

Submission to WA Fracking Inquiry

March 19, 2018 By email: info@frackinginquiry.wa.gov.au

Introduction

The Conservation Council of Western Australia (CCWA) is the State's peak conservation organisation representing over 100 community groups and tens of thousands of individual supporters who are concerned with the conservation of our natural environment, and a sustainable future for Western Australia.

In consultation with CCWA member groups and the broader community of people who would be impacted by a gas fracking industry in Western Australia, we have formed the position that unconventional gas development in WA must be permanently banned, as it has been in many other jurisdictions globally. We set out the reasons to support such a conclusion in this submission, and in previous submissions we made to the WA Parliamentary Inquiry on Hydraulic Fracturing, which we further submit for the consideration of this inquiry as if it were part of this submission.

Rather than 'reinventing the wheel' when it comes to research, we submit that the global knowledge base regarding the risks and harms of fracking is very large indeed and growing rapidly. In this respect, we refer the Inquiry to the *Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking* (the Compendium) which is a fully referenced compilation of the evidence outlining the risks and harms of fracking.¹ We request that the full body of evidence contained in this compendium is considered by the Inquiry as if it were part of this submission.

In this submission we have attempted to focus on information specific to Western Australia, summarising the arguments for a permanent statewide ban on fracking under the following headings:

- The Precautionary Principle and the Principle of Intergenerational Equity must be applied
- There is no need for gas fracking, or for the gas it would produce
- Fracking in WA presents an unacceptable risk to the global and local climate
- Fracking in WA presents unacceptable risk to ground and surface water
- Fracking in WA represents an unacceptable risk to public health
- Fracking in WA represents an unacceptable risk to cultural heritage, and to the amenity of regional areas that would be impacted by industrialization
- Fracking in WA represents an unacceptable risk to existing industries including agriculture and tourism
- Western Australians overwhelmingly do not support gas fracking

In addition, we provide comments on the regulatory regime for fracking in WA as it was prior to the introduction of the Southwest ban and statewide moratorium.

¹ Concerned Health Professionals of New York & Physicians for Social Responsibility. (2018, March). Compendium of scientific, medical, and media findings demonstrating risks and harms of fracking (unconventional gas and oil extraction) (5th ed.). <http://concernedhealthny.org/compendium/>

First, a brief comment on the background papers and Terms of Reference for the Inquiry

We are extremely concerned that the Terms of Reference appear to lead the Inquiry to a position that gas fracking can be made to be acceptable through the application of regulatory controls. The background papers issued by the Inquiry add to this concern, as they appear to further endorse the view that it is possible to make fracking acceptable by regulation. We reject this view and we are deeply disappointed that the inquiry appears to have pre-empted its own conclusions in this regard.

In particular we are concerned about the 'Regulatory Environment' background paper published by the Inquiry which we believe makes a number of misleading or at the very least contestable claims, and also omits key information. The information presented in the background papers presents what can only be described as an extremely generous and optimistic interpretation of the regulatory environment that existed prior to the Statewide fracking moratorium and fracking ban in the southwest of the state.

These regulatory arrangements were developed under a government that had a policy of deregulation, removing duplication, reducing environmental 'green tape' and promoting the rapid development of fracking across Western Australia. We will refrain from a full critical analysis of the material here, however we do believe to be the shortcomings of the pre-moratorium regulatory arrangements elsewhere.

Rather than taking the pre-moratorium regulatory arrangements as the baseline 'status quo' to build from, we hope that the Inquiry understands that the Southwest ban and statewide moratorium represents the current regulatory position. We hope that this Inquiry can see that position as a baseline precautionary position which has the backing of a strong public and electoral mandate and is in line with a long and growing list of other jurisdictions which have put in place permanent bans on fracking.

The Inquiry should only recommend a deviation from that position if there is irresistible evidence that fracking in other parts of Western Australia would present a significantly lower risk than in the Southwest, or other parts of the world where fracking has been permanently banned.

We also note that information about the potential size and scale of fracking operations provided in the Inquiry background papers. Professor Tony Ingraffea, one of the world's foremost experts on fracking made the following comments in relation to the paper:

"The Background and Issues Paper for the Scientific Inquiry notes, 'A horizontal well, as shown on Figure 1 (with a horizontal length of one kilometre) with ten fracture stages is likely to require 21 million litres of water per well. This is the same as approximately 8.5 Olympic size swimming pools.'

*I hope the Independent Panel moves forward a decade in its research to acknowledge that state-of-the-art shale gas wells in the U.S. have lateral lengths longer than 3 kilometres, more than 100 fracture stages, use 3 tons of proppant per meter, inject over 100 million litres of water, and use over 400 tons of steel, per well. And each of those wells will cost over \$A10 million to complete. The time for comparison to swimming pools is long past."*²

We hope information contained in the background papers (whether in regard to the efficacy of regulatory arrangements or the nature of gas fracking activity and its risks) do not represent the pre-determined views of the Inquiry members.

² Professor Anthony Ingraffea, Dwight C. Baum Professor in Engineering, Cornell University – Presentation to Conservation Council of WA public event 'Fracking QandA', University Of western Australia, Thursday 15 March 2018.

1) The Precautionary Principle and the Principle of Intergenerational Equity must be applied

A growing list of countries, states and sub-national governments have banned gas fracking globally (for a full up-to-date list see the Compendium). However the Inquiry has sought input regarding the particular Western Australian context.

In a Western Australian context, there is a paucity of data regarding our geology, and the potential impacts of fracking on our groundwater have not been well researched.

The WA Environmental Protection Act provides as its first Object and Principle, that:

Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason to for postponing measures to prevent environmental degradation.³

We submit that an application of the Precautionary Principle is necessary here, because the risks that such large scale experimentation could result in significant impacts are very high indeed.

The second Object and Principle provided in the Act is the principle of intergenerational equity

The present generation should ensure that the health, diversity, and productivity of the environment is maintained or enhanced for the benefit of future generations.⁴

We submit that any decision that allows gas fracking to take place in Western Australia would be in direct breach of both of the above principles. As such, we urge the Inquiry to recommend that Western Australia follows the same regulatory pathway as many other countries which have banned gas fracking permanently.

2) There is no need for gas fracking, or for the gas it would produce

There is no demonstrated need for the gas that would be extracted. Western Australia already has a huge amount of surplus gas, far exceeding our energy needs, which is currently being exported as fast as petroleum companies can develop it. There is no need for additional gas as an energy source in the WA economy. For almost all applications of gas as an energy source, there are economically viable alternatives for energy generation in the form of renewable energy, for which WA has abundant opportunities. Estimates of future demand for gas in the WA economy do not indicate that there will be significant growth in demand in the future. In its most recent (2017) Gas Statement of Opportunities for Western Australia⁵, the Australian Energy Market Operator (AEMO) found that:

- WA domestic gas demand growth remains low
- In the near term, to 2020, the domestic gas market is well-supplied
- Gas supply (not including fracking) is expected to exceed forecast demand over the entire outlook period

The AEMO projections appear to be based on a 'business as usual' scenario. Investigation of other scenarios including where renewable energy gains a high level of penetration in the WA energy market

³ *Environmental Protection Act* (Western Australia (1986) 4A Object and Principles of the Act. Principle 1

⁴ *Environmental Protection Act* (Western Australia (1986) 4A Object and Principles of the Act. Principle 2.

⁵ Gas Statement of Opportunities for Western Australia (AEMO) 2017 http://www.aemo.com.au/-/media/Files/Gas/National_Planning_and_Forecasting/WA_GSOO/2017/2017-WA-GSOO.pdf

also show that gas demand is unlikely to increase significantly (for example, see submissions from *Climate Analytics* and *Sustainable Energy Now*).

As such, the idea that more gas will be required as part of a transition to high levels of renewable energy here in WA does not bear scrutiny.

The ability of gas generation to provide 'peaking' generation (and even the increasing use of gas generation equipment in performing this role in this role) does NOT require large additional volumes of gas to that which is currently available (and projected to be available) in the WA energy market. This is because peaking services are required during only comparatively short time intervals, and the overall amount of gas consumed is relatively low, even if the number and capacity of generation facilities required may be larger than currently installed.

For similar reasons which are also elaborated further below and in other submissions, gas is not similarly necessary as a transition fuel in other economies.

3) Fracking in WA presents an unacceptable risk to the global and local climate

Gas, especially when extracted by the process of fracking is a highly polluting fossil fuel. Western Australia has some of the worlds largest fossil fuel deposits in the form of onshore (unconventional gas) which would be developed by the use of fracking technology. It is our moral responsibility to do everything we can to ensure that this resource remains undeveloped.

Lifecycle emissions associated with the development of WA onshore gas resources have been estimated to be extremely high, up to and more than 30 billion tons of Carbon Dioxide equivalent⁶ if WA's entire economically recoverable onshore gas resources were to be developed. Even the domestic emissions component of this pollution is far greater than Australia can emit in order to remain compliant with its international obligations under the Paris Agreement.

There is simply no ethical or science-based argument that can be made to support or allow the release of this amount of carbon pollution, especially when the gas is not needed; alternative energy sources are available at a low cost.

We have presented significant and detailed evidence to support this conclusion in our submission to the WA Parliamentary Inquiry on Hydraulic Fracturing, however climate change impacts were considered to be outside the scope of that inquiry and as such our submission was ignored in this regard. We urge the inquiry to revisit this.

We understand that the Inquiry may also be inclined to avoid dealing with the problem of carbon pollution, by considering that certain carbon pollution arising from the development and use of gas from fracking in WA would be outside the scope of its consideration. We do not believe that this is an ethical position to take, or one which will result in a credible inquiry report which can be accepted by the wider community or the academic and research community. Clearly, there is a strong community expectation that the inquiry will examine 'lifecycle emissions from unconventional gas development; in line with the election commitment made by WA Labor prior to the state election. To ignore this would be to produce a report which could not be considered a credible basis for decision making. Furthermore, just because impacts may be considered out of the scope of consideration by the inquiry does not mean that they do not occur or are somehow not real or relevant. If the Committee believes there is a legal limitation

⁶ Climate Analytics, *Western Australia's Gas Gamble*, 2018

under the Environmental Protection Act to the consideration of Scope 2 or scope 3 emissions (we do not believe there is), then we request that the analysis of emissions from these areas is provided to the Government under 'other advice'.

The 'clean fuel' and 'bridge fuel' myths

Proponents of gas development are often heard presenting an argument that gas is a 'clean fuel' which is playing a positive role in tackling global climate change. A variation to this is that gas is a 'bridge fuel' which is assisting the world move to renewable energy. We note that the draft final report from the NT fracking inquiry partially adopted this view, suggesting that it may be considered acceptable for unconventional gas developments to produce very large amounts of carbon pollution because gas was an energy source that would be important in a transition to renewable energy in the Australian context. We also note that the NT draft report presents no evidence to support this proposition.

Such 'clean fuel' and 'bridge fuel' arguments are spurious and dangerous, as explained in our previous submissions and in a range of literature. The counter argument is summarised recently in the publication *Burning the Gas 'Bridge Fuel' Myth*⁷. This publication makes a number of compelling arguments points in support of its conclusion, including that:

- new gas developments lock in emissions for 40+ years,
- new gas is holding back renewable energy,
- existing fossil fuel developments under production or in construction phase (including gas) are already enough to exceed climate goals.

The implications of gas being mistaken as a clean fuel for efforts to decarbonise the US economy are discussed most recently in this article published last week: *How Climate Activists Failed to Make Clear the Problem with Natural Gas*⁸ in which the author notes:

"If we hadn't discovered fracked natural gas, the effort to deal with climate change would have moved us far more quickly into renewables. With the move to natural gas, it's as if we proudly announced we kicked our Oxycontin habit by taking up heroin instead." Bill McKibben, Schumann Distinguished Scholar at Middlebury College.

There is no evidence that gas as an energy source is used in way that significantly displaces coal as a stationery energy source in Australia, or in the countries that Australia would export gas to.

We note that in the particular domestic context of the USA a decade ago (at a time when renewable energy was significantly more expensive) gas fired electricity generation did replace some coal capacity and this has been credited with reducing the USA's overall carbon footprint. For a variety of reasons including that the USA was a net gas importer prior to the US 'shale gas revolution', the comparison is not analogous to Western Australia. The conclusion that the replacement of ageing coal capacity with new gas generation in the US will deliver a long-term reduction in GHG emissions in that country is also unsupported. A more likely outcome is that the impact of fast-acting climate pollutants (methane in particular) from gas developments in the USA has been significantly underestimated, and that the lock-in effect of new gas generation will significantly delay the transition to renewable energy in that economy, having the net effect of significantly increasing carbon pollution.

⁷ <http://priceofoil.org/2017/11/09/burning-the-gas-bridge-fuel-myth/>

⁸ <https://e360.yale.edu/features/how-climate-activists-failed-to-make-clear-the-problem-with-natural-gas-mckibben>

In most economies where Australian gas would be used, coal is a cheaper fuel and where it is available and tolerated by policy, it is used for baseload electricity generation. Gas is comparatively more expensive and generally plays a different role in the energy generation mix and is therefore not a significant factor in the early closure of coal fired power stations.

In terms of new energy generation build, the growth of new renewable energy installation gathering considerable pace, and has exceeded that of coal. New gas generation is therefore much more likely to be displacing renewable energy in the global context. One end-use where gas could potentially provide an emissions reduction benefit as a direct replacement for dirtier fuels is as an energy source for international shipping, however even here there are far better alternatives in the form of renewable energy derived hydrogen and other bio-derived liquid fuels, and the promotion of gas in this market is likely to slow the adoption of these other cleaner alternatives.

Gas can only be treated as a very significant new and additional source of carbon pollution that cannot be tolerated. We note that the Commonwealth Department of the Environment, Water, Heritage and the Arts reached a similar conclusion in 2010 when it assessed the environmental impacts of the Shell Prelude Floating LNG (FLNG) development⁹. The assessment report noted that:

Shell notes in the EIS that when the CO2 emissions intensity of the FLNG facility are compared with like for like other fossil fuels (e.g. coal) on a well to wheels basis, the FLNG facility could potentially have a net positive impact, but only if the export of Prelude LNG displaces more carbon intensive fuels in power stations. The Department notes that Shell has not proposed to replace any emitters currently using more carbon intensive fuels, and as such, operation of the FLNG facility will add to Australia's total GHG emissions.

Even if gas were replacing coal, when the lifecycle emissions from gas development, processing, transport and end-use are taken into account, the total pollution can be similar or even greater than more efficient forms of coal generation.

No effective way to mitigate emissions

Gas must be treated as a very large, new, additional and unnecessary source of carbon pollution and we submit that there is no way to mitigate the impacts of this very significant new emissions source. The current Commonwealth policy regime is fundamentally inadequate at dealing with carbon pollution from all sources and there is no indication that a policy regime will be established that can provide certainty in this regard. An alternative approach is to introduce state-based requirements for gas developments to offset their emissions, however offsets such as carbon farming are simply not available at the scale required in the Australian context, and the quality of international offsets cannot be guaranteed. In a global context, all available means of offsetting emissions will be required in order to mitigate the impacts of existing fossil fuel developments, leaving no capacity to offset new sources of emissions such as would be created were WA's onshore gas deposits be developed.

Furthermore, it may be problematic to require gas producers to offset the emissions from the combustion of the gas by third parties, and these combustion emissions are likely to occur outside of Western Australian, or even Australian jurisdiction. As such, the ability to exercise regulatory authority over the release of these emissions does not match the need to accept moral responsibility for their impacts. We therefore conclude that there are no effective or satisfactory means by which to mitigate either direct or lifecycle emissions from gas development in WA.

⁹ Prelude Floating Liquefied Natural Gas Facility Recommendation Report (EPBC 2008/4146) April 2010

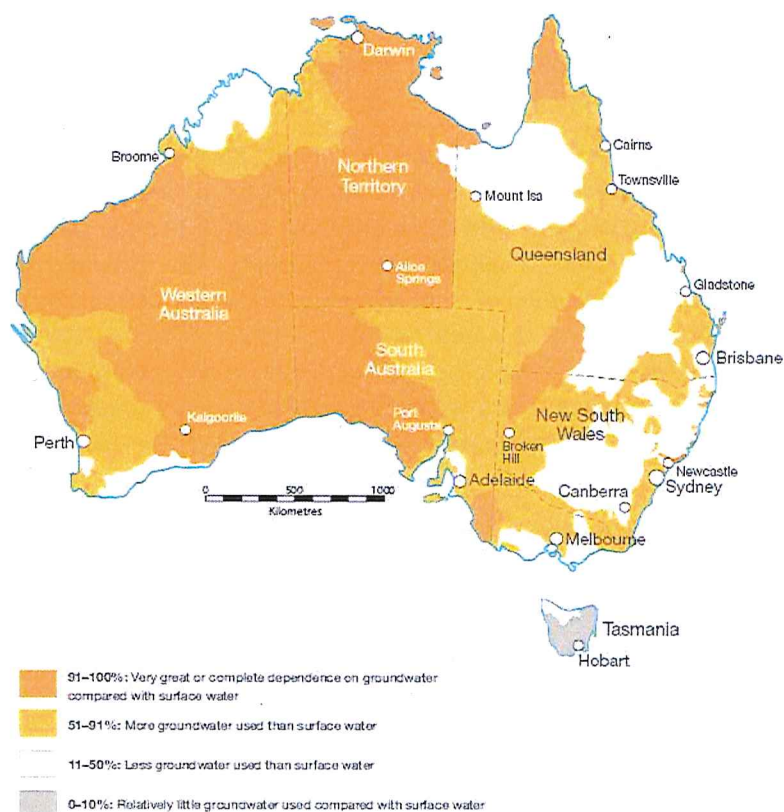
4) Fracking in WA presents unacceptable risk to ground and surface water

There is very considerable research and evidence detailing impacts on groundwater and surface water in other jurisdictions where fracking has taken place. Again we refer the Inquiry to the Compendium.

In a Western Australian context, there is a paucity of data because our geology, and the potential impacts of fracking on our groundwater are not well understood. We submit that an application of the Precautionary Principle is necessary here, because the risks that such large scale experimentation could result in significant impacts are very high indeed.

Evidence presented in other submissions, including our previous submissions to the Parliamentary Inquiry as well as more recent technical contributions from experts to this Inquiry support this conclusion.

Western Australia has a far greater level of dependence on groundwater than many other countries, and most other parts of Australia (see below). Activities that present risk to groundwater such as petroleum development activities should be treated with a far higher level of caution in the Western Australian context



Groundwater dependency in Australia (CSIRO)

While the experience with fracking in WA is not well developed, there have been some important contributions which we draw to the attention of the Inquiry.

In an abstract submitted to the Australian Water Association, WA researcher Fiona Mullen makes the following comments based on research into the Wodada Deep and Arrowsmith 2 shale gas exploration wells which tested fracking of the Kockatea Shale in the North Perth basin:

Regulatory requirements regarding the assessment of seal integrity in unconventional gas reservoirs are currently not well developed in Western Australia. For example, the Department of Mines advises that geological faults must be avoided during hydraulic fracture stimulation due to the potential for induced seismicity (Department of Mines 2015). This requirement is not considered to be realistic as 2km long horizontal wells are likely to intersect multiple faults on a routine basis. In addition active or critically stressed faults are more likely to be fluid conduits whereas non active or non-critically stressed faults are more likely to act as barriers (Sibson 1987). There is a risk that hydraulic fracturing will result in fault slip and hydrocarbons and potentially other fluids may discharge into low salinity deep aquifers.

The existence of thermogenic gas (methane and short chain alkanes) in shallow aquifers should alert regulators to the possibility that the Earth's crust is already close to failure.¹⁰

The authors recommends a prohibition on fracking in and in other areas it is suggested that fracture stress analysis should be a mandatory requirement.

Professor Ryan Vogwill described similar concerns relating to the attempted fracking (using diesel) of the shale deposits under the Whicher Range:

The Whicher Range in the southern Perth Basin is a poignant Western Australian example of the lack of certainty in methods used by unconventional gas proponents to investigate the risks to aquifers. The Whicher Range seismic data interpretations from 2004 and 2012 draw quite different interpretations of the same data. The 2004 interpretation shows relatively little connectivity between faults and relatively little propagation of faults to the surface, hence the industry's appraisal of hydraulic stimulation as low risk at this site. The 2012 analysis of the same data shows significantly more fault connectivity at depth in the target zone and fault propagation to nearer the surface. The 2012 interpretation of subsurface structure (faulting) presents a much greater risk that the 600,000 litres of unrecovered diesel injected into the hydraulic stimulation target zone may reach aquifers near the surface.¹¹

A permanent moratorium is recommended over conservation estate and public drinking water source areas, given the considerable risk that even surface activities hold in the context of the biodiversity values or long term water supply security that these areas are created to protect.

Appendix 1 provides more detailed comments on the adequacy of Western Australia's and Australia's regulatory framework for the protection of water. These comments conclude that the application of groundwater protection is highly variable, subjective, and at times bears little resemblance to environmental outcomes or sustainability.

¹⁰ Fiona Mullen and Rosalind Archer, *Unconventional Gas Risk to Deep Aquifers using Stress Analysis* paper submitted to Australian Water Association conference 2018. (This research is currently in publication elsewhere).

¹¹ Vogwill R., 2017, Western Australia's Tight Gas Industry - A review of groundwater and environmental risks. Conservation Council of Western Australia. ISBN(13): 978-0-9750708-1-9.

https://d3n8a8pro7vhmx.cloudfront.net/ccwa/pages/6404/attachments/original/1493710594/Western_Australia_n_Tight_Gas_Risk_Published.pdf?1493710594

5) Fracking in WA represents an unacceptable risk to public health

There is significant and growing international literature linking gas fracking to serious impacts on public health, including mental health and we again refer the Inquiry to the Compendium for the most recent literature in this area.

In the Western Australian context, to the report by Dr. Melissa Haswell, *Health Concerns Associated with Unconventional Gas Mining in Western Australia*¹² In this report Dr. Haswell reviews the available global literature (which has expanded significantly since), and provides an independent review of the previous reports prepared by the WA Department of Health, and the Parliamentary Inquiry examining health impacts of fracking in the WA context. These reported are often cited by the fracking industry and its promoters in support of the proposition that fracking is safe or can be regulated safely in WA.

In contrast, Dr. Haswell concludes that:

The Reports do not appear to have fully and accurately assessed the potential risks and benefits of the industry to the health and wellbeing of Western Australians, based on current knowledge.

The Reports did not accurately and sufficiently acknowledge the recommendations from many professional public health and medical groups, both in Australia and abroad, to apply the Precautionary Principle to unconventional gas mining.

The terms of reference and/or scope of the review was not sufficient to capture the health and wellbeing risks associated with the unconventional gas industry. These risks arise from much more than just the hydraulic fracturing aspect of shale and tight gas mining.

The Reports do not reflect current understandings from recent research evidence, which support, rather than refute, risks from unconventional gas activity. Other publications highlight the inadequacy of regulation in the protection of human and environmental health.

And that there were:

Issues of potential bias in the interpretation and communication of knowledge- versus opinion that favour industry over the communities that will have to bear the risks that industry brings.

6) Fracking in WA represents an unacceptable risk to cultural heritage, and to the amenity of regional areas that would be impacted by industrialisation

We submit that the inevitable industrialization of landscapes that would result from gas fracking operations presents an unacceptable impact on cultural heritage and amenity values both for white and indigenous Australians.

We refer to the evidence presented by Professor Carmen Lawrence and other to the Inquiry, which provide a more comprehensive treatment of this subject matter.

Professor Lawrence provides the following in her submission:

¹² *Health Concerns Associated with Unconventional Gas Mining in Western Australia*, Melissa Haswell, MSc PhD (London) Professor of Health, Safety and Environment School of Public Health and Social Work Queensland University of Technology (QUT), Brisbane. Available online here: <https://d3n8a8pro7vnm.cloudfront.net/ccwa/pages/6404/attachments/original/1490592015/haswell-report-unconventional-gas-and-health-in-wa-final.pdf?1490592015>

Fundamental to any conception of environmental justice is the right to an environment that is not only clean and health promoting, but also retains its natural, cultural and heritage values, including its biodiversity, ecological integrity, aesthetic qualities and historical associations. The exploitation of unconventional gas in Western Australia is likely to violate these rights – not to mention the effects adding more fossil fuel supplies would have on the existing burden of greenhouse gas emissions which are already producing accelerated warming, more frequent extreme weather events and wildfires, ocean acidification and sea level rise, all of which have very destructive effects on human health and wellbeing.¹³

The lack of effective protection under the Aboriginal Heritage Act, and the lack of detailed examination of these issues under the Environmental Impact Assessment Process indicate that the current approach to managing these issues is significantly lacking, even for existing industries and activities.

7) Fracking in WA represents an unacceptable risk to existing industries including agriculture and tourism

We refer the Inquiry to research published by The Australia Institute (including *Fracking the future - Busting industry myths about coal seam gas*¹⁴) This research demonstrates that claims by the fracking industry of significant economic benefit are exaggerated and come with consequential negative impacts on other industries which are rarely evaluated.

Here in Western Australia, farming and other primary production on the North Perth Basin are significant employers and sources of economic activity.

Similarly the tourism industry is a very significant employer in WA. We know that the primary reason tourists come to Western Australia is because of our wilderness, nature and natural landscapes, and (to a lesser extent) our clean green food and wine industries. We submit that these values would be significantly compromised were a fracking industry to be developed here in WA.

While we are not aware of any studies that have been undertaken to quantify the impacts here in WA, we note that research is included in the Compendium which provides a strong evidence base for considering the likely impacts in this state.

8) Western Australians overwhelmingly do not support gas fracking

Part of the job of the inquiry is to understand what Western Australians value about the environment, so that this may be protected. Western Australians have displayed an overwhelming preference for a frack free future in Western Australia. This is because Western Australians place a high value on the protection of health, communities, and the natural environment, and on the confidence that these values will not be compromised.

¹³ Professor Carmen Lawrence, Director, Centre for the Study of Social Change, School of Psychological Science, University of Western Australia.

¹⁴ *Fracking the future - Busting industry myths about coal seam gas* Institute Paper No. 16 March 2014 ISSN 1836-8948 Matt Grudnoff http://www.tai.org.au/sites/default/files/IP%2016%20Fracking%20the%20future%20-%20amended_0.pdf

There have been well over 100,000 signatures on various petitions opposing fracking over the last five years, including in the lead-up to the March 2017 state election where thousands of people directly contacted their Members of Parliament and took other action in support of a Frack Free Future.

Numerous communities around the state (and in particular in areas targeted for fracking) have made 'gasfield free community' declarations and in many cases such declarations have been supported by Local Government Authorities.

Several Local Shires have also passed policies supporting communities and seeking to constrain gas fracking developments and the Coorow and Carnamah Shire policy provided with this submission is an example (relevant excerpt provided at Appendix 2 to this document)

The high number of submissions to the Parliamentary Inquiry and now to this inquiry demonstrate a very high level of public interest in preventing a fracking industry from becoming established in Western Australia.

Whether it is informed by science or not, people value the confidence that they can drink water from their tap without worrying for its safety, and the confidence that the resources will be protected so that future generations will be able to do the same. They value the ability to visit regional areas and enjoy and experience natural and agricultural landscapes, and to do so without fear that the air that they breathe will cause ill effects on their health. They value the confidence of buying and consuming Western Australian produce without concerns for its safety or whether it is contaminated, or grown in a way that is not environmentally sustainable because water that could be used for food production has instead been allocated to gas fracking.

We submit to the inquiry that this confidence is a function of the relationship that people have to the environment and therefore must be an important consideration for the Inquiry. This confidence has a very significant value, and it is a value that should be protected. However, this confidence can easily be broken, and would be compromised by any fracking developments even if the level of risk is very small indeed.

The lack of effective regulatory controls to protect the environment and communities from the risks of fracking

We believe there is ample evidence and public support to support a permanent ban on fracking in Western Australia for the reasons outlined above and elsewhere. Many of the risks either cannot be regulated effectively (such as climate change impacts, impacts to groundwater, impacts on landscape amenity, impacts on other industries), or regulations that would provide adequate protection would be so onerous as to prevent the activity from occurring in a manner that would be capable of generating profit. For this reason, we urge the Inquiry to recommend a permanent ban on fracking across the state (as has been adopted in many other jurisdictions) as the appropriate regulatory solution.

Without prejudice to this, we take the opportunity to provide some comments on the adequacy of the existing regulatory arrangements in place here in Western Australia.

We draw the Inquiry's attention to the ENGO submission to the DMP on the draft fracking regulations (provided as an attachment). Very few of the concerns raised in this submission are addressed in the current regulatory arrangements that resulted from that process.

We refer the committee to the plain-English guide to how fracking is currently regulated in WA: *Rights, regulations and fracking in WA: How the regulatory system for unconventional gas fails to protect people*

and the environment.¹⁵ This document describes a number of fundamental shortcomings and failings in the existing regulatory system. This document reminds us that:

The process of fracking – drilling holes and pumping toxic chemicals into the Earth under pressure – is by definition a polluting activity. For this reason all over the world the industry can only operate where exempted from pollution control regulations that apply to other industries.

The results of the Western Australian regulatory system can be examined by reference to the outcomes of the handful of fracking attempts which have occurred to date here in Western Australia.

CCWA has carefully examined a number of case-studies of gas fracking in WA (to the extent that this is possible given the withholding of various regulatory information from the public domain). We have concluded that almost all of the fracking activities that have been undertaken to date have had serious problems, issues, or impacts on the environment that were not foreseen at the time of approval.

There have only been a handful of gas wells fracked in WA so far, but there have already been serious problems. We summarise them below:

A summary of fracking fails here in Western Australia

Whicher Range: near Busselton - Over 1 million liters of diesel pumped into the well in an attempted fracking operation, some of this was recovered and the rest remains in the environment presenting a permanent contamination risk to aquifers.

Corrybas: near Dongara - The Corrybas well leaked gas as reported by the West Australian¹⁶

Yulleroo-3: Kimberley - There is a detailed body of evidence surrounding the attempted fracking operations at Yulleroo-3 which has been submitted to this and previous enquiries. This has included the overflow of a wastewater pond following heavy rainfall. This mobilized drilling fluids into the natural environment and demonstrates the significant risk of allowing fracking in the Kimberley where evaporation rates are often exceeded by precipitation for months of the year. Gas leaks also occurred at the Yulleroo-3 well.

Warro 3&4: near Watheroo National Park - The fracking attempt at these wells was abandoned after hitting high pressure artesian aquifer. The wells were allowed to run water for a period of months in an attempt to de-pressure the aquifer.

Woodada wells: near Eneabba - These wells are located in a nature reserve and within 500m of Lake Logue - wetland of national significance. Clearly not a location where a high risk industry should be locating, if industry claims are true that every effort is taken to minimize environmental impact.

Drover-01: near Green Head - This well was approved and drilled in a drinking water catchment for 2 towns. Methane has been found in groundwater monitoring bores. Thankfully the well was abandoned before fracking commenced. More detailed information about this case study has been presented to the WA Parliamentary Inquiry and we draw that information to the attention of this Inquiry.

¹⁵ *Rights, regulations and fracking in WA: How the regulatory system for unconventional gas fails to protect people and the environment*, CCWA 2017, available online here

https://d3n8a8pro7vnm.cloudfront.net/ccwa/pages/1268/attachments/original/1485307130/FFF_170118_Briefing_WA_UG_fracking_regulations.pdf?1485307130

¹⁶ <https://thewest.com.au/news/australia/corrybas-leak-sparks-alarm-ng-ya-306135>

List of Attachments

- 1) CCWA primary submission to gas fracking Parliamentary Inquiry-2014
- 2) Appendix A - CCWA primary submission to Parliamentary Inquiry
- 3) ENGO Submission on WA Fracking Regulations
- 4) CCWA final evidence to the Parliamentary Inquiry Fracking 2015
- 5) CCWA Final Evidence Appendix A - CCWA response to APPEA
- 6) CCWA Final Evidence Appendix B West Australian full finding APPEA misleading and deceptive
- 7) CCWA Final Evidence -Appendix C - Carnamah Shire Policy - Petroleum, Extractive Industries
- 8) CCWA Submission to Parliamentary Inquiry on Drover-01 Case study (13 Documents including cover letter and 12 attachments)

Appendix 1

Comments on the adequacy of current regulatory controls for the protection of water resources in Western Australia

Extract from CCWA submission to Senate Standing Committee on Environment and Communications inquiry into the water use and extractive industries, 2017

Water allocation

Water allocation in Western Australia is done on a 'first come, first served' basis, and there is no current provision for statutory water allocation plans to be put in place. As a consequence, many groundwater areas have no strategic management framework or objectives to guide allocation decisions, regional groundwater studies are often not undertaken before allocation decisions are made, sustainable yields are not well understood, and planning for future water resource demands is not a feature of allocation decisions.

Protection of water quality

The regulatory regime applied in Western Australia for the protection of groundwater water quality is in our view inadequate for the maintenance of environmental values and the protection of human health. There is no single agency or regulator responsible for the setting and enforcing of groundwater quality standards or protections. Such protections are given effect through a multitude of different legislative and regulatory instruments, administered by a number of different agencies. As a result the protection of groundwater quality from impacts by extractive industries is highly variable.

Regulatory conditions for groundwater protection from threats by extractive industries are typically established through the requirements for licensing under the *Environmental Protection Act*; through Ministerial Conditions following Environmental Impact Assessment; under the *Petroleum and Geothermal Resources* legislation; under the *Mining Act*; under the *Rights in Water and Irrigation Act*; or through Management Plans or other subsidiary and delegated approvals required by one or more of the agencies responsible for administering these pieces of legislation. This complexity makes it very difficult to ascertain what standards or policies are being applied in different situations, and the lack of transparency under a number of these agencies and jurisdictions makes it impossible for the public to understand which regulator is responsible, and which standards are being applied for water quality protection.

Where they are gazetted, *Public Drinking Water Supply Areas* provide a level of protection by informing a rigorous approach to risk assessment linked to specific numerical water quality values. However these areas are often very small, and take on arbitrary boundaries (such as property boundaries) that do not align to the physical or hydrological extent or nature of the resource to be protected. As a result we have seen high risk extractive activities such as petroleum drilling and fracking approved within the recharge zones and catchment areas of borefields supplying public drinking water, and within very close proximity to the proclaimed Public Drinking Water Supply Areas.

The majority of extractive industries operate outside of Public Drinking Water Supply Areas, however this does not mean that the groundwater is not being used for drinking and stock watering. Indeed in large areas across the state, groundwater is the primary or only source of drinking and stock water, and is critical for the survival of communities, including Aboriginal communities. The location of many (if not the majority) of abstraction points or natural expressions of groundwater used for drinking in these areas (bores, wells, waterholes) are not known to regulators, making it difficult or impossible for them to properly provide for the protection of these resources when making regulatory decisions.

Water quality protections and standards applied outside the Public Drinking Water Supply Areas appears to be highly variable.

Advice from the relevant WA Government agencies is that the [Guidelines for Groundwater Quality Protection in Australia](#) provide the policy framework for assessing risk, determining standards, and therefore setting protection measures for groundwater in WA.

However these guidelines provide almost complete discretion for state regulators in setting numerical standards for permissible water quality impacts.

The following statements are direct quotes from the guidelines:

There are currently no water quality guidelines for Groundwater Dependent Ecosystems (GDEs) 'that rely on the subsurface presence of groundwater' (i.e. vegetation). In setting water quality objectives to protect these GDEs, parameters that are important for vegetation health should be considered, such as nitrogen, phosphorus, organic carbon, metals, salinity, dissolved oxygen and pH.

There are currently no specified water quality guideline values for protection of cultural and spiritual or industrial water use

Even where generic guideline values are available in NWQMS documents, water quality objectives may be locally defined to consider water quality issues specific to the groundwater system in question. This enables existing water quality, community values, potential and future uses to be considered within water quality objectives.

When it comes down to it, the Guidelines provide that groundwater protection standards for areas outside of drinking water protection zones are to be determined by local regulators taking into account a range of factors as they see fit, including existing and future potential uses of the water resources, as well as other matters such as economic considerations.

In practice this means that there are no consistent groundwater quality protection standards that across the State, and regulators can 'make it up as they go along'.

The most frequent way that this has been applied by WA regulators (especially for extractive industries under the Petroleum and Mining legislation) has been to apply 'As Low As Reasonably Practicable' (ALARP) as the guiding principle for setting standards for groundwater protection.

This ALARP principle bears no relationship whatsoever to the maintenance of ecological processes or protection of human health. It is entirely a construct of what is possible to achieve within a certain budget volunteered by a proponent. In our view this is deeply inadequate and flawed as a basis for setting regulatory conditions for the protection of water as a publicly owned asset.

Appendix 2

Excerpt from Shire of Coorow and Shire of Carnamah policies on fracking

Council support for specific onshore petroleum development or exploration proposals

- a. Council does not support further petroleum resource development within the Shire (including exploration) which has not first undergone thorough and independent assessment of environmental, health, agricultural and socio-economic impacts (including cumulative impacts) by the Environmental Protection Authority, Department of Health and other relevant agencies.
- b. The Shire of Coorow will consider each proposal for petroleum resource development or exploration within the Shire by applying the follow criteria for decision-making. To be supported by the Shire, exploration and development must;
 - Undertake thorough community consultation and achieve demonstrated broad community support for development
 - Maintain and protect the amenity and character of the Shire, and its existing communities and land uses;
 - Ensure zero impact on groundwater resources used for drinking, agriculture or other existing uses, including the catchment and recharge areas for these resources;
 - Ensure zero impact on the health of communities or individuals within the Shire;
 - Ensure that the impacts on Council infrastructure are adequately compensated for in the immediate and future life of that asset, and that the full costs are recovered for any additional infrastructure required;
 - Provide full transparency to the community regarding all environmental compliance and monitoring data, including air quality and groundwater monitoring results, chemicals used, and any other relevant information which must be disclosed in a timely manner.
 - Accept a 'presumption of liability' for any groundwater pollution that is detected in the vicinity of petroleum operations and which can reasonably be associated with those operations.
 - Provide guarantees of full reparation and remediation of groundwater, land, infrastructure, public health or other unplanned impacts that arise from the development.
- c. The Shire of Coorow is not willing to provide its support or assistance to proponents or other parties (including the State Government) who seek to undertake or promote petroleum activities within the Shire that do not meet these standards.



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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7. Appendix

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 of 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 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 on health. In Australia, concern about the possibility of health impacts of unconventional gas mining has been expressed by bodies as eminent as 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 by 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 Pennsylvania¹. 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 the unconventional 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.

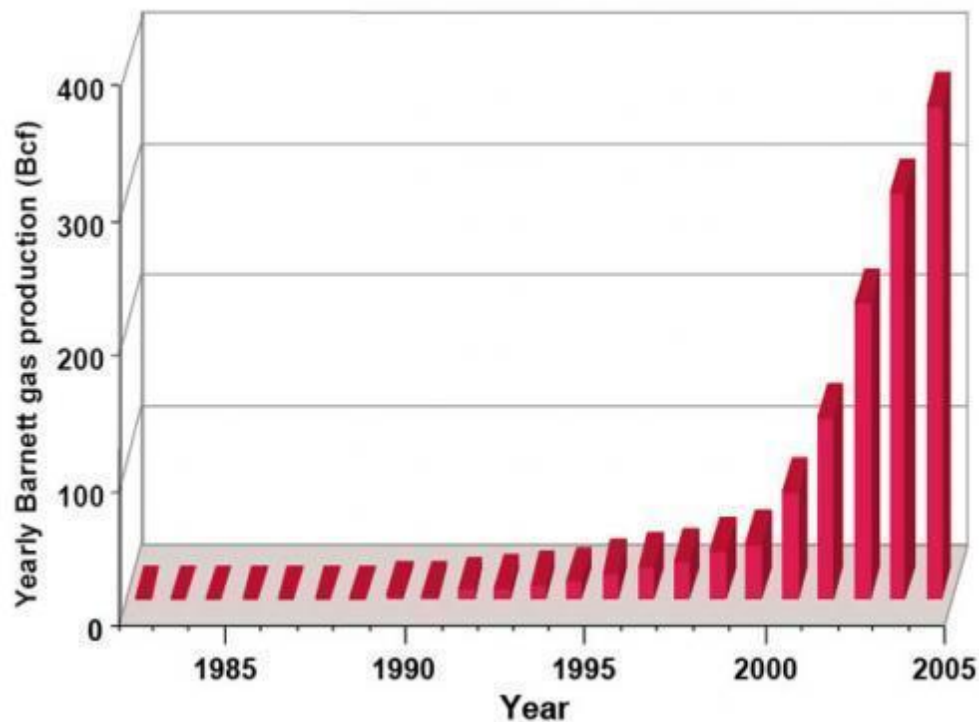
Each well will also require the build of high quality all-weather roads – roads capable of supporting a considerable number of movements of heavy trucks. Total truck movements during the construction and development phases of a well are estimated at between 7,000 and 11,000 for a single ten-well pad (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 be 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, toluene, 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:

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 agriculture⁶.

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.)

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

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 Iternational 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_CementFailureCausesRateAnalysis_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 CO₂ 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 (SO₂ acts as a ‘dimmer’, see Wigley 2011²²)

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%99green-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 CO₂e pollution. To put that into perspective, the entire Australian economy produces about 500 million tonnes of CO₂e pollution per annum at present – so Australia is sitting on gas with the CO₂e 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 CO₂ equivalent (CO₂e) 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 CO₂e of these gasfields is c.5 billion tonnes CO₂e. 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 CO₂e.

- 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](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 2012²⁷ 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

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, mercury³⁰. **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 quality³² 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

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 leukemia³⁵
- Neurological diseases³⁶
- Impacts to the nervous system
- Aggravation of existing heart diseases
- Asthma and other lung diseases (such as chronic obstructive pulmonary disease (COPD))³⁷
- Headache

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 LechtenBöhrer 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

³⁸ 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.

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 Risk 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 linked 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 Tinnapple'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, and 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 on 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





TO: [REDACTED]

30 May 2014

Submission on DMP fracking regulations

1. General comments and recommendations regarding the regulation of proposed gas fracking in Western Australia.

Gas fracking is one of the most polluting, toxic and environmentally damaging industries on the planet. Evidence for this can be seen at developed onshore gas fracking fields around the world.

The existing regulatory framework for proposed gas fracking administered by the Department of Mines and Petroleum is inadequate to protect the environment, groundwater and public health.

The proposed latest round of DMP regulations does nothing to improve the situation – given the high level of industry discretion and the complete absence of transparency embedded in the regulations.

As the DMP is responsible for promoting gas fracking, it is a conflict of interest for the same agency to play a determining or exclusive role in the regulation of the environmental impacts of these activities.

At a minimum, gas fracking must be subject to full Environmental Impact Assessment by the EPA, including the setting of enforceable environmental conditions, with strong and enforceable pollution control regulations administered by the Department of Environmental Regulation.

In the absence of the basic protections outlined in this submission and assuming there will be no significant improvement in the draft regulations, the submitting groups reiterate their demand for a moratorium on proposed onshore unconventional gas fracking in WA.

2. Draft regulations released for consultation.

Overall we believe these regulations will be totally ineffective in controlling an inherently risky industry in the public interest. They seem intended to provide a guaranteed rubber-stamp approval should any company make an application and comply with some simple administrative requirements.

Regulatory approach

We have previously expressed concern about the use of prescriptive regulations which potentially transfer liability to the State in the event of a pollution incident.

We have consistently called for an ‘outcomes-based’ regulatory regime which clearly establishes the environmental outcomes that must be achieved (and the monitoring regime necessary to ensure compliance).

Unbelievably, these draft regulations are silent about outcomes, instead taking a ‘risk-based’ approach which is potentially worse than the current prescriptive model.

Reliance on standards such as ‘*industry best practice*’ and reducing risk to ‘*as low as reasonably practicable*’ is totally unacceptable.

Using these standards as the basis for regulations does not offer any meaningful protection of the environment, groundwater and public health. Such measures cannot be used in place of rigorous outcome-based standards.

Outcomes-based standards must apply

The regulations must stipulate exactly what the tolerable level of environmental impact is, whether that be pollution to groundwater, surface water, air emissions or clearing of native vegetation or disturbance to soil profile, subterranean fauna etc.

The regulations must specifically prohibit ANY contamination of groundwater by gas fracking operations. The gas fracking industry has stated that gas fracking has never caused contamination of groundwater so this should not be resisted by industry.

Monitoring of environmental condition

The regulations must require constant real-time monitoring of environmental condition, including all parameters listed above, so that it is possible to ascertain compliance with the environmental outcomes that have been set. This information must be publicly reported.

Presumption of liability for environmental impacts

The regulations must include an assumption of liability (until proven otherwise) for any groundwater contamination or air pollution detected within 2km of a fracking well. Examples of where this has been implemented is provided at APPENDIX A.

Enforcement and compliance instruments

We are particularly concerned that the Petroleum Act lacks the necessary head powers for enforcement of environmental outcomes, and we speculate that is why these regulations have been drafted to avoid any mention of environmental outcomes. This is not acceptable and the Act must be amended if this is the case.

The regulations must contain meaningful fines and Company Director’s liability for any contamination of groundwater or other breaches that occur. The fines established by the regulations are totally inadequate as a disincentive to cause pollution or environmental harm.

Make-good provisions

In addition to fines, the regulations must include 'make good' requirements for the remediation of environmental impacts to original condition in the event of pollution or other environmental harm.

Well abandonment

The very short period of operator monitoring and liability post-abandonment in the current regulations is not acceptable and confers an unacceptable risk the State.

Well integrity must remain the responsibility of the proponent in perpetuity (including responsibility for carbon pollution arising from gas leakage); and an environmental bonding system must be established to provide for the remediation of abandoned wells which cause pollution or other impacts to the surrounding environment.

A monitoring regime must be established to monitor abandoned wells in perpetuity.

Environmental Bonds

Environmental bonds must be applied to gas fracking at a rate of 100% of remediation costs, with a significant proportion of these bonds to be permanently retained by the State for post-abandonment liability.

Fugitive gas leakage

Methane gas is a powerful driver of climate change and methane leakage is a major issue in gas fracking operations elsewhere in the world.

The regulations must:

- Require baseline monitoring of ambient methane emissions
- Require ongoing real-time monitoring of ambient methane in proximity to all gas wells at all times.
- Prohibit any fugitive gas leakage from any gas wells or infrastructure, without flaring.

Public access to information

Given the high level of community concern regarding the impacts of gas fracking it is absolutely essential that there is a very high level of transparency in the regulatory process.

As such, the lack of transparency requirements in the draft regulations is totally unacceptable.

All documents supplied by proponents for the purpose of achieving approvals, or in the process of complying with regulations, must be made publicly available.

Environmental Management Plans and any other similar documents which require 'downstream approval' must be released for public comment PRIOR to approval.

Hiding behind 'commercial in confidence' provisions is further evidence that the industry and the purported regulator have no interest in transparency or accountability.

Specific comments on particular clauses in draft regulations

- Reg 4(c): "integrity" - use of terms "as low as reasonably possible" is entirely insufficient. Require clear provision and measurable results and sufficient provision for this to be monitored.
- Reg 7: time periods generally (for purposes of protection) appear extremely short and unreasonable.
- Reg 9: 3 – what happens if not approved? Sufficiently captured in later provisions?
- Reg 10: penalties seem generally entirely petty and inappropriate – applies right through the document: i.e. reg's 11.
- Reg 10(2): Why would there ever be need to exempt an "emergency"? A WMP (well management plan) should also be easily completed before commencement of the activity.
- Reg 12: "may apply... of WMP" – must always be a proper EMP, which would include the plans for the well field and WMP's as appropriate. Seems as if "may" implies proponent decides whether it wishes to file any plans?
- Reg 13(1): should provide here that further information may be called for to enable decision – applies through reg's.
- Reg 13(7): provide here for what happens if application rejected.
- Reg 14: rejection - what then?
- Reg 16: why should the Minister be obliged to approve a WMP? Or at least there should be much expanded list of reasons for rejection an application.
- Reg 16(1)(c): "sound engineering principles, codes, standards and specifications" and "in a manner that is consistent with good oil-field practice" – utterly open-ended. Require much clearer provisions with measureable provisions.
- Reg 16(d): appears that it is only concerned about "significant detrimental risk or effect" to any fracking activity. No concern about the fracking itself potentially being detrimental to other activities (tourism, farming, community, health etc).
- Reg 47: as at 12 and 13 above.
- Reg 50: definition "major change" too subjective – no measureable requirements.
- Reg 52(b)(ii) "a" – why limited to a single condition? Change to plural.
- Reg 54: Seems not sufficient information for the Minister to know when a variation may be required – too loose again.
- Reg 55(2): too open-ended as to period or basis on which it may be extended.
- Reg 58: Why should there ever be activity prior to application and approval, with all usual plans etc filed?
- Reg 58(2)(d): disposal or flaring – should flaring be allowed at any time? Why cannot all disposal be properly contained, measured etc?
- Reg 61: extensions, more than once – again no public insight.
- Reg 64: in these regulations all onus is constantly passed to the operator and it seems that the operator is trusted to be trustworthy.
- Reg 67: like all fines, this seems ludicrously minimal.
- Reg 68: should prescribe time period for retention of records.

- Reg 69: as at 25 above.
- Reg 84 & 85: the information defined as “excluded information” is overly/unnecessarily restrictive, is highly relevant and should be made available and be open to public access!

Schedules

- Sch 1 (4) & (8): “sound engineering principles, codes and standards and specifications” - as for 13 above.
- Sch 2: industry may complain that the required disclosures are too broad. All information disclosed to the regulator should be also available to public access.
- Sch 4(8)(a): first time “aquifers” mentioned, yet these are due to be impacted on detrimentally by all these activities.

3. Further specific recommendations.

The use of large volumes of water together with chemical additives makes it essential that the environmental and social implications of this process are fully and rigorously considered – via an open, public and transparent process.

- a) Extensive hydrological and geohydrological studies before exploration and production drilling should be required and made public in order to minimise or eliminate potential impacts on other users.
- b) Appoint an independent specialist(s) to conduct a hydrocensus as well as identify priority water source areas and domestic aquifer supplies indicated on relevant geohydrological maps for consideration in the impact assessment.
- c) Prior to conducting hydraulic fracturing operations, appoint an independent specialist to conduct baseline water quality assessment of all water resources within 2 kilometre of the vertical projection of the planned wellbore to surface.
- d) Water samples collected as part of the baseline quality assessment must be analysed by an accredited laboratory and the holder must submit the results to the relevant authority.
- e) The results must, at a minimum, include a detailed description of the sampling and testing conducted, including duplicate samples, the chain of custody of the samples and quality control of the testing.
- f) After the baseline water quality assessment is conducted-
 - all water resources subjected to regular sampling, analysis and interpretation of water quality and changes in water levels by an independent specialist; and
 - submit the results of the analysis and interpretation to the relevant department.
- g) The relevant department may collect samples of any fluids encountered in the exploration or production area (water or hydrocarbons, at depth or at the surface) for their own analysis and interpretation.

4. Further regulatory failure: Lack of water quality guidelines for the vast majority of water resources in WA

The vast majority of WA's underground water resources are not designated as 'public drinking water supplies' and have no water quality standards applied at all by any regulatory agency. This is despite the fact that they may be declared groundwater areas (i.e. subject to licensing for water use) and these water resources actually supply drinking, stock watering, agriculture, horticulture and various economic uses as well as water to maintain groundwater dependent ecosystems. All of these purposes are quality dependent and would be significantly and irreversibly impacted by contamination from gas fracking.

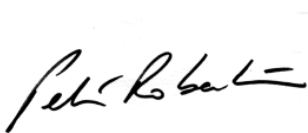
To the extent that there is widespread use of groundwater for drinking purposes throughout the Mid-west and Kimberley, the distinction between a protected drinking water resource (with water quality standards applied) and declared groundwater areas (where no quality standards are applied) is arbitrary.

The same water quality protection measures that are applied to declared drinking water areas (i.e. water quality standards, buffer zones, etc) should be applied to all declared groundwater protection areas.

Any proposed regulations dealing with matters that may impact important groundwater sources should fully reflect the social, economic and environmental value and uses of those sources and ensure their protection. The current proposed regulations fail in this regard also.

In addition to the input set out in this submission, please find attached a copy of the submission to the Inquiry in WA fracking recently presented by CCWA. Most if not all the issues and recommendations in this submission are relevant to the current public comment opportunity.

Yours faithfully



Peter Robertson
Campaigner
The Wilderness Society WA



Piers Verstegen
Director
Conservation Council of WA



Martin Pritchard
Director
Environs Kimberley

And also: Mr Wade Freeman, Kimberley Project Officer, ACF.

Appendices

Appendix A: Examples of regulatory regimes for gas fracking where there is a presumption of liability
Appendix B (attached): Submission to the Inquiry into the implications for Western Australia of Hydraulic Fracturing for Unconventional Gas

All correspondence to: Conservation Council of WA, City West Lotteries House, 2 Delhi St, West Perth, 6005.

APPENDIX A

Examples of regulatory regimes for gas fracking where there is a presumption of liability

PASSED

West Virginia: presumes operator liability for water contamination, but operator can rebut liability if 1. pollution existed prior to drilling, 2. the land owner or water purveyor refused pre-drilling tests, 3. the well was more than 1,500 feet away from the impacted water supply pollution occurred more than 6-months after stimulation, 4. pollution occurred more than 6 months after drilling/stimulation, or 5. for reasons other than drilling/alteration activity.

Pennsylvania (PA): P.L. 87, No. 13 (§ 3217) presumes liability of the operator of an unconventional oil or gas well for all water contamination occurring within 1 yr of a well completed within 2500 feet of a contaminated water resource (6 months, 1,000 ft for conventional wells) unless the operator can affirmatively prove: (i) the pollution existed prior to the drilling, stimulation or alteration activity as determined by a pre-drilling or pre-alteration survey; (ii) the landowner or water purveyor refused to allow the operator access to conduct a pre-drilling or pre-alteration survey; (iii) the water supply is not within 2,500 feet of the unconventional vertical well bore; (iv) the pollution occurred more than 12 months after completion of drilling or alteration activities; or (v) the pollution occurred as the result of a cause other than the drilling or alteration activity.

<http://www.legis.state.pa.us/WU01/LI/LI/US/HTM/2012/0/0013..HTM>

Illinois (IL): Section 1-85 of Public Act 098-0022 states, “it shall be presumed that any person conducting or who has conducted high volume horizontal hydraulic fracturing operations shall be liable for pollution or diminution of a water supply if: (1) the water source is within 1,500 feet of the well site; (2) water quality data showed no pollution or diminution prior to the start of high volume horizontal hydraulic fracturing operations; and (3) the pollution or diminution occurred during high volume horizontal hydraulic fracturing operations or no more than 30 months after the completion of the high volume horizontal hydraulic fracturing operations.” Rebuttal is allowed if the operator can “affirmatively prove by clear and convincing evidence” that: that impacted water resource is more than 1,500 ft from the well site, the pollution occurred prior to horizontal HVHF, the pollution occurred more than 30 months after completion of HVHF operations, or the pollution occurred as a result of an identifiable cause other than horizontal HVHF.

<http://www.ilga.gov/legislation/publicacts/98/098-0022.htm>

North Carolina (NC): In 2012 the NC legislature overrode the Governor’s veto and passed SL2012-143. The act allows presumptive liability of oil and gas developers or operators for water contamination within 5,000 feet of a wellhead. Rebuttal is allowed if a developer/operator can establish that: 1. contamination existed prior to the commencement of drilling activities (as evidenced by the required pre-drilling test of the water supply); 2. the surface owner or owner of the water supply refused the developer or operator access to conduct a pre-drilling water quality test; 3. the water supply in question is not within 5,000 feet of a wellhead that part of the developer or operator’s drilling activities; 4. contamination occurred as the result of a cause other than activities of the developer or operator.

<http://www.ncleg.net/Sessions/2011/Bills/Senate/PDF/S820v6.pdf>

ATTEMPTED

West Virginia: Amendments proposed in 2012 would have extended the distance of liability to 3,500 ft, time since stimulation to 1 year, and redacted paragraph 5. The bill died.


http://www.legis.state.wv.us/Bill_Text_HTML/2012_SESSIONS/RS/bills/hb4386%20intr.pdf

Michigan (MI): Michigan proposed legislation in 2011 that would presumes operator liability without distance limits: "Sec. 20126b. (1) If groundwater in the vicinity of a well used for hydraulic fracturing is determined to contain 1 or more hazardous substances that were injected into that well while conducting hydraulic fracturing, there is a rebuttable presumption that the person conducting the hydraulic fracturing is liable under section 20126 for the contamination present in the groundwater. (2) As used in this section, "hydraulic fracturing" means fluid-driven fracturing of rock for the purpose of stimulating natural gas or oil production." No rebuttal criterion was included. This bill did not pass.

<http://www.legislature.mi.gov/documents/2011-2012/billintroduced/House/pdf/2011-HIB-4736.pdf>

The following webpage includes a more extensive listing:

<http://www.thefreelibrary.com/Shale+oil+and+gas+state+regulatory+issues+and+trends.-a0334277569>


Standing Committee on Environment and Public Affairs,
Legislative Council, Parliament House,
GPO Box A11 Perth WA 6837



15 June 2015

Dear Ms Liveris, Ms Lobeto-Ortega and Members of the Committee,

Additional evidence for inquiry into gas fracking in Western Australia

We are grateful for the opportunity to draw some additional relevant information to the attention of the Committee before the Inquiry finishes its deliberations.

1. Misleading and deceptive claims regarding the impact of gas fracking

You may recall that last year, the Australian Petroleum Production and Exploration Association (APPEA) placed a full page advertisement in The West Australian accusing the Conservation Council and other community groups of promoting misleading information about the environmental and health impacts of gas fracking. A letter was sent to Members of Parliament by APPEA containing similar claims.

At the time we published a response to these claims, which I have attached for your information (appendix A). I am now writing to let you know that APPEA advertisement has itself been found to contain misleading and deceptive claims by the West Australian Newspaper's General Council.

The misleading and deceptive claims and the findings against them can be briefly summarised as follows:

- i) "...hydraulic fracturing has been used for decades in this State to extract natural gas from various geological formations" –

This was found to be misleading and deceptive, the finding determines that: *“Slickwater fracturing is not a long standing, well understood technique and has not been used around the world for many decades. It was first used in 1997. In Western Australia it has been used on seven occasions since 2005.”*

In addition to the finding, we note that almost all of the wells that have been fracked in WA have had serious problems which in some cases have resulted in environmental contamination - see attached for more information.

ii) “Natural gas is safe and clean”

This was also found to be misleading and deceptive, the finding determines that: *The use of the word “clean” in the advertisement the subject of this complaint is misleading and deceptive because an ordinary reasonable reader is likely to interpret the word “clean” as an absolute claim meaning that natural gas does not produce CO2 emissions. That is not the case.*

We have attached the full unedited findings for your information (appendix B)

Whilst it may be understandable that the gas fracking industry would seek to mislead the general public regarding the impacts of its activities, it is far more alarming that very similar statements to those quoted above have been used repeatedly by Government Agencies and Ministers, including the agency charged with regulating gas fracking, the Department of Mines and Petroleum.

2. Review of industry claims in support of shale gas fracking in the USA

The claims being made by the gas industry here in Western Australia are not dissimilar to those used by the gas industry in other countries. We draw the Committee’s attention to a recent analysis of studies, reports and evidence used by the gas industry to support fracking development in the USA. This analysis found that:

- 78% had some form of industry connection and were not independent
- Only 14% of the studies were peer-reviewed
- Only one peer-reviewed study explicitly dealt with public health concerns (and it was industry funded)
- The list included retracted and discredited studies, blog posts and powerpoint presentations.

For more information visit the Public Accountability Initiative <http://public-accountability.org/>

3. Increasing cause for concern identified in peer-reviewed literature

By comparison, a recent review of 447 peer-reviewed studies addressing environmental and health impacts of gas fracking found that:

- 96% of studies indicate potential public health risks or actual adverse health outcomes
- 73% of studies indicate potential, positive association, or actual incidence of water contamination
- 92% of studies indicate elevated air pollutant emissions and/or atmospheric concentrations

The full research paper can be downloaded here:

http://psehealthyenergy.org/data/Database_Analysis_2015.1_.27_1.pdf

4. New research on the climate impact of fracking in WA

As we outlined in our previous submissions, greenhouse gas emissions arising resulting from shale gas fracking in Western Australia are likely to be very significant, however they are unlikely to be mitigated or even identified under the current policy and regulatory environment.

- The WA EPA is the only government agency with a statutory remit to examine greenhouse gas emissions and there has not been any EPA assessment of gas fracking in WA, hence GHG emissions have not been considered by the WA Government
- The lack of an effective national carbon price or other equivalent measure means that there will be no Commonwealth government requirement to mitigate GHG emissions from gas fracking in WA.
- The National Greenhouse Gas reporting framework methodology does not require comprehensive reporting of fugitive and other GHG emissions from gas fracking, so very significant emissions sources are likely to go unreported.

This situation has prompted CCWA to commission new independent research to investigate the likely GHG emissions that would result from a potential shale gas fracking industry in WA. This work has been completed and is now undergoing peer review. We would be willing to provide this research on a confidential basis to the Committee prior to publication should it be of interest.

5. Recent UK House of Commons report on fracking

We would also like to draw the Committee's attention to a recent report on fracking by the UK House of Commons Environmental Audit Committee. The EAC recommended a moratorium on gas fracking in the UK after examining the likely GHG emissions resulting from a UK gas fracking industry and concluding that 'cannot be accommodated within our climate change obligations'. They went on to say that a halt on further fracking developments is also needed 'on environmental grounds'. (Paragraph 83)

The Full report can be accessed here:

<http://www.publications.parliament.uk/pa/cm201415/cmselect/cmenvaud/856/85602.htm>

There are several points in the UK Report, which we feel are particularly relevant to WA and to which we draw the attention of your inquiry:

- The Committee notes that "any large scale extraction of shale gas in the UK is likely to be at least 10-15 years away" so would be more likely to be displacing renewable energy generation rather than coal-fired energy production. It noted that by this stage the industry i) would be unable to compete against renewable energy on cost and ii) the cumulative emissions from the industry would be breaching the UK's carbon budgets. The Committee therefore concludes that only "a very small fraction of the possible shale gas deposits will be burnable."
- 2. A moratorium on the extraction of unconventional gas through fracking is needed to avoid the UK's carbon budgets being breached in the 2020s and beyond, and the international credibility of the UK in tackling climate change being critically weakened. (Paragraph 27)
- 8. Fracking must be prohibited outright in protected and nationally important areas including National Parks, the Broads, Areas of Outstanding Natural Beauty, Sites of Special Scientific Interest and ancient woodland, and any land functionally linked to these areas. (Paragraph 68)

- 9. Venting of methane emissions is not acceptable. Full containment of methane must be mandated in all fracking permits and permissions. (Paragraph 69)
- 10. It is crucial that groundwater is protected and the restriction on fracking in water source protection zones 1 is welcome. However, fracking should be prohibited in all source protection zones and all fracking activity must require a groundwater permit when wells extend under aquifers. A minimum vertical separation distance between shales being fracked and a groundwater aquifer should be defined and mandated. (Paragraph 70)

6. WA community opposition to gas fracking is growing and strengthening

We have previously drawn the attention of the Committee to polling undertaