill contaminated a three-mile-long segment of the creek before it was contained.

- Following nearby hydraulic fracturing operations in 2009, the Railroad Commission of Texas and the Town of Dish tested a resident's tap water and detected elevated levels of arsenic, lead, chromium, butanone, acetone, carbon disulfide, and strontium up to 21 times above allowable concentrations.
- In early 2009, the PA DEP found 9 drinking water wells in the Dimock area contained methane, four at levels indicating a threat of explosion. Isotopic analysis showed the gas originated from a nearby geological formation which also happened to be a high-volume hydraulic fracturing site operated by Cabot Oil and Gas Corporation. The PA DEP ruled out the possibility that the gas was produced by bacteria or originated from a shallower gas-bearing formation. Later, The PA DEP also found elevated levels of methane gas in wells that provide drinking water to 13 area homes and identified combustible gas in the headspaces of seven of the wells.
- In September 2009, additional incidents in Dimock were linked to Cabot when three liquid gel spills occurred at the company's Heitsman natural gas well pad. The spills, totalling over 8400 gallons, polluted a wetland and caused a fish kill in Stevens Creek.
- In August 2010, Chesapeake Energy was found to have contaminated three drinking water wells in Bradford County with methane, with a lid exploding off of one of the wells.
- In April 2009, drilling activities conducted by Schreiner Oil & Gas impacted at least seven drinking water supplies along Hedgehog Lane in Foster, PA. Two of the affected water supplies contained methane and five had iron and manganese above established drinking water standards. After investigating, the PA DEP found that "the stray gas occurrence is a result of 26 recently drilled wells, four of which had excessive pressure at the surface casing seat and others that had no cement returns."

And so on. Each example, in isolation, constitutes a significant environmental impact. Cumulatively, the impacts are considerable. However, impacts aren't limited to explosion hazards and water pollution.

Air pollution

Air quality studies are expensive. It's not possible to test air quality wherever gas extraction takes place. However, the studies that do exist raise alarm bells.

- The town of Dish, Texas, where significant gas mining activities occur, was so concerned about their air quality that in 2009 they spent 15% of their annual budget to commission an independent report[135]. They found high concentrations of carcinogenic and neurotoxic compounds in ambient air near, and on, residential properties[136]. The compounds included benzene, xylene, carbon disulfide, naphthalene, dimethyl disulphide, methyl ethyl disulphide, and pyridine metabolites. Many of the compounds were found in levels that exceeded either short- or long- term Effects Screening Levels established by the Texas Commission on Environmental Quality (TCEQ).
- A Southern Methodist University report[137] found that the pollutant emissions from gas drilling activities in the Barnett Shale surpassed those produced by all of the vehicle traffic in the Dallas-Fort Worth region.
- A July 2011 report[138] (attached) found air samples collected from around natural gas operations in the San Juan Basin area of Colorado and New Mexico, as well as Garfield County in western Colorado, contained at least 22

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[135] State Tests Air Around Drilling And Pipeline Sites, KERA, Oct. 14, 2009, http://www.publicbroad-casting.net/kera/news.newsmain/article/0/1/1566121/North.Texas/State.Tests..Air.Around.Drilling.And . Pipeline.Sites.

[136] Wolf Eagle Environmental, DISH Air Study Results, Sept. 15, 2009 at 9, available at, http://www. townofdish.com/objects/DISH_Air_Study.pdf.

[137] Al Armendariz, Emissions from Natural Gas Production in Barnett Shale Area and Opportunities for Cost-Effective Improvements, Jan. 26, 2009, http://www.edf.org/documents/9235_Barnett_Shale_Report. pdf.

[138] Gassed! Citizen Investigation of Toxic Air Pollution from Natural Gas Development July 2011, Global Community Monitor, www.gcmonitor.org

contaminants. These include 4 carcinogens (benzene, acrylonitrile, methylene chloride and ethylbenzene) as well as neurotoxins and respiratory irritants. Levels between 3 and 3000 times higher than those considered safe were found near homes, playgrounds, schools and community centers[139].

Livestock and wildlife

In 2010, the Louisiana Department of Environmental Quality (LA DEQ) found that a "milky white substance", containing high levels of potassium chloride, flowed from a natural gas well operated by Chesapeake Energy and Schlumberger Technology, and into an area accessible by cows, 17 of which died[140]. People who witnessed the deaths reported that the cows appeared to be suffering a slow, painful death, with many bellowing loudly, bleeding and foaming at the mouth.

