[redacted]

From: Chantelle Roberts <[redacted]
Sent: Friday, 30 January 2015 7:39 PM
To: Dupont, Patrick
Cc: Piers Verstegen
Subject: CCWA submission to the South Australian Parliamentary Inquiry into Unconventional Gas
Attachments: CCWA submission to gas fracking Parliamentary Inquiry-2014.pdf; Appendix A.pdf

FAO the Executive Officer, Natural Resources Committee

Dear Mr Dupont,

Please find attached a submission to the South Australian Parliamentary Inquiry into Unconventional Gas. The Conservation Council of WA prepared this submission for WA's own Parliamentary Inquiry on Unconventional Gas - we believe many of the issues are shared across WA and SA and hope this submission will be of interest to the Committee.

We would be happy to provide further evidence to the Committee in person if required.

Many thanks

Chantelle Roberts

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Conservation Council of Western Australia

Submission to the Inquiry into the implications for Western Australia of Hydraulic Fracturing for Unconventional Gas

Parliament of Western Australia

Environment and Public Affairs Committee

October 2013

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6.10. The need for cumulative impact assessments of potential gasfield developments, *prior* to exploration and production applications

6.11. Rational for unconventional gas mining and investigation of alternative energy supplies.

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Attachment A: *Five myths about shale gas fracking in WA*

Executive Summary and Introduction

The Conservation Council of Western Australia (CCWA) is the state's peak independent environment and conservation group, representing nearly 100 community-based member groups and tens of thousands of individual supporters. CCWA welcomes this Parliamentary Inquiry; however we believe the narrow Terms of Reference are insufficient and need to be expanded (see below).

The view of CCWA is that if allowed to proceed at the scale planned by industry and promoted by Government, unconventional gas mining will be one of the largest social and environmental issues for current and future generations of Western Australians.

Unconventional gas mining in Western Australia has the potential to:

- cause unacceptable permanent damage to WA's environment, ecosystems and natural and cultural heritage over very large areas;
- permanently contaminate groundwater and surface water resources;
- cause serious negative public health impacts;
- create significant social justice issues for farmers and traditional owners; and,
- act as a globally significant driver of climate change through releasing very high levels of greenhouse gas emissions.

While we believe these risks are by themselves unacceptable, there are several other contributing factors which make the practice of unconventional gas mining fundamentally problematic:

1) While technology development may lead to some reductions in risk in some areas, many of these impacts are inherent in the practice of unconventional gas mining and therefore unavoidable.
2) Current regulatory systems are inadequate for managing and mitigating the risks of unconventional gas mining and/or to prevent the practice where the risks are too high.
3) The established pattern globally is that the unconventional gas mining industry has been successful in 'capturing' governments and regulators to the detriment of environment and public interests, at least for the time required to establish the industry at a large scale. There is clear evidence that this has occurred in Western Australia.
4) When the full costs and benefits of unconventional gas mining are examined it is almost certain that this energy source would have far higher costs and significantly less benefits than alternative renewable energy generation sources.

Given the unacceptable and inherent risks of unconventional gas mining, the inadequacy of regulatory systems to protect communities and the environment from these risks, the 'captured' nature of regulators, and the abundant alternative energy supply options for Western Australia, CCWA calls for an outright ban on all unconventional gas mining development in WA, inclusive of exploration.

Given the particularly poor record f environmental damage and health impacts of gas fracking in other jurisdictions, the industry has come under considerable pressure from community and civil society organisations here and globally.

One of the tactics that has been employed by the industry, its representatives and supporters, is to promote false, misleading or obfuscating information. We are certain that this Inquiry will receive such input and we have attached to this submission a recent report from CCWA which outlines five common myths about shale gas fracking (attachment A).

As mentioned above (and expanded further in this submission) we believe there is strong evidence to suggest that Western Australia's primary regulator of unconventional gas fracking, the Department of Mines and Petroleum (and, to an extent flowing from this other government agencies such as the EPA and Department of State Development) are subject to industry capture, leading to a breakdown of confidence among community and civil society in these institutions.

Given the narrow Terms of Reference for this particular inquiry (which appear to us to be carefully crafted to avoid investigation of some of the most concerning aspects of the industry), it seems likely that the Committee itself is subject to the strong influence of captured regulatory and policy agencies within government and/or industry itself.

While the following submission provides detailed responses to the Terms of Reference, our submission also provides detailed evidence to show that a much wider investigation is vital. Issues which are outside of the Terms of Reference of this inquiry, but warrant full investigation include:

- Climate change impacts
- Health impacts
- Social impacts
- Groundwater contamination and surface water contamination
- Air pollution
- Impacts on farming and pastoral land, as well as natural ecosystems
- The adequacy of current regulatory settings inclusive of the ability of existing government agencies to make effective public policy
- Lack of community and civil society confidence in government regulators and regulation
- The need for proper inquiries into the cumulative impacts of gasfield developments

Proceeding with a narrow investigation based on the current Terms of Reference has the potential to be highly damaging, as the selective investigation of issues is likely to lead to an inaccurate perception of the risks associated with this type of development.

CCWA also urges the Parliamentary inquiry to consult as widely as possible. In particular, CCWA urges the WA Parliament to seek independent verification of any information or advice received from Western Australian government agencies and industry bodies, as well regulatory bodies from other jurisdictions which may be similarly compromised.

The following submission is begins by providing a background on unconventional gas development including its political and policy context in WA, Australia, and internationally.

Sections 2-5 address the Terms of Reference of the Inquiry. Section 6 presents evidence in a range of other areas that we believe must be included in the inquiry but may be outside the current Terms of Reference.

1. Unconventional Gas Mining in WA

1.1 Background

WA has considerable identified unconventional gas in shale and tight sandstone formations. In particular, WA has two internationally significant regions of gas bearing shale and tight gas rock, centred on the Mid West (the North Perth sedimentary basin) and the Kimberley (the Canning sedimentary basin).

WA also contains other regions that are considered prospective for shale and tight gas, especially the region from Carnarvon up the Ningaloo coast, the South West (especially around the high conservation value Whicher Ranges), and in the Officer Basin. Industry estimates have suggested that the Australian shale gas industry will spend at least $500 million on exploration over the next 1-2 years.

Unconventional gas mining causes greater environmental harm than conventional gas mining. Terrestrial impact is much greater, as is risk to water resources, and rates of climate change causing fugitive emissions of methane. Additionally, and importantly, increases in unconventional gas production challenge investment in renewable energy, undermining international efforts to prevent climate change from degrading the natural environment, and harming communities (both in Australia and internationally).

It is clear that the WA government wants to invest in development of an unconventional gas mining industry. Department of Mines and Petroleum documents express great enthusiasm for unconventional gas mining, and a range of incentives are in place to smooth approvals process and stimulate activity, such as co-funding grants for 'innovative drilling', and subsidies through decreased royalty rates for unconventional gas mining.

CCWA does not believe that the WA government has done the type of due diligence that will be required if we are to ensure that unconventional gas mining – shale and tight gas fracking - does not cause unacceptable damage to the Western Australian environment and public health. To date there have been no environmental assessments, and certainly no attempts to consider landscape scale impacts. CCWA considers that this work must be done urgently, and prior to any development (inclusive of exploration). Further, CCWA's view is that new fossil fuel precincts should all be declared off limits to development because of their role in fueling dangerous climate change.

Finally, CCWA is aware of no attempts to determine the level of risk to public health of unconventional gas mining. Studies concerning the risk to health have been conducted in other regions – the Canadian state of New Brunswick has, for instance, released a study concerning the potential health impacts of shale mining of health. In Australia, concern about the possibility of health impacts of unconventional gas mining has been expressed by bodies as eminent at the Australian Medical Association (https://ama.com.au/media/ama-calls-coal-seam-gas-health-checks). In the light of concern from such bodies, it is appropriate that work is done to properly assess potential risks, as well as to identify gaps in knowledge.

1.2 Community Concern

It is important to note that WA unconventional gas development is being pushed forwards by government and industry in a technocratic and non-consultative manner, despite abundant evidence that unconventional gas mining has created greater conflict in areas that have seen development internationally than any other type of resource development over recent decades.

It is to be anticipated that conflict of that type will accompany development in Western Australia, especially given the environmental movement's opposition to development, experience to date in eastern states and expressed concern of local communities.

It is wrong to push landscape altering industrialisation on communities that don't want it. Experience in other regions internationally demonstrates some of the conflict we may see in WA. Communities have been torn apart and undermined. Shale and tight gas industrialisation is deeply unpopular with almost everyone – across political affiliation, age, gender, ethnicity and income. The anti-CSG movement on the east coast is the largest event in grassroots community mobilisation that Australia has seen in decades, with protests all up and down the coast often numbering in the thousands. The 'Lock the Gate' federation of anti-unconventional gas groups has over 100 member groups. A similar movement is emerging in Western Australia. In our own Mid-West region the issue of shale and tight gas fracking has become something of a livewire, and CCWA is aware of around a dozen community groups in Western Australia that have formed from concern about the impact that shale and tight gas mining will have on their communities, local environment, and in some cases on the broader WA environment. This movement that will inevitably grow as the threat becomes clearer and better understood.

Social conflict will be exacerbated by the fact that under the WA Petroleum Act, farmers do not have a right of veto to prevent unwanted shale or tight gas mining on their land. Many feel helpless to prevent the damage to their farms and communities that gas fracking will inevitably entail. This is an issue that has been of considerable concern to, for instance, the WA Farmer's Federation, who have lawyers working fulltime representing the interests of farmers in disputes with gas companies that want to build gas mines on their properties. Already, litigation is reaching court, with a Mid West farmer currently locked in a dispute with a gas mining company.

The significant liabilities that landholders are likely to be left with as a result of gas fracking activities includes reduced access to groundwater, contaminated ground and surface water, ongoing fugitive methane emissions, high-risk and uninsurable infrastructure on farms, decline in property values (or in some cases, unsalable land) and very significant surface disturbance with associated loss of agricultural productivity. Given this, it is easy to see why the level of anxiety in regional communities regarding the threats of gas fracking is rapidly increasing.

Most people have no idea what shale and tight gas fracking involves, what the risks are, and what experiences in other regions can tell us about whether it is an industry that we want to see imposed on iconic regions of Western Australia. Despite that lack of knowledge, and the failure of any social licence that it implies, the government is intent on pushing forward with development. It is to be noted with particular regret that attempts by the environmental movement to be involved in community consultation have been rebuffed by this government.

2. Impact of Hydraulic fracturing on Current and Future Uses of Land (Term of Reference A)

2.1 Recommendations:

- *Research required.* The environmental impacts of industrial development centred on shale and tight gas fracking will be unacceptable; however, we currently do not know enough to properly understand them. More research, most of it specific to WA conditions, is required. There must be a complete ban on unconventional gas development until research of appropriate depth and quality has been completed
- *Fast movement.* It is recommended that WA moves quickly to assess the potential risks from unconventional gas development
- *Landscape scale assessment.* Potential environmental damage and related potential impacts on public health should consider potential impacts at a landscape scale, not at (as is currently the case) a well be well basis
- *A better understanding of underground water is required.*
- *Conservation Estate.* All unconventional gas development and exploration in conservation estate should be immediately banned
- *Agriculture.* The potential of unconventional gas mining to affect agricultural land use through water abstraction, groundwater pollution, degradation of farming land, loss of organic status and other types of damage should be considered
- *Tourism.* The potential of unconventional gas mining to affect tourism operators – e.g., in Wildflower country, Ningaloo, South West viticulture regions – should be considered
- *Indigenous Heritage.* The parliamentary inquiry should consult with the appropriate representative bodies for aboriginal communities in targeted regions to ensure that policy decisions are informed by strong awareness of aboriginal heritage issues

2.2 Summary:

At present, not enough is known to accurately assess the scale of potential harms to the environment that will flow from unconventional gas mining; however, we know enough to be able to judge that the impacts will be severe.

Shale and tight gas fracking will industrialise the Western Australian landscape and will contaminate groundwater. The evidence that this is the case has become increasingly strong; for instance, a recent Duke University report showed that rates of methane are 600% elevated and rates of ethane 2300% elevated in the vicinity of shale gas wells in Pennsylvania[1]. The US EPA is currently conducting a multi-year study into contamination of groundwater in shale gas fields.[2]

Development of unconventional gas fields will also create significant surface environmental disturbance.

Fundamentally, shale and tight gas fracking involves the drilling of wells, most of which pass through groundwater aquifers, in order to target gas held in shales or tight sandstone. The fracturing process

[1] Available at: http://www.nicholas.duke.edu/news/higher-levels-of-stray-gases-found-in-water-wells-near-shale-gas-sites.
[2] See http://www2.epa.gov/hfstudy

itself requires many thousands of litres of chemicals – including many known carcinogens – to be mixed with millions of litres of water then pumped into the wells at extreme pressures to fracture the deep-lying gas bearing rocks, in order to release that gas. Onshore shale and tight gas fields resemble something similar to aerial bombing ranges, with tens, hundreds, sometimes thousands of cleared well pads with associated truck parking and space for gas compressing facilities and so forth. Each such clearing will be up to several hectares in area. Other associated infrastructure required to develop a gas-field including access roads for each of these well pads, and the pipelines required to transport gas either to market domestically, or to LNG facilities for export.

Each frack well also requires one or more settlement ponds, in which stored fracking fluids pose a very high risk of contaminating surface water in the surrounding environment, as well as creating high levels of dangerous atmospheric pollution. This is particularly the case with post-frack 'produced water', which contains a range of other pollutants released from the deep lying shales – most notably radon (the second highest cause of lung cancer in Australia), and a range of lung damaging volatile organic compounds.

Considerable amounts of shale and tight gas fracking activity has occurred around the world – particularly in the United States. Some regions that have seen intense activity have geology that is analogous to that in Western Australia. These locations can be used to illustrate some of the potential for environmental harm that shale and tight gas industrialisation brings with it. Amongst observed harms have been impacts that range from irreversible hydrocarbon and chemical contamination of groundwater aquifers to induced seismic activity.

It is true that many shale and tight gas source rocks lie at a considerable distance from groundwater resources. It is not true – contrary to a vein of industry lobbying that has obtained considerable traction within government departments and within cabinet that this fact eliminates serious concerns regarding pollution of groundwater sources.

The major pathway for pollution of groundwater is, indeed, precisely the well itself. Although effort is made to ensure that these wells are well-built and protect groundwater resources, no gas well is secure – and indeed, a range of research has shown that they suffer extremely high rates of failure, in which well casings lose their ability to protect the surrounding environment from gas pollution.

A study of shale gas wells in Pennsylvania conducted last year showed that 6-7% of newly constructed shale gas wells in that United States state were leaking within a year of being built (Ingraffea, 'Fluid Migration Mechanisms Due To Faulty Well Design And/Or Construction', 2012). Industry research has shown that over 60% of conventional gas wells fail within 30 years – a startlingly high number (Bruffatto *et al*., 'Oilfield Review', ConocoPhillips & Schlumberger, 2003).

There is reason to be concerned by these high failure rates. The Mid West of our state has long been the home, for instance, of a conventional gas industry centred around communities such as Gingin and Dongara. There is a chance that gas wells used in these regions will begin to fail as time passes, and that is concerning. But it is worth nothing that the level of industrialisation anticipated from theunconventional gas industry is of a different scale, and with this scaling up comes a scaling up of risk to water and health. Whereas a profitable conventional gas-field can be centred around a single well, the same is not true of unconventional gas sources like shale and tight stone. Each well produces far less gas, and dozens, hundreds, sometimes thousands of wells will be required in order to develop a gas field.

Every one of these dozens, hundreds, thousands of gas wells becomes a source of enduring environmental risk.

Local people in communities around such gas-fields are right to be alarmed about the integrity of their water.

Further, it is worth noting that well failure is not the only potential pathways for hydrocarbon pollution with shale and tight gas development. Others potential pathways include faults, which riddle the gas rich North Perth Basin region below Geraldton – an area for which considerable amounts of gas fracking activity is anticipated - and abandoned wells from previous exploratory or production activity.

Finally, it is to be noted that we have little to no detailed information about the natural interactions between WA's groundwater systems and the underlying geology. If pollution incidents do occur, we have little understanding about the type or scale of damage to the environment, to farmland, and to public health that might flow from such incidents.

To allow development of a shale and tight gas fracking industry in WA is to allow a very large and risky experiment which could permanently compromise the groundwater that Western Australia relies upon for drinking, agricultural production, and food security.

Until a thorough assessment of the likely cumulative impacts of gas fracking in WA has been undertaken, development of this industry should be put on hold.

2.3 Cumulative Impacts on Landscape

CCWA is particularly alarmed that no efforts have been made to assess potential impacts at a landscape level. Unconventional gas mining effects landscape scale systems, with landscape, ecology, land use and water resources each components of a highly connected and complex landscape system.

In particular, CCWA is deeply concerned by the impact that shale and tight gas mining will have on much loved Western Australian landscapes such as the Mid West (particularly on the exceptional bio-diverse Kwonghan Heathland wildflower country), the Kimberley, and the Ningaloo Coast. Indeed, much of Western Australia's shale and tight gas lies below some of the most beautiful and bio-diverse regions in the world – the wildflower country, Ningaloo and the West Kimberley.

The causes of environmental impact that flow from unconventional gas mining are multiple, including terrestrial landscape disturbance and degradation, spreading of invasive feral species, pollution (atmospheric, to soil, and to water). Unconventional gas extraction can affect biodiversity in a number of ways. For instance, unconventional gas mining may result in the degradation or complete removal of a natural habitat through excessive water abstraction, the splitting up of a habitat as a result of road construction or fencing being erected, or from construction of the well-pad itself. New, invasive species such as plants, animals or micro-organisms may be introduced during the development and operation of the well, affecting both land and water ecosystems. Water pollution incidents may affect vulnerable species.

As mentioned above, the key difference with regards to environmental risk that differentiates unconventional gas mining is well intensity. Because of the nature of the mining process, unconventional gas mining operations require many more wells than equivalent scale conventional gas mining operations. Where a conventional gas field can be drained by a small number of wells, many unconventional gas mining operations require thousands of wells.

CCWA have done some research aimed at providing estimates of the number of wells that WA might see if the industry develops to capacity. The figures are startling. The Mid West region, for instance, might see well over 25,000 wells – assuming a field size of 71 trillion cubic feet, and similar well intensity ratios as have been seen in equivalent US shale gas fields such as the Barnett Shale (c.15,000 wells for a 40tcf gasfield). Using the same multiplier, the Kimberley may see upwards of 100,000 wells.

The concerns here are multiple. Firstly, large areas of land will be taken up by these wells, even excluding other types of impact. A well pad and associated truck parking and on-site processing facilities take up a considerable amount of space – in the region of a few hectares. Pipelines are required to service each well. These will either be above ground, in which case they create an impediment to wildlife, stock, or agricultural use, or underground, in which case considerable disturbance is created during the process of actually laying the pipelines in the first place.

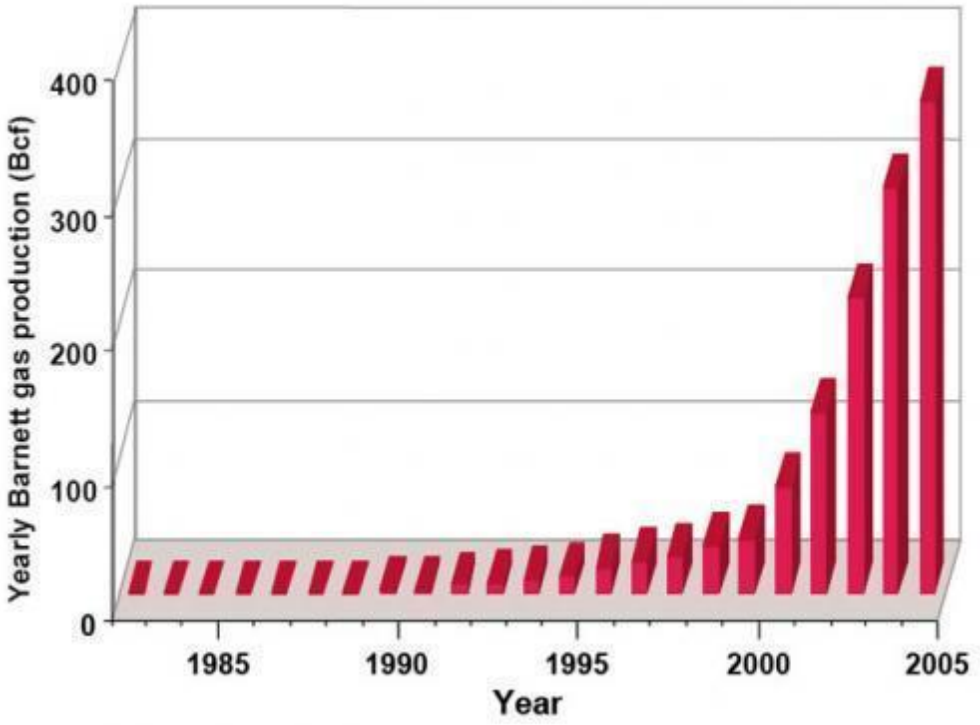
Each well will also require the build of high quality all-weather roads – roads capable of supporting a considerable number of movements of heavy trucks. Total truck movements during the construction and development phases of a well are estimated at between 7,000 and 11,000 for a single ten-well pad (European Commission Report, 2012). The effects may include increased traffic on public roadways (affecting traffic flows and causing congestion), road safety issues, damage to roads, bridges and other infrastructure, and increased risk of spillages and accidents involving hazardous materials. Required will be new trunk roads in remote areas (e.g., the Kimberley) as well as higher spend on road maintenance in regional areas that already have roads (e.g., the Mid West), as well as considerable build of new roads linking the large number of shale and tight gas wells that are likely to spotted through the landscape.

2.4 Speed of Development

It is also worth noting that despite industry assurances that development of onshore gas in WA will be slow, there are reasons to be cautious with regards to these assurances. Gas fracking fields can emerge with alarming speed. In Queensland and New South Wales, despite vocal community opposition, several thousand coal seam gas wells have been drilled inside a few short years.[3]

The Barnett shale in Texas grew from 400 gas wells in 2004, to well over 15,000 wells today. It is true that there are infrastructure bottlenecks – e.g., roads and pipelines, LNG processing facilities and ports. However, these problems are easily solved through construction, and there is no reason to suppose that aggressive and well funded companies will not move quickly to develop WA's gasfields if they believe that they will be profitable.

[3] CCWA is well aware of the differences between Coal Seam Gas mining and Shale/Tight Gas mining. Despite these differences, CCWA believes the *modus operandi* and scale of development and industrialization is comparable between CSG and Shale/Tight gas.



Graph showing the speed with which the industry developed in Texas - note the explosion in development from 2000 onwards

2.5 Risk to land from flood damage to gas infrastructure

The risk of flooding to unconventional gas fields is significant, particularly in highly flood-prone areas such as the Kimberley. As detailed in Section 6.5 below, the waste water or 'flowback fluid' of a fracking well is contained in exposed, open-air holding ponds and can contain chemicals used in the fracking process, as well toxic chemicals released from the source rock (please see section 6.5). Flooding can also lead to well failures, gas pipeline leaks and ruptures and condensate storage tank spills. This poses a significant risk of surface pollution should holding ponds be compromised by floods – thus potentially impacting future uses of land.

The Queensland Flood Commission of Inquiry received photographic evidence of flooded CSG mines (please see appendix 1). During the same inquiry, CSG producer Arrow Energy testified that they had discharged untreated fracking water into the Isaac River as a result of the floods.[4]

Recent flooding across large portions Colorado has caused an unprecedented amount of damage. In one of the hardest hit areas, Weld County, there are over 20,000 frack wells, which have been directly impacted by the flooding. It is too soon for authorities to assess the full scale of damage at this early stage; however there are a large number of photographs and reports of overturned liquid storage tanks at flooded frack sites, as well as multiple ruptured gas and oil pipelines. Images of the flood affected gasfields are available here: http://vimeo.com/74683562

[4] ABC, see: http://www.abc.net.au/news/2011-11-08/csg-operator-released-untreated-water-during-floods-inquiry/3652556

2.6 Displacement of Alternative Land-uses

It is obvious that unconventional gas mining will have a large impact on conservation estate. Although most community members believe it unlikely that development will be permitted to occur in areas that have conservation value, their confidence has proven to be misplaced, with an exploratory frack having already occurred within the Lake Logue Nature Reserve near Eneabba, an area protected under two international agreements concerning migratory birds.

It is CCWA's view that no unconventional gas mining should be permitted inside conservation estate.

Other types of land-use that will be affected by unconventional gas mining include:

a. **Farming land.** Many areas that are considered highly prospective for unconventional gas currently have horticultural, pastoral, or viticultural uses. These activities are both culturally and economically important at both a regional and state-wide scale. For instance:

- The Gascoyne region is a 'food bowl' region, which is currently targeted for exploration by Empire Oil and others
- Coastal regions of the Mid West, regions around Gingin, and other Mid West regions, are important horticultural centres
- The remainder of the Mid West is used for cropping, sheep and beef farming
- The South West region. Targeted for tight gas is an important dairy and viticultural area
- The Kimberley is an important pastoral region. The region is also considered highly prospective for irrigated agriculture

b. **Tourism.** Potentially targeted areas are important actual or potential tourism destinations

- The South West wine growing region
- Ningaloo coast
- Kimberley, especially the Fitzroy River region
- The Mid West Wildflower country/heathland

c. **Aboriginal Heritage**. Many targeted areas will have high levels of indigenous cultural value. Examples include:

- The Fitzroy River Valley, which has been listed on the National Heritage Register, along with other significant Kimberley sites
- Some potentially targeted areas in the Kennedy Ranges
- Some potentially targeted areas in the Mid West

3. The regulation of chemicals used in the hydraulic fracturing process (Term of Reference B)

3.1 Regulation of chemicals

We submit that while the question of regulation of chemicals used in gas fracking is important, it is a relatively small part of the overall concerns relating to contamination of lands and groundwater arising from unconventional gas mining operations. As such, a singular focus on this one element has the potential to divert and obfuscate proposer consideration of environment and land contamination risks.

To the extent that chemicals used in gas fracking pose threats to the environment and health, we submit that not enough is known about the risks presented by the use of chemicals used during unconventional gas mining operations (throughout the mining process).

Some research is being done into the risks posed to the environment by these chemicals. Of the 50 - 60 chemicals that are commonly used in fracking operations in Australia, only 4 have been formally assessed by NICNAS, the national regulator. None have been assessed specifically with regards to fracking – the potential for reactions amongst the chemicals is an under-researched area. [5]

It is important to note that the environmental risks of shale gas mining extend far beyond chemicals used in the fracking process. Considerable environmental and health risk flows from chemicals found in source rocks (particularly shale stone). BTEX chemicals – benzene, tolulene, ethylbenzene and xylene – co-occur with hydrocarbons in shale, and are mobilised during the fracking process, becoming risks to the environment – through well failures, migration through (for instance) abandoned wells or naturally occurring faults (extremely common in the Mid West regions targeted by shale gas miners), or through surface level leaks.

Of equal or greater concern than the risks associated with chemical contamination is the very real likelihood of hydrocarbon pollution of groundwater. Contamination of groundwater with dissolved gasses arising from fracking operations have been documented in a number of locations as detailed elsewhere in this submission. Because of the sheer quantity of wells required to obtain commercial flows of gas from shale and tight gas deposits, and the extreme pressures induced within the wells during the fracking process, the risk to the environment and public health from shale and tight gas wells is much higher than is the risk from conventional gas wells.

3.2 Regulation of other environmental and health risks

CCWA submits that Western Australia's current regulatory framework for gas fracking is inadequate, subject to industry 'capture', and does not have the confidence of the community. We submit that the Inquiry must examine these issues in detail, including:

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[5] Inquiry into the management of the Murray-Darling Basin Australia
Public hearing - Canberra, Friday 9 September 2011. Please see, at 2:04:
www.youtube.com/watch?v=DBnOBgJPuYE

- The Exemption of gas fracking from pollution control and Environmental impact Assessment
- The inadequacy of DMP's environmental regulation regime;
- Industry 'capture' and conflict of interest in environmental regulator;
- The lack of transparency and consultation;
- Lack of outcome-based requirements for groundwater and air quality protection (problems with the prescriptive regulatory approach);
- Lack of resources to support effective regulation; and
- The need for cumulative impact assessments of potential gasfield developments, *prior* to exploration and production applications.

We have detailed our concerns in each of these areas elsewhere in this submission.

4. The use of ground water in the hydraulic fracturing process and the potential for recycling of ground water (Term of Reference C)

4.1 Summary of recommendations:

- That the potential for water use in unconventional gas mining to create unjust and environmentally damaging outcomes is carefully considered
- That the parliamentary inquiry expands the terms of reference of the inquiry to consider the pollution threat to ground and surface water that flows from unconventional gas mining

4.2 Fracking is Highly Water Intensive

Western Australia's water resources are scarce - groundwater supplies two-thirds of our state's water needs – both for drinking and agriculture[6].

Unconventional gas fracking is a highly water-intensive process. Each shale gas frack requires between 9 million and 29 million litres of water - that's for a single *well.* [7]

Each time a shale body is fractured - multiple times per well, usually – additional millions of litres of water will be used. To get a grip on the scale of water required to develop the industry, we can multiply that figure by the thousands of wells needed to extract the gas of just one deposits.[8] It quickly becomes obvious that the water consumption of the industry becomes deeply concerning for a state as dry as Western Australia - and particularly in dry regions like the Midwest and Gascoyne (both of which are likely to see significant development.)

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[6] Please see Geoscience Australia website, www.ga.gov.au/groundwater/basics/groundwater-use.html

[7] Wood Ruth, Gilbert Paul, Sharmina Maria, Anderson Kevin, Footit Anthony, Glynn Steven, Nicholls Fiona. Shale Gas : a provisional assessment of climate change and environmental impacts. Tyndall Center for Climate Change Research, 2011. Available at www.karooplaces.com/wpcontent/uploads/2011/06/coop_shale_gas_report_final_200111.pdf

[8] See US Energy Information Administration's 'Review of Emerging Resources', http://www.eia.gov/analysis/studies/usshalegas/

Over allocation of the aquifer could result in serious decreases to the availability of the water supply for drinking, farming, and ensuring the ongoing health of the overall environment.[9]

There have been incidents in other jurisdictions around the world in which unconventional gas developments have placed unsustainable strain on aquifers. For instance, there are regions in Texas in which over-allocation of water resources to unconventional gas miners has caused farmers' water-bores to go dry.[10] That is clearly unjust, and should be avoided in WA. It is also extremely environmentally irresponsible. It is important that the inquiry considers the possibility that overly aggressive development of an unconventional gas mining industry in WA might lead to similar unjust and environmentally damaging outcomes in WA.

4.3 Threats to Groundwater

While strictly, *threats* to groundwater from unconventional gas lie outside of the terms of reference for this committee, CCWA is strongly of the view that given community concern with regards to unconventional gas production rests on groundwater issues, that the inquiry should consider the potential that serious pollution to groundwater might be caused by unconventional gas mining developments in WA. Further, it is the view of CCWA that the focus of the inquiry should more broadly fall on threats to water *per se*, as unconventional gas mining poses a serious threat to surface water resources as well.

Unconventional gas activity carries a serious threat of groundwater contamination, surface water pollution and depletion of groundwater aquifers. The European Commission commissioned a thorough 2012 report into the risks that accompany shale gas fracking. The Commission's conclusion: there is an overall high risk of groundwater contamination from unconventional gas fracking activities.[11]

Furthermore, chemicals used in gas fracking processes include toxic, allergenic, mutagenic and carcinogenic substances, which even in minute quantities can make water toxic and potentially dangerous.[12]

The primary sources of risk come from:

- **Fracking Fluid ('slickwater') -** the fluids used in fracking comprise a mix of water and sand (98%), combined with around 2% additional chemical additives (such substances are also known as 'slickwater'). The chemicals used in fracking fluids include known toxic, allergenic, mutagenic and, carcinogenic substances.[13]
- **Toxic particulates released from the shale itself** - released from the source rock after fracking, and returning to the surface as 'flow-back fluid', usually kept in open-air, on-site ponds. This new mixture can contain harmful substances such as heavy metals, naturally occurring radioactive materials (NORMs - including Radium, Thorium and Uranium), high concentrations of salts, oils and other contaminants, including arsenic, benzene and mercury.[14]

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[9] Wood *et als Op Cit.*

[10] The Guardian 11/08/13, www.theguardian.com/environment/2013/aug/11/texas-tragedy-ample-oil-no-water

[11] Broomfield Mark, Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe. AEA Technology, 2012, available on http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf

[12] Colborn Theo, Kwiatkowski Carol, Schultz Kim, Bachran Mary, Natural Gas Operations from a Public Health Perspective, int the Inernational Journal of Human and Ecological Rosk Assessment, 2010. Available on www.endocrinedisruption.com/files/Oct2011HERA10-48forweb3-3-11.pdf

[13] Ibid.

[14] Ibid.

Importantly, the European Commission 2012 report into shale gas fracking mentioned above found an overall high risk of surface water contamination from unconventional gas fracking activities.[15]

The risk is that the chemicals and dangerous substances listed above could reach surface water bodies, such as rivers, lakes and wetlands.

Pollution of surface water would directly affect environmental and human health, as well as agricultural production.

4.4 Groundwater Contamination

Contamination can occur through catastrophic well failure during production, longer term well failure linked to corrosion, migration through faults, or through surface water pollution migrating into aquifers. A well failure during critical points of production could lead to irreversible pollution of Western Australian aquifers.

Do wells fail? Yes - and failures are far from rare. Indeed operator-wide statistics in Pennsylvania have shown that 6-7% of new wells drilled in each of the past three years *already* have compromised structural integrity - a figure that will continue to increase over time as wells corrode and cement casing jobs crack and degrade.[16]

In WA, we are likely to see tens of thousands of gas wells across one landscape. Only one well of these tens of thousands needs to critically fail to render an aquifer undrinkable.

Well failures with conventional gas wells are common. Risks can be reduced by using best practice technology, but they can never be eliminated.

4.5 Surface Water

The major risk to surface water is from accidental spills – either on transport lines or through an accident at an open-air pond.

After the fracking process, between 15-80% of the fracking fluid is returned to the surface with additional substances (listed above) from the shale rock.[17]

The wastewater from fracking is typically kept in exposed open-air, plastic-lined ponds on the surface of the well site. These exposed pond sites are particularly vulnerable to flooding, tears in the lining and other accidents. (Please see appendices 2 and 4)

The risk of flooding to unconventional gas fields is significant, particularly in highly flood-prone areas such as the Kimberley. As detailed in Section 6.5 below, the waste water or 'flowback fluid' of a fracking well is contained in exposed, open-air holding ponds and can contain chemicals used in the fracking process, as well toxic chemicals released from the source rock (please see section 6.5). This poses a significant risk of surface pollution should holding ponds be compromised by floods – thus potentially impacting future uses of land.

The Queensland Flood Commission of Inquiry received photographic evidence of flooded CSG mines (please see

[15] (Broomfield 2012 *Op Cit.*)

[16] http://www.psehealthyenergy.org/data/PSE__CementFailureCausesRateAnalaysis_Oct_2012_Ingraffea.pdf

[17] Wood Ruth, Gilbert Paul, Sharmina Maria, Anderson Kevin, Footit Anthony, Glynn Steven, Nicholls Fiona. Shale Gas : a provisional assessment of climate change and environmental impacts. Tyndall Center for Climate Change Research, 2011. Available on http://www.karooplaces.com/wp-content/uploads/2011/06/coop_shale_gas_report_final_200111.pdf

appendix 1).[18] During the same inquiry, CSG producer Arrow Energy testified that they had discharged untreated fracking water into the Isaac River as a result of the floods.[19]

Similarly, historic flooding across large portions Colorado has caused an unprecedented amount of damage. In one of the hardest hit areas, Weld County, there are over 20,000 frack wells, which have been directly impacted by the flooding. It is too soon for authorities to assess the full scale of damage at this early stage; however there are a large number of photographs and reports of overturned liquid storage tanks at flooded frack sites, as well as multiple ruptured gas and oil pipelines. Images of the flood affected gasfields are available here: http://vimeo.com/74683562

Total truck movements for a single well pad are estimated at 7,000 to 11,000 all up - producing not only the pollution which comes with heavy traffic, but also exponentially increasing the risk of a spill of wastewater or fracking fluid on transport lines.

[18] www.floodcommission.qld.gov.au/__data/assets/pdf_file/0017/12059/Submission_from_QLD_Greens_with_attachments.PDF

[19] ABC, see: http://www.abc.net.au/news/2011-11-08/csg-operator-released-untreated-water-during-floods-inquiry/3652556

6. Other critical issues not covered in the Terms of Reference for this Inquiry

6.1 Recommendations with regards to expansion of terms of reference

CCWA strongly believes that the terms of reference of the Parliamentary Inquiry should be expanded.

A range of issues that are of great importance to the broader community, or to prominent bodies within the community, fall outside the terms of reference.

In particular, the recommendation of CCWA is that the terms of reference of the inquiry are expanded such that they allow parliamentarians to consider:

- The potential climate change impacts of unconventional gas developments
- Potential impacts of unconventional gas development on public health
- Potential social impacts of unconventional gas development
- Potential of unconventional gas development to cause groundwater and surface water pollution
- Potential impacts of unconventional gas development to cause air pollution
- Potential impacts of unconventional gas development on farming and pastoral land, on traditional owners, as well as ecosystems and landscapes
- The adequacy of current regulatory settings to appropriately manage the risk of serious environmental, public health and social justice impacts of unconventional gas development, inclusive of the ability of existing government agencies to make effective public policy
- Drivers for lack of community and civil society confidence in existing government regulators and regulation
- The need for cumulative impact assessments of potential gasfield developments, *prior* to exploration and production applications

These issues will be addressed in turn.

6.2 Climate change.

6.2.1 Summary and Recommendations:

- The Terms of reference of the inquiry should be expanded to include the impact of unconventional gas mining on greenhouse gas concentrations in the global atmosphere
- WA should not allow development of new fossil fuel mining precincts in WA
- WA is not running out of gas, and has abundant renewable energy alternatives
- Fracked gas, especially for export as LNG, is NOT a bridging fuel
- Federal climate regime under the Liberal government will not incentivize 'green completions', and will lead to bad outcomes with regards to climate pollution flowing from unconventional gas developments in WA
- The WA government must develop appropriate regulations to reduce GHG pollution from unconventional gas developments
- Arguments that gas is a 'bridging fuel' should be considered warily. That is particularly the case with LNG for export, which has a GHG footprint 15% higher than non-liquefied gas;
- Interventions that reduce the scale of Australian LNG exports will constitute a globally significant contribution to fighting climate change;
- Reducing Australian LNG exports will drive up the international gas price and incentivise use of alternative types of fuel

- Taking supply of LNG out of the international market may actually reduce overall gross energy consumption
- China, our anticipated growth market with regards to LNG imports, is moving extremely quickly to phase out coal and to bring renewables online; this undermines arguments that cutting gas supply will simply drive higher coal use

6.2.2 Unconventional gas and climate change

The Terms of reference of the inquiry should be expanded to include the impact of unconventional gas mining on greenhouse gas concentrations in the global atmosphere

The Terms of Reference of the inquiry should be expanded to include the impact of unconventional gas mining on greenhouse gas concentrations in the global atmosphere. WA's onshore gasfields have the capacity to act as a significant driver of global climate change. It would be irresponsible in the extreme to allow unrestricted and under-regulated development of these gasfields without due consideration of the role that they are likely to play as drivers of climate change.

WA should not allow development of new fossil fuel mining precincts in WA

The view of CCWA is that the WA government should not permit development of new fossil fuel mining precincts. We do not need to mine for fossil fuels; WA has enough fossil fuel energy online already to service its short term needs, and the capacity to make the investments in renewable energy over the medium term to transition our economy towards zero or negative emissions. Climate change is the greatest threat to the environment and to human communities that our and future generations will face. CCWA's view is that there is a clear moral case that suggests that we should not allow development of WA shale gasfields.

WA is not running out of gas, and has abundant renewable energy alternatives

It is clear that Western Australians want a future powered by clean, renewable energy rather than dirty fossil fuels. During the consultation phase on Western Australia's *Strategic Energy initiative*, over 1800 Western Australians sent submissions to the Office of Energy objecting to the strong emphasis placed on unconventional gas in the draft Strategic Energy blueprint, calling instead for a much greater emphasis on development of the state's clean renewable energy resources.

Western Australia already has abundant natural gas, and has access to undeveloped renewable energy resources comparable to any other region on the planet.

Western Australia does not need a gas fracking industry at this time to secure energy for the future as claimed by proponents of the unconventional gas industry. In fact, the development of a gas fracking industry will constrain development of renewable energy alternatives and lock the WA economy into continued reliance on polluting and unsustainable fossil fuels.

The State Government is providing very significant subsidies to the gas fracking industry, including over $100m in unconventional gas exploration subsidies (via Royalties for Regions) and a 50% royalty reduction for the industry. These funds would be far better directed to the development of sustainable energy options (including base load-capable solar thermal and wave power). These largely untapped

energy sources can provide clean competitive energy that does not pollute the environment, but rather enhances the viability of WA's regional economies.

Fracked Gas, Especially for Export, is NOT a Bridging Fuel

Unconventional gas is an extremely GHG intensive form of fuel. Further, arguments that gas is a 'bridging fuel' should be considered warily; that is particularly the case with LNG for export, which has a GHG footprint 15% higher than non-liquefied gas.

Gas industry proponents like to refer to the (relatively) low emissions of natural gas in comparison to coal. It is important, however, to be clear about this claim:

- It relies on selective accounting;
- It does not allow for extremely different emissions profiles for different types of natural gas (and indeed coal);
- It disregards issues concerning fugitive emissions

Unconventional gas production involves the release of significant amounts of methane into the atmosphere in the form of 'fugitive emissions.'

There are varying estimates on the extent of fugitive emissions from shale gas fracking operations in published literature. However, if medium-case scenarios are assumed (consistent with the approach taken by the US EPA), then the life-cycle emissions per joule of energy derived from shale gas are likely to be similar to those derived from coal.[20] As noted in the next, best practice reduces fugitives, and should be mandated through the approvals process.

It is worth noting that any slight saving in carbon pollution achieved by the use of gas is dwarfed that which is immediately available through the deployment of renewable energy sources like wind – which emits roughly 5% the greenhouse gas per joule of energy.[21]

With regards to the frequently voiced view that natural gas is a bridging fuel, it is true that conventionally mined natural gas burned close to the location in which it has been mined has a lower GHG footprint than coal, and should be preferred to it in cases where there is a choice between these two fuel types. However:

- All major renewable kinds have a GHG footprint an order of magnitude lower than either (Hardisty 2012)
- The key driver of expansion in Australian gas production is gas-for-export, all of which will be liquefied and shipped to distant markets. This process increases GHG footprint per joule of energy by c.15% (Hardisty 2012)
- Much of the climate impact from unconventional gas flows from fugitive emissions – these can be extremely significant, and – even setting aside liquefaction – drive natural gas to equivalence with dirtier forms of coal-fuelled energy

[20] See, e.g., Thomas Wigley's 2011, 'Coal to gas: the influence of methane leakage', or Paul Hardisty's 2012, 'Lifecycle Greenhouse Gas Emissions'

[21] Hardisty 2012, 'Lifecycle Greenhouse Gas Emissions'

- Climate change impacts flowing from fugitive emissions are 'front-loaded' – that is, because they are caused by fast-acting, but (relatively) rapidly decaying methane, the damage will be particularly severe over the next 20 years (72x impacts of CO2), and remain severe for 100 years (25x impact) and well into the future
- When considering conventional gas, it is important to keep in mind the impact of reservoir emissions – that is, release into the atmosphere of CO_2 naturally comingled with natural gas and separated from it during refining (see Hardisty *ibid*);
- Lower rates of sulphur dioxide pollution are associated with natural gas combustion (SO_2 acts as a 'dimmer', see Wigley 2011[22])

Thomas Wigley calculates that when these additional factors are suitably accounted for, the warming potential of natural gas turns out to be roughly similar to that of coal (per joule of energy produced). Indeed under most scenarios that Wigley considers the warming potential of gas is slightly higher than that of coal. In the view of Paul Hardisty (*op cit*), on the other hand, the warming potential of liquefied CSG (analogous in most respects to shale gas) is slightly lower than coal per unit of energy produced - n.b., however, that Hardisty does not assess the dimming potential of SO2. Furthermore, as mentioned above, it is important to keep in mind that Australian gas exports are in the form of LNG, which increases the GHG footprint of the fuel.

Gas should not be considered a transition fuel, a lower-emissions bridge from coal to renewable energy sources.

Federal climate regime under the Liberal government will not incentivize 'green completions', and will lead to bad outcomes with regards to climate pollution flowing from unconventional gas developments in WA

It is extremely important that the best possible practices are used with regards to minimising fugitive emissions from unconventional gas mines. As mentioned above, methane, the primary component of natural gas, is a powerful greenhouse gas, 72 times more potent than carbon dioxide over a 20-year time frame. Fugitive emissions from gas production will, if not controlled, pose a significant risk to the climate and regional air quality (from ozone pollution).

What seems like small changes in percentages can have a large impact. For example, the USA EPA currently estimates methane escaping during development and delivery of natural gas to be 1.5 percent of total U.S. production, including associated gas from oil wells. Getting that number down to one percent — controlling just a third of the emissions — would have the same climate benefit over the next 20 years as retiring another 10 percent of U.S. coal generation. There is considerable benefit to be gained by ensuring that unconventional gas developments ensure absolute best practice with regards to minimisation of emissions of fugitive gas.

There are serious reasons for concern with regards to unconventional gas production and methane emissions, with some studies showing that rates of fugitives from unconventional gas production are

[22] Wigley, T., 'Coal to gas: the influence of methane leakage', in *Climactic Change 2011:*

extremely high. For instance, a major study released in August in *Geophysical Research Letters* from 19 researchers led by the extremely credible US agency the National Oceanic and Atmospheric Administration found that on one February day in the Uintah Basin, the natural gas field leaked 6 to 12 percent of the methane produced.

Colm Sweeney, a co-author of the NOAA-led study that found high leakage did a supplementary on-ground assessment of wells, and found that of the wells he looked at, nine were 'clean', eight had emissions enhanced by 20 percent above background, and five wells showed enhancements of methane 100 percent over background.[23]

It is extremely important that, if unconventional gas development is to proceed, that it proceeds in a way that ensures that rates of fugitive emissions are constrained to as a low a rate as possible. This can be done by ensuring that 'green completions' technologies are used.[24]

The view of the WA state government, as expressed to CCWA by the State Environment Minister Albert Jacob, is that the state does not have a role to play in mitigation of greenhouse gas emissions. The state government certainly has the capacity to ensure that there is appropriate monitoring of fugitive emissions in any unconventional gas mines as part of the approvals process, in order that producers pay the appropriate price for GHG pollution under the Federal climate regime – and in order that Australia has data sufficient to allow for proper monitoring of our greenhouse gas emissions. The state also has the capacity to mandate best practice with regards to implementation of technologies aimed at reducing levels of fugitive emissions, and there is no clear reason why it should not use these powers.

This is especially the case when it is considered that the Federal Liberal government intends to remove Federal mechanisms that are aimed at ensuring industry minimises pollution. In the absence of a Federal instrument it is clearly appropriate that the state ensures that appropriate conditions are placed on developments during the approvals process to ensure that the lowest possible amounts of greenhouse gas pollution flow from WA based production of natural gas.

Western Australia's Gas Reserves are Globally Significant

Interventions that reduce the scale of Australian LNG exports will constitute a globally significant contribution to fighting climate change.

The world contains a great deal of gas. The International Energy Association's 2011 Golden Age of Gas report made this clear, calculating that we know of gas sufficient to power our contemporary economy for c.250 years. These gas resources are scattered around the globe. Unconventional gas deposits (shale,

[23] http://thinkprogress.org/climate/2013/09/19/2646881/study-fracked-wells-methane-emissions-super-emitters/
[24] http://watchlist.vermontlaw.edu/fracking-and-%E2%80%98green-completion%E2%80%99-still-incomplete/

tight gas, CSG) are often found in regions that have not been sites of hydrocarbon mining in the past; to some extent, unconventional gas deposits are common.[25]

That said Australia's reserves are still globally significant. Furthermore, as with our capacity to export coal, Australia's role as a major gas exporter means that the Australian environmental movement carries a heavy burden to reduce offshore emissions from combustion of resources mined in Australia.

Recent estimates suggest that there are:

- c.300 trillion cubic feet of gas in the Kimberley
- c.100 trillion cubic feet of gas in the North Perth Basin
- c.80 trillion cubic feet of gas in the Cooper Basin
- c.60 trillion cubic feet of gas in east coast coal seams

These reserves place WA in the handful of regions with the largest gas reserves. On the back of these huge gas reserves, WA is in a position to develop a major export oriented gas industry, with good proximity to major markets (e.g., China, South Korea), a stable political regime, and a favorable environment for operations of multinational oil and gas companies.

If mined to 50% of capacity, and assuming conservative figures regarding fugitive emissions, these onshore unconventional gas fields will produce c.30 billion tonnes of CO_2e pollution. To put that into perspective, the entire Australian economy produces about 500 million tonnes of CO_2e pollution per annum at present – so Australia is sitting on gas with the CO_2e of 120 times the annual output of our entire national economy.[26]

REFERENCES:

- Climate Commission, 'The Critical Decade: International Action on Climate Change', http://climatecommission.gov.au/wp-content/uploads/climatecommission_internationalReport_20120821.pdf

[25] Which is not to say that all unconventional gas plays are equivalent. Chinese and Polish shale gas plays have proven extremely difficult and expensive to mine, for instance, which has restricted development in these regions.

[26] Using conservative metrics due to the US EPA, it can be calculated that the CO_2 equivalent (CO_2e) from combustion of the gas in the Kimberley gas field alone will be roughly 16 billion metric tons - provided that the gas in question is extracted and cleanly burned without fugitives. A range of studies have drawn attention to the high rate of fugitives from unconventional gas fields – e.g., the recent Australian research by Santos and Maher (see, e.g., Graeme Redfern's Gas industry rattled by findings of triple normal levels of methane, Renew Economy Nov 2012, available: www.reneweconomy.com.au/2012/gas-industry-rattled-by-findings-of-triple-normal-levels-of-methane-66978). The EPA figure can be roughly doubled in order to derive lifecycle emissions from fracked extraction (inclusive energy use + fugitives), and liquefaction (as *per* Hardisty *op cit*), to c.30 billion tonnes. The Perth Basin and Cooper Basin gasfields each contains roughly 1/3 the gas that the Canning does; using the same multiplier, we can figure the CO_2e of these gasfields is c.5 billion tonnes CO_2e. Similarly to above, when fugitives are properly factored into assessment of warming potential the figure in question becomes a much larger figure – c.10 billion tons CO_2e.

- Ernst and Young Global Gas and Oil Center, '*Global LNG: will new demand and new supply mean new pricing' 2013, http://www.ey.com/Publication/vwLUAssets/Global_LNG_New_pricing_ahead/$FILE/Global_LNG_New_pricing_ahead_DW0240.pdf*
- Hardisty, P., (2012) 'Life Cycle Greenhouse Gas Emissions from Electricity Generation: A Comparative Analysis of Australian Energy Sources', www.mdpi.com/1996-1073/5/4/872
- Wigley, T., 'Coal to gas: the influence of methane leakage', in *Climactic Change 2011,* http://www.usclimatenetwork.org/resource-database/report-coal-to-gas-the-influence-of-methane-leakage
- Redfern, G., 'Gas industry rattled by findings of triple normal levels of methane', Renew Economy, www.reneweconomy.com.au/2012/gas-industry-rattled-by-findings-of-triple-normal-levels-of-methane-66978

6.3 Potential for unconventional gas developments to impact on public health

Several international reports have indicated the potential of hydraulic fracturing and associated processes to lead to significant adverse impacts on human health.

The New Brunswick Department of Health 2012[27] report into shale gas fracking outlined several aspects of human health leading from unconventional gas extraction:

- Physical hazards, due to accidents, malfunctions, emergencies etc.
- Environmental hazards, due to the quality of air, water, soil and/or food
- Mental health impacts to individuals
- Socioeconomic impacts on communities
- Other impacts such as cumulative effects (i.e. traffic increases, noise), radiation etc.

6.3.1 Human Health impacts

Many of the health risks flow directly from the environmental threats (such as pollution of air and water) and are related to the toxic nature of the chemicals associated with unconventional gas fracking.

Researchers in the United States examined 353 chemicals used in fracking fluids, and found them to include toxic, allergenic, mutagenic and, carcinogenic substances.[28]

Of the 353 chemicals: [29]

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[27] Chief Medical Officer of Health's Recommendations Concerning Shale Gas Development in New Brunswick, New Brunswick Department of Health 2012. Available at: www2.gnb.ca/content/dam/gnb/Departments/h-s/pdf/en/HealthyEnvironments/Recommendations_ShaleGasDevelopment.pdf

[28] Colborn Theo, Kwiatkowski Carol, Schultz Kim, Bachran Mary, Natural Gas Operations from a Public Health Perspective, in the International Journal of Human and Ecological Risk Assessment, 2010. Available on : http://www.endocrinedisruption.com/files/Oct2011HERA10-48forweb3-3-11.pdf

[29] Colborn Theo, Kwiatoski Carol, Shultz Kim, Bachran Mary, *Natural Gas operations from a Public Health Perspective,* in Human and Ecological Risk assessment : an international Journal, 2011.

- 75% may affect skin, eyes and other sensory organs, and the respiratory and gastro-intestinal systems.
- 40-50% may impact the brain and nervous system, immune and cardiovascular systems, and the kidneys.
- 37% could affect the endocrine system.
- 25% pose a risk of cancer and mutation.

Further health risks come from the toxic particulates released from the source rock after fracturing has taken place. These particulates can include harmful substances such as heavy metals, naturally occurring radioactive materials (NORMs), including Radium, Thorium and Uranium, and other contaminants including arsenic, benzene and, mercury[30].**Long term chronic illness**

Many chemicals used in or released during shale gas fracking operations can have long term health effects that are not immediately apparent. These include unpredictable delayed effects on people who are exposed to fracking-related toxins - and on their children.[31]

For example, BTEX compounds are commonly released from source rocks during fracking, and are thus can be present in fracking flow-back fluids. Once on the surface, they are left to sit in uncovered, open-air settling ponds, where they are 'gassed off' into the air.

BTEX compounds are acute skin, respiratory and nervous system irritants, and long term exposure to then has the capacity to affect bone marrow, causing anaemia and increasing the risk of leukaemia. BTEX chemicals can also affect the liver and kidneys.

Another commonly used chemical in fracking processes is 2-Butoxyethanol (2-BE) which is rapidly absorbed by humans in a number of ways - through the skin, ingestion and inhalation. Once absorbed, this substance has the capacity to destroy red blood cells, damage the liver, spleen and bone marrow.

These chemicals carry serious health risks. Benzene, for example, even at the lowest level of detection - 1 part per billion – is highly dangerous. There is no safe level of exposure.

In addition to contamination concerns, there are potential health risks due to air quality[32] noise, vibration, continuous illumination and physical hazards due to extensive heavy truck traffic. The European Commission report estimated that up to 2,000 truck trips are needed for each gas well (European Parliament 2011; New York DEC 2011). This heavy vehicle traffic is often on rural roads that were not designed for such traffic. As a result, the potential for increased truck traffic accidents that could impact residents near development areas is a concern. Road fatalities are already a serious issue in rural areas of Western Australia pegged for shale development and the impact of heavy traffic on the

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[30] Broomfield Mark, Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe. AEA Technology, 2012, available on http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf

[31] Ibid.

[32] please see section 6.6

quality of rural roads, and the increased traffic, could pose significant danger to local residents and other users of regional roads (tourists, truck drivers etc.).

There are other possible hazards to mental health and community wellbeing that result from a feeling of lack of control over one's destiny in local communities in the face of these issues.[33] Regional Australia already suffers from devastatingly high rates of depression, anxiety and suicide and there is the potential for unwanted unconventional gas industry to exacerbate poor mental health in regional communities.

It is CCWA's strong recommendation that the terms of reference are expanded to include the potential impacts to human health, and that a comprehensive study of these risks is conducted *prior* to industry approval.

6.3 Assessment of potential social impacts of unconventional gas developments on affected regional and remote areas

Some proponents of unconventional gas development have argued for the economic benefits of such a boom – however the potential for a lucrative industry must be balanced against the potential for such industries to create a 'Boomtown Effect' in regional areas. Certain towns in Western Australia have already experienced the social transformation that results from a 'Boomtown Effect' and from a Fly-in, Fly-out workforce.

There have been many documented cases since the 1970s (Jacquet 2009) of energy boomtowns where a rapid change in population, industrialization and economic prosperity also led to a host of social ills that impacted community health. These include increased rates of crime, drug and alcohol abuse, sexually-transmitted infections (STIs), and domestic violence; inadequate supply and quality of housing; increased cost of living; increased community dissatisfaction; increased mental health and social services case loads; increased hospital admissions; insufficient infrastructure; and insufficient capacity in public services, including policing, local government, social services, and health care.

Although all residents in a gas development area share in the potential risks, in many cases not all of them have gained from it thorough employment or access to revenues, and indeed many of the specialized jobs may be taken by non-resident workers who already have the necessary expertise. This is particularly the case in hydraulic fracturing as the process requires highly specialized personnel, and in Western Australia where there already exists a Fly-in, Fly-out culture and infrastructure. In addition, even when local people are hired some existing local businesses and local public services can suffer due to loss of their employees to the gas industry.

The positive effect of economic gains can be further limited due to inequitable distribution of risk and reward among local residents (Gever 2011; Perry 2011; Brasier 2011). For example, all of the people in a given community will share in the risks of having the industry located nearby, but only some of them will gain from it: some people will benefit from new jobs in the industry or jobs serving the industry, but obviously not all of them will, and some long-standing local businesses and public services will be

[33] Chief Medical Officer of Health's Recommendations Concerning Shale Gas Development in New Brunswick, New Brunswick Department of Health 2012. Available at: www2.gnb.ca/content/dam/gnb/Departments/h-s/pdf/en/HealthyEnvironments/Recommendations_ShaleGasDevelopment.pdf

adversely affected by loss of their employees to higher-paying jobs in the gas industry. Similarly, some people will gain economically by leasing access to their land to the gas companies, while their neighbours won't. This is particularly concerning in regards to the shared risk of groundwater contamination and air pollution, which obviously doesn't respect property boundaries – the risk of the industry is shared, but the benefits are not.

6.4 Groundwater and surface water pollution

CCWA believes that the terms of reference of the inquiry should be expanded to allow parliamentarians to consider the potential impacts of development on ground and surface water.

A great deal of research has been done concerning these issues (for a review, see for instance the European Commission report into the impact of shale gas development on the environment and public health).

CCWA's reasoning with regards to expansion of the terms of reference with regards to water pollution issues are canvassed above in Section 4 (Response to Terms of Reference (C)).

6.6 Air pollution

A by-product of fracking operations is high levels of atmospheric pollution.[34] Industry development is poised to see thousands of wells on and around land inhabited by farmers and near to regional towns, placing communities at risk of a number of toxic, harmful chemicals – not to mention the workers at the drilling sites. Levels of ozone in remote locations near gasfields have been found to exceed that found in highly polluted urban locations.

Air pollution as a consequence of unconventional gas production has been documented to increase the risk of:

- Cancers, in particular leukemia [35]
- Neurological diseases[36]
- Impacts to the nervous system
- Aggravation of existing heart diseases
- Asthma and other lung diseases (such as chronic obstructive pulmonary disease (COPD)[37]
- Headache

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[34] Broomfield, Mark, *Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe*. AEA Technology, 2012, available on http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf

[35] LechtenBöhmer Stephan, Altmann Mathias, Capito Sofia, Motra Zsoltz, Weindrofr Werner, Zitell Werner, Impacts of Shale gas and shale oil extraction on the environment and on human health. European Oarliament, directoret general for internal policies, policy department, A : Economic and Scientific policy. 2011, available on : http://www.europarl.europa.eu/document/activities/cont/201107/20110715ATT24183/20110715ATT24183EN.pdf

[36] Ibid

[37] Colborn Theo, Kwiatkowski Carol, Schultz Kim, Bachran Mary, *Natural Gas Operations from a Public Health Perspective*, in the International Journal of Human and Ecological Risk Assessment, 2010. Available on : http://www.endocrinedisruption.com/files/Oct2011HERA10-48forweb3-3-11.pdf

- Irritation of the throat and eyes

What are the pollutants?

The fracking process releases a variety of air pollutants into the atmosphere.
The three main sources of air pollution are toxic Volatile Organic Compounds (VOCs), Ground Level Ozone and Naturally Occurring Radioactive Materials (NORMs).

1. **Toxic Volatile Organic Compounds**

VOCs are organic compounds that are released into the atmosphere (http://www.epa.gov/iaq/voc2.html#definition), some of which are extremely toxic. There are three VOCs of particular concern associated with the fracking process: BTEX chemical compounds, hydrocarbons, and methane.

BTEX chemical compounds

The BTEX compounds are benzene, toluene, ethylbenzene and xylene. Each of these chemical types is extremely toxic. Benzene is the BTEX chemical that is most commonly linked with fracking; there is no safe level of benzene exposure and ambient benzene presence is correlated with increases in cancer (leukemia), blood diseases, and serious impacts on the nervous system.[38]

Hydrocarbons

Exposure related to fracking activity has been shown to lead to increases in headaches and throat and eyes irritation (Mc Kenzie M. Liza, Witter Z. Roxana, Newman S. Lee, Adgate L. John, *Human health risk assessment of air emissions from development of unconventional natural gas resources*. In the Science of Total Environment, 2012).

2. **Naturally Occurring Radioactive Material (NORMs)**

Considerable radioactive material comes to the surface in flow-back fluid; this is particularly the case in shale gas fracking, which will be the type of fracking most common in Western Australia. These substances – including radium and uranium – are naturally present in shale, and are freed during the fracking process.

3. **Ground Level Ozone**

Ground Level Ozone is created when VOCs combine with nitrogen monoxide, heat and sunlight. Chronic exposure to heightened level of ozone is correlated with higher rates of asthma and chronic obstructive pulmonary disease.[39] Combined with Particulate Matter, ozone creates smog.[40]

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[38] Mc Kenzie M. Liza, Witter Z. Roxana, Newman S. Lee, Adgate L. John, *Human health risk assessment of air emissions from development of unconvetional natural gas ressources*. In the Science of Total Environment, 2012.
[39] (Colborn Theo, Kwiatkowski Carol, Schultz Kim, Bachran Mary, *Natural Gas Operations from a Public Health Perspective*, in the International Journal of Human and Ecological Rosk Assessment, 2010. Available on: http://www.endocrinedisruption.com/files/Oct2011HERA10-48forweb3-3-11.pdf).
[40] Ibid.

There are high stakes here. Air pollution can have dire consequences on public health. The European Commission report found there is a cumulatively high risk of air pollution.[41] The gas fracking industry must prove to the community that what they are doing will not make people sick.

6.7 Potential impacts of unconventional gas development on farmers and other post-European settlement types of land tenure, on farmlands, on traditional owners, on areas of high cultural value, and on ecosystems and landscapes

Some issues concerning the impact re canvassed above in Section 2, 'Response to Terms of Reference (A)'. CCWA's recommendation is that the terms of reference of the Inquiry should be explicitly expanded to allow parliamentarians to consider the potential impacts of unconventional gas developments on farmers (alongside their land), on traditional owners (alongside their land), and on ecosystems and landscapes considered as possessing intrinsic worth that extends beyond their 'use.'

CCWA notes and supports the call from the WA Farmers Federation for gas fracking to be subject to rigorous Agricultural impact Assessment, however we believe that this must be expanded to consider all types of land use under a comprehensive land use impact assessment process.

6.8 Adequacy and effectiveness of regulatory framework

CCWA submits that Western Australia's current regulatory framework for gas fracking is inadequate, subject to industry 'capture', and does not have the confidence of the community. We submit that the Inquiry must examine these issues in detail, including:

- The Exemption of gas fracking from pollution control and Environmental impact Assessment
- The inadequacy of DMP's environmental regulation regime;
- Industry 'capture' and conflict of interest in environmental regulator;
- The lack of transparency and consultation;
- Lack of outcome-based requirements for groundwater and air quality protection (problems with the prescriptive regulatory approach);
- Lack of resources to support effective regulation; and
- The need for cumulative impact assessments of potential gasfield developments, *prior* to exploration and production applications.

Concerns in each of these areas is detailed below

Exemption of gas fracking from pollution control and Environmental Impact Assessment (EIA)

Gas fracking is occurring in Western Australia without environmental impact assessment, and with no regulatory oversight by either of the Government's environmental agencies – the Environmental Protection Authority (EPA) or the Department of Environment and Conservation (DEC).

[41] Broomfield Mark, *Support to the identification of potential risks for the environment and human health arising from hydrocarbons operations involving hydraulic fracturing in Europe*. AEA Technology, 2012, available on http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf

Most, if not all other polluting industrial activities in Western Australia are regulated under Part IV of the *Environmental Protection Act* through the issuing of pollution control licenses. Gas fracking activities, however are not explicitly listed as /prescribed premises' under the Environmental Protection Act, and are therefore exempt from the normal regulatory and licensing requirements for polluting industries under this Act.

Similarly, the Environmental Protection Authority (EPA) has allowed gas fracking to take place without Environmental Impact Assessment or any form of conditions or regulation imposed by that agency. Their stated rational for allowing this to take place is that they believe the risks of gas fracking are adequately managed by the Department of Mining and Petroleum (DMP). As we will demonstrate this is clearly not the case.

Inadequacy of DMP's environmental regulation regime

In WA, unconventional gas development is regulated under the *Petroleum and Geothermal Energy Resources Management (PGER) Act* which is administered by the Department of Mines and Petroleum (DMP).

There are a growing number of independent reports highlighting serious inadequacies with the DMP's environmental regulation regime, including a recent report into environmental Regulation of mining activity by the Auditor General. This report found widespread non-compliance with environmental requirements, and a systematic breakdown of compliance and enforcement activity within the DMP.

In 2011, the DMP commissioned an independent expert (Dr. Tina Hunter) to review its regulatory arrangements for gas fracking in WA, which falls under the *Petroleum and Geothermal Resources Act.* In her report, Dr. Hunter concluded that "*there are no legal provisions in the* [petroleum] *Act that specifically pertains to the management of the environment in onshore petroleum activities*." [42]

Dr. Hunter identified DMP's requirement for proponents to develop 'Environmental Management Plans' (EMP) as a measure to manage environmental impact, however she also noted that "*under the current legislative framework the EMP is legally unenforceable."*

While some improvements have been made since this report, the fundamental failures noted by Dr. Tina Hunter have not been rectified.

With inadequate powers relating to environmental protection, and inadequate enforcement tools to hold proponents to account, the DMP cannot be expected or relied upon to adequately manage the serious risks associated with this activity.

While some of the problems that have been identified with DMP's environmental regulation systems are being addressed (such as the lack of stated environmental outcomes), there is a long way to go before the systems are fixed, and in most cases changes to legislation are required. In other cases, serious failures (like those identified in the Dr. Tina Hunter Report) have not been addressed at all.

[42] Hunter, T (2011) *Regulation of Shale, Coal Seam and Tight Gas Activities in Western Australia*, Faculty of Law, Bond University

Any reform process to correct these issues will take time, carrying the risks that a) it will not be done due to other higher government priorities, and 2) changes will not apply retrospectively to existing approved projects.

As such, any further approvals of gas fracking under the current regime represent a very high risk to the environment and the state, yet the DMP is aggressively promoting and subsidizing gas fracking in WA.

Given this situation, the WA community cannot have confidence in the regulatory regime currently in place for shale gas fracking in WA.

Industry 'capture' and conflict of interest in environmental regulator

One of the most serious concerns with the WA regulatory system is that there is very significant evidence that the primary regulator (the DMP) are subject to serious conflicts of interest and 'capture' by the industry they are supposed to regulate.

It can be seen that the DMP has been aggressively promoting gas fracking in WA (more aggressively even than industry itself) and in doing so have been perpetuating many of the myths that we have addressed in Attachment 1 (see for example recent DMP media release here: http://www.dmp.wa.gov.au/7105_17715.aspx)

In addition to this, financial subsidies have been paid by the DMP under their exploration incentive scheme and other programs for gas fracking proponents.

Not only is there clear evidence that the regulator is acting on behalf of, and in interests of the gas fracking industry in its publications, media releases and other public information, but it is the same personnel within the agency that are responsible for the regulation of gas fracking activities.

In the astonishing media release liked above, the Government's chief regulator of onshore gas fracking totally dismisses environmental risks of gas fracking and criticises community groups for spreading 'misinformation' regarding the environmental risks of the practice.

The comments are a clear demonstration of the conflict of interest that results from a government agency charged with both promoting gas fracking, and regulating the environmental impacts of the industry

While we have come to expect misleading public-relations spin from the gas industry, the fact that a senior government regulator paid by WA taxpayers is engaged in these activities is astonishing.

By totally dismissing serious environment and health concerns, these statements only serve to further undermine community confidence in the already inadequate regulatory system that is supposed to protect WA communities and the environment from this highly risky activity.

Attacks on community organisations by government regulators like Mr. Tinapple are totally disingenuous and CCWA strongly defends any statements we have made regarding the risks of shale gas fracking in Western Australia.

Mr Tinnaple's statements are misleading, alarming and potentially defamatory towards the growing number of people and community groups who have legitimate concerns about groundwater pollution and other serious impacts of gas fracking planned for WA."

Not only is the Department of Mines and Petroleum subject to an appalling conflict of interest, a recent review commissioned by the Government reveals that the agency lacks the basic legal powers necessary to enforce environmental standards in the gas fracking industry.

Clearly gas fracking must be regulated by an independent agency that does not act as an unashamed promoter of gas fracking, and which has the necessary legal powers to manage the serious risks inherent in this activity.

If these serious issues are not corrected urgently, then we are likely to see a repeat of what has occurred in Queensland, where local communities have lost faith in environmental regulators, and where conflict between communities and gas companies has become bitter and embedded

Lack of transparency and consultation

Furthermore, the regulatory regime applied to gas fracking (much like mining) operates with very little transparency or opportunity for public engagement or comment.

Pollution control licenses under Part IV of the Environmental Protection Act are provided for public comment and subject to third party appeal rights; however gas fracking is exempt from these requirements as outlined above. Similarly, Environmental Impact Assessment by the EPA involves community consultation, with third party appeal rights however gas fracking has not subject to this assessment.

The DMP have recently moved to allow public release of Environmental Management Plans (EMP's) associated with gas fracking licenses granted under the *PGER Act* which has improved transparency to some degree, however there are still not opportunities for public comment or third party appeals to be submitted prior to, or even after approvals are granted.

Under the current regime, information relating to other matters including compliance with conditions; environmental monitoring data; enforcement activity undertaken, or any other information is treated as 'commercial in confidence' and as such is not available or discoverable, even by Parliament.

This lack of transparency has a number of obvious implications, including that serious contamination of groundwater or surface water could occur as a result of gas fracking operations, and the local community or landholder may never be informed.

Lack of outcome-based requirements for groundwater and air quality protection (problems with the prescriptive regulatory approach)

The regulatory approach currently employed by the DMP under the PGER Act is highly prescriptive rather than outcomes based – that is the regulations specify in great detail (for example) well casing design specifications that are to be used in unconventional gas mining.

There are several related problems inherent in this prescriptive approach

1) It transfers liability and risk to the State for pollution and other unintended consequences of (for example) well casing failure. If the proponent has done exactly as required according to their prescriptive operating license, ant the well still leaks, then it cannot be their responsibility, as they were required to build the well in that way. Pollution incidents will therefore be the responsibility of the regulator and therefore the State.

2) The prescriptive requirements provided in PGER Act permits may provide a defence against pollution charges that could otherwise be applied under the Environmental Protection Act. Again, if the operator is acting in accordance with a prescriptive license, and the outcome of following the requirements of the license are to cause pollution, then a strong legal defense may exist to pollution charges. This means that the State may have no way of seeking damages or even penalties for pollution caused by gas fracking operations.

3) The lack of requirements for achieving environmental *outcomes* (e.g. pollution below certain thresholds) means that there is actually very little monitoring required of the environmental conditions. Closely related to this are the inadequacy of baseline monitoring prior to fracking operations and the lack of ongoing environmental monitoring requirements post well abandonment. All of this means that pollution incidents may never be discovered or become apparent, or if they are, it will be very difficult for the State to prosecute or seek damages.

Other than requiring certain prescriptive engineering standards (which can and frequently do fail) it can be seen that current petroleum regulations do nothing to protect groundwater, or ensure that air does not become dangerous and polluted – both impacts that have been observed in United States shale and tight gas development.

Lack of resources to support effective regulation

While the burden on regulators will certainly increase substantially with the onset of gas fracking development, there is a serious concern that regulatory agencies are not resourced to deal with the implications of this.

One of the key findings of the 2011 Auditor-General's report into DMP environmental regulations is that the agency was under-resourced to provide an appropriate level of oversight of the operations of the industry.

Similarly, we understand that a significant reason for the EPA to not assess gas fracking proposals that have been referred to it is the lack of resources to do so. Since these decisions were made, further significant cuts have been made to the EPA budget, diminishing their capacity to assess these proposals further.

Shale and tight gas mining will make the difficulty of ensuring the industry complies with regulation much more difficult, with the sheer scale of possible development placing an unsustainable burden of an agency that is – by the admission (off the record) of senior figures – already failing to appropriately regulate resources sector operations in Western Australia.

The need for cumulative impact assessments of potential gasfield developments, *prior* to exploration and production applications

In other jurisdictions, the experience with unconventional gas mining has been a proliferation of smaller operators with relatively small-scale projects, but which aggregate to extremely large gasfields with thousands to tens-of-thousands of individual wells.

If each proposal is assessed on its merits, it would be seen as presenting a relatively low environmental risk, however taken cumulatively, the risks are very substantially higher. The date the WA EPA has refused to assess small-scale fracking proposals, creating a dangerous precedent for the industry to develop in this way without ever being subject to proper cumulative impact assessment.

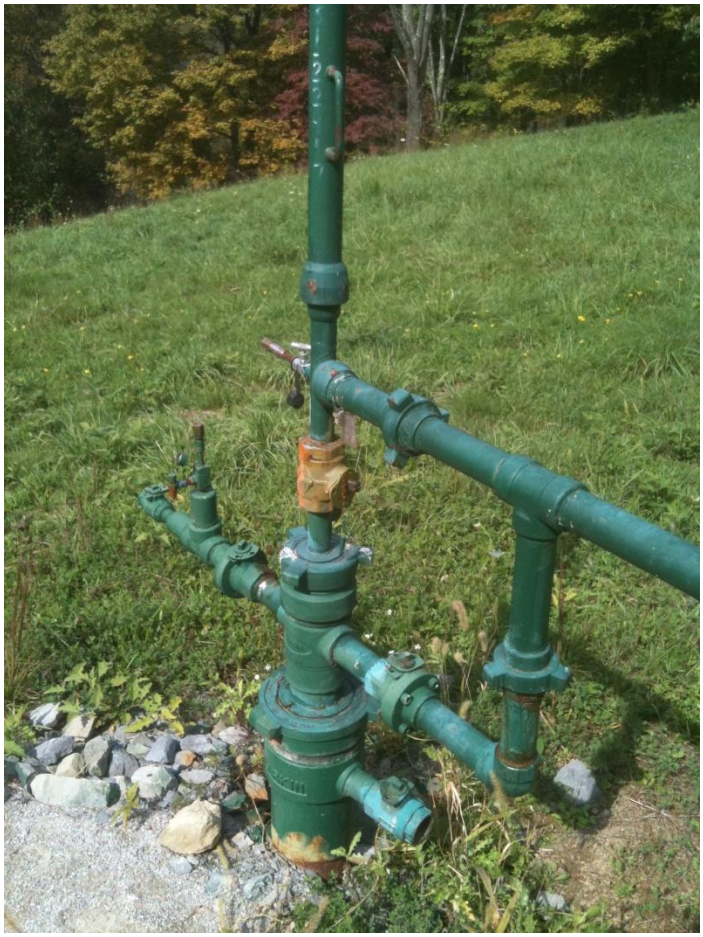
CCWA submits that a full cumulative impact assessment for likely unconventional gas provinces should take place *before* any development is approved.

7. Appendix 1

Photos of a QGC coal seam gas camp inundated with flood waters.

Appendix 2.

Appendix 3



Appendix 4

Five myths about shale gas fracking in WA

Conservation Council of Western Australia, May 2013

This document outlines 5 key claims being made by gas fracking proponents in WA, together with a statement that provides a more balanced perspective to correct the record.

In recent months, gas industry representatives have made variations of these statements in what appears to be an attempt to minimise legitimate and growing community opposition to gas fracking in Western Australia. While obvious bias in industry statements is perhaps to be expected, what is much more concerning is that this information appears to have been taken up, and even promoted by some WA Government agencies.

The following information is provided to correct the record on statements that we believe to be misleading, false, selective or questionable.

Industry claim 1: The depth of WA shale deposits means fracking is safe

Claim: Because most Western Australian shale deposits are at a depth range of 1500-3500 meters below potable groundwater resources, the risk of water contamination due to shale gas fracking is low, or negligible.

This claim is false. The two most significant causes of water contamination from gas fracking operations are not related to the depth of gas-bearing rock. US studies have found clear evidence of groundwater pollution from shale and tight gas developments where target formations are at similar depths to those in Western Australia.

Main pathways for water contamination from shale gas fracking operations are:

a) Well casing failure due to corrosion and / or faulty construction. Research shows that 6-7% of shale gas wells in USA fail within one year of construction and over 60% fail after 30 years[1]. Well casings can fail (leak) at any point and almost all gas wells will intersect groundwater in WA.

b) Disposal of fracking 'flowback' fluids. Tens of thousands of litres of water mixed with fracking chemicals must be stored, and then disposed of after fracking at each gas well. Storage and disposal of used fracking fluids represents a major pathway for contamination of surface water and/or groundwater.

[1] Anthony Ingraffea, 'Fluid Migration Mechanisms Due To Faulty Well Design And/Or Construction' 2012; Bruffatto *et al*., 'Oilfield Review', ConocoPhillips & Schlumberger, 2003.

Industry claim 2: WA has a lot of experience with shale gas fracking

Claim: Fracking has been undertaken safely in WA for years – hundreds of wells have been fracked with no reported groundwater contamination.

This claim is highly misleading at best. To date there have only been a handful of shale gas wells fracked in WA using the methods that are planned for extensive shale gas fracking developments.

In making this claim, industry and regulators have conflated shale gas fracking with a very different practice that has been used for years to recover oil from depleted oilfields. Oilfield fracking involves only vertical wells, lower pressures, and less chemicals. This cannot be compared directly with the much greater technical challenges of horizontal drilling and slickwater gas fracking planned for shale and tight gas deposits.

Industry claim 3: Opponents of shale gas fracking are confusing it with CSG

Claim: Environmentalists, farmers, and other community members are mistaking shale for coal seam gas (CSG). In fact shale gas bears low environmental risk, whereas the risks of CSG are higher.

This claim is false. CCWA and others concerned about shale gas fracking in WA realise that the Western Australian situation is different to that of Coal Seam Gas (CSG) development in the Eastern states, although similarities do apply.

The most comparable experience with shale gas fracking is the development of very significant shale deposits in the USA (such as the Marcellus Shale) which lie at similar depths to shale deposits in Western Australia.

A shale gasfield in Wyoming, USA and a Queensland CSG gasfield. Note that the surface impact is extremely similar. The risks to groundwater are also closely related.

Industry claim 4: Shale gas is a clean source of energy

Claim: Shale gas is actually 'green', because it has low greenhouse gas emissions per joule of energy compared with other fossil fuels.

This claim is based upon highly selective accounting for greenhouse gas emissions. In making this claim, gas industry proponents only refer to emissions at the point of combustion, ignoring other very significant emissions caused during the extraction and processing of the gas.

In reality, gas fracking involves the release of significant amounts of methane into the atmosphere in the form of 'fugitive emissions' - an extremely powerful greenhouse gas (72 times the warming potential of carbon dioxide over 20 years).

There are varying estimates on the extent of fugitive emissions from shale gas fracking operations in published literature. However, if medium-case scenarios are assumed (consistent with the approach taken by the US EPA), then the life-cycle emissions per joule of energy derived from shale gas are likely to be similar to those derived from coal.[2]

It is also worth noting that any slight saving in carbon pollution achieved by the use of gas is dwarfed that which is immediately available through the deployment of renewable energy sources like wind – which emits roughly 5% the greenhouse gas per joule of energy (Hardisty 2012, 'Lifecycle Greenhouse Gas Emissions').

Industry claim 5: There is a robust regulatory framework for shale gas in WA

Claim: There are strong regulations in place in WA which ensure that the community and environment are protected from the risks of shale gas fracking

This claim is highly questionable. Under WA law, most activities that pollute (or have the potential to pollute) the environment are subject to licensing by the Department of Environment and Conservation (DEC) under the *Environmental Protection Act*. While other activities such as mining and minerals processing require *Operating Licenses* to control pollution, shale gas fracking is currently exempt from these requirements.

As stated by previous Minister for the Environment, Hon. Bill Marmion it remains the State Government's preference that the environmental impacts of shale gas fracking are regulated by the Department of Mines and Petroleum (DMP).

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[2] See, e.g., Wigley, T. (2011), *Coal to gas: the influence of methane leakage*; Hardisty, P,(2012), *Life Cycle Greenhouse Gas Emissions from Electricity Generation: A Comparative Analysis of Australian Energy Sources*

In 2011, the DMP commissioned an independent expert (Dr. Tina Hunter) to review its regulatory arrangements for gas fracking in WA, which falls under the *Petroleum and Geothermal Resources Act.* In her report, Dr. Hunter concluded that "*there are no legal provisions in the* [petroleum] *Act that specifically pertains to the management of the environment in onshore petroleum activities*." [3]

Dr. Hunter identified DMP's requirement for proponents to develop 'Environmental Management Plans' (EMP) as a measure to manage environmental impact, however she also noted that "*under the current legislative framework the EMP is legally unenforceable."*

While some improvements have been made since this report, the fundamental failures noted by Dr. Tina Hunter have not been rectified. As a consequence the WA community cannot have confidence in the regulatory regime currently in place for shale gas fracking in WA.

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Conservation Council of Western Australia
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Look forward

[3] Hunter, T (2011) *Regulation of Shale, Coal Seam and Tight Gas Activities in Western Australia*, Faculty of Law, Bond University