Earth tremors

The process of hydraulic fracturing for unconventional gas extraction has been implicated in the production of earthquakes and tremors. For example, industrial gas drilling activity in the Barnett Shale has been linked to a series of minor earthquakes in the Fort Worth region[141]. The Dallas- Fort Worth area has experienced at least 18 earthquakes since early 2008. In the town of Cleburne, less than thirty miles from Fort Worth, at least seven earthquakes were documented in Cleburne alone between June and July 2009. While no formal proof has been established, it is significant to note that the town of Cleburne had not registered an earthquake in its 142-year history prior to the June quakes[142].

In Blackpool, in the UK, two earthquakes shook the area surrounding where Cuadrilla Resources was fracking. Brian Baptie of the British Geological Survey (BGS), said

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[139] http://www.gcmonitor.org/article.php?id=1339

[140] KLSA, We may now know what killed cows in Caddo Parish (May 2009), available at: http://www.ksla.com/Global/story.asp?S=10325772.

[141] Is Drilling to Blame for Texas Quakes?, NPR, June 30, 2009, http://www.npr.org/templates/transcript/ transcript.php?storyId=106059425.

[142] Temblors Rattle Texas Town, Wall Street Journal, June 12, 2009, http://online.wsj.com/article/ SB124476331270108225.html.

"The timing of these two events in conjunction with the ongoing fracking at the site suggests that they may be related." He added: "It is well-established that drilling like this can trigger small earthquakes."[143]

A culture of deceit

These impacts, both in Australia and overseas, have been perpetuated and exacerbated by what appears to be a culture of "whatever we can get way with" within the mining industry, including misrepresenting the facts and ignoring applicable legislation.

Industry marketing

Politicians and decision-makers who are informed only by industry lobbyists receive a sanitised version of mining activities[144]. By the time they become aware of the problems that the industry has glossed over, it is too late to prevent significant impact, for example to people, water supplies, air quality and animal life.

It is important to learn from the misfortunes of others, and not to fall into the same trap. Mining industry claims must be treated with a degree of caution. For example, a frequent claim by industry representatives is that "there is no evidence of adverse impacts" and that "fracking is safe"[145]. This is simply not true, as the case studies above show.

Already in NSW, we have seen misleading advertising[146], misinformation[147], and the famous "We have no plans to..." (WHNPT) phrase.[148] (Eyewitness accounts by

[143] http://www.independent.co.uk/news/science/small-earthquake-in-blackpool-major-shock-for-uks-energy-policy-2291597.html

[144] http://newmatilda.com/2009/03/24/has-carbon-lobby-captured-kevin-rudd

[145] For example, Peter Henderson, CEO of Metgasco, in his address to the Casino community, August 2011, stated," Fracking is a safe practice" and in response to a question about environmental impacts, replied "I don't think it's been established that this environmental harm has been done".

[146] www.unitedearth.com.au/thecreekblog/coal-seam-gas-lies-2

[147] www.unitedearth.com.au/thecreekblog/coal-seam-gas-lies

[148] See for example, Dart Energy's Jason Needham's quote: "We've got no plans to frack…" http://www.greenleft.org.au/node/47914

farmers from the gasfields in Queensland report that mining industry representatives, when negotiating access agreements, often say "We have no plans to...drill/construct more roads/build more infrastructure/etc". While often that may be technically true - as in, they may actually have no plans at that time - it is often misleading, as many farmers come away with the impression that they plan *not* to. And it isn't always technically correct, either. Farmers have sighted maps dating from *before* they were told WHNPT, that show plans for more wells, another roads, more infrastructure.) The mining industry has placed advertisements on TV and in newspapers, claiming "clean, green" credentials. The mining industry is also financing movies that show mining in a favourable, non-threatening light (for example, Rio Tinto and Woodside invested in the recent movie, "Red Dog"[149]). It appears that more marketing may be coming our way soon[150].

It is important not to be swayed by glossy advertising, or misleading phrasing, and instead to look at the clear evidence of the impacts gas mining has had in other jurisdictions, because these are the likely impacts in NSW.

Disrespect for applicable legislation

Another aspect of the "whatever we can get away with" culture is a disrespect for applicable legislation. Again, it is important to learn from the mistakes made in other areas, so as to avoid them here in NSW. Experience from other jurisdictions is that legislation, on its own, is insufficient to regulate the activities of gas mining companies. Effective enforcement is also required. The examples below point to an industry with a culture of simply flouting the law, and if found out, simply paying the fine. Fines which are only a fraction of normal operating costs (such as those set out

[149] http://www.encoremagazine.com.au/mining-companies-support-red-dog-feature-1582
[150] http://www.smh.com.au/environment/conservation/ad-campaign-aims-to-put-industry-view-on-fracking-20110904-1jsdr.html

in the Water and Other Legislation Amendment Act 2010 (Qld)[151]) are not effective deterrents.

For example, on December 12, 2006, PA DEP found that Synd Enterprises, Inc. and Vertical Resources had "continued and numerous violations" of Pennsylvania law and had shown a lack of ability or intention to comply with the provisions of the commonwealth's environmental laws. Among the violations cited were: over-pressured wells that cause gas migration and contaminate groundwater; failure to implement erosion and sedimentation controls at well sites which has caused accelerated erosion; unpermitted discharges of brine onto the ground; and encroachments into flood ways and streams without permits[152]. Novus Operating LLC began drilling wells without Susquehanna River Basin Commission (SRBC) approval, despite SRBC's notification of the need for prior approval[153].

On July 10, 2009, PA DEP issued a cease and desist order against U.S. Energy Development Inc. "for persistent and repeated violations of environmental laws and regulations": 302 violations since August 2007, 197 of which remained unresolved as at September 2010. The violations included: failure to implement measures to prevent accelerated erosion, unpermitted discharges, failure to restore well sites, encroachments into streams and wetlands without obtaining required permits, and failure to plug abandoned wells[154].

In November 2009, the PA DEP took action against Cabot Oil and Gas Corporation for: excessive pressure/improper or insufficient cementing (casings) on certain wells;

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[151] http://www.austlii.edu.au/au/legis/qld/num_act/waolaa2010n53379/

[152] PA DEP, DEP Seeks $657,040 Civil Penalty Against New York Company For Environmental Damage in Allegheny National Forest (January 11, 2007), available at: http://www.portal.state.pa.us/portal/server. pt/community/newsroom/14287?id=1114&typeid=1.

[153] SRBC, SRBC Orders Natural Gas Driller to Stop All Water-Related Work at Drilling Site in Tioga, County, PA (January 13, 2010), available at: http://www.srbc.net/pubinfo/press/docs/Project%20Re-viewNaturalGasNovusCeaseOrder11310.pdf

[154] PA DEP, DEP Orders U.S. Energy to Cease Drilling Operations Throughout Pennsylvania (July 10, 2009), available at: http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=2273& typeid=1.

pollution of private water supplies within Dimock and Springville Townships in Susquehanna County; discharge of natural gas into ground water; discharge of industrial waste and/or residual waste onto the ground and/or into state waters, as well as failure to keep adequate records[155].

Colorado Oil and Gas Conservation Commission's (COGCC) states that during 2008 and 2009, it issued fines to 17 gas operators for violations impacting public health, safety, welfare and water resources. COGCC also reported that approximately 726 spills or releases of exploration and production (E&P) waste were reported to the agency during those years[156].

In Queensland, in November 2009, Carbon Energy Ltd failed to report a discharge of contaminated water from their plant to a nearby creek[157]. The ABC's Four Corners[158] revealed that materials safety data sheet (MSDS) submitted by QGC for the fracking chemical THPS (Tetrakis hydoxymethyl phosphonium sulfate) was American, incomplete and 10 years out of date. Importantly, it failed to correctly describe the toxic nature of the chemical. Arrow Energy was recently fined $40,000 after breaching Queensland's gas laws and drilling on a property near Dalby for two years without permission from the landowner[159].

In summarising their report, the authors of Fractured Communities[160] state:
"At a time when the oil & gas industry should be on its best behaviour, the industry continues to operate with impunity and lobby against federal regulatory oversight.

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[155] PA DEP Cabot Oil and Gas Consent Order and Agreement (November 4, 2009), available at: http:// s3.amazonaws.com/propublica/assets/natural_gas/final_cabot_co-a.pdf.
[156] Colorado Oil & Gas Conservation Commission, Department Of Natural Resources, Annual Report To The Water Quality Control Commission Of The Colorado Department Of Public Health And Environment, 3 (2008, 2009).
[157] http://www.derm.qld.gov.au/media-room/2010/07/kingaroy-plant-closed.html
[158] ABC TV Four Corners, program 'The gas rush', aired 21 February 2011. http://www.abc.net.au/4corners/content/2011/s3141787.htm
[159] http://www.miningaustralia.com.au/news/arrow-energy-fined-40-000
[160] Michaels, C., Simpson, J., Wegner, W. (2010) Fractured Communities: Case Studies of the Environmental Impacts of Industrial Gas Drilling. Riverkeeper, NY.

Even as the impact of the Gulf disaster continues to shine a light on the true costs of deregulation, the industry continues to cut corners at the expense of workers and communities across America."

Conclusion

This collection of examples from more mature mining industries clearly demonstrates the serious potential impacts of CSG mining in NSW. It is crucial for NSW to avoid the serious environmental and social consequences that have been experienced in the gas fields of Queensland and overseas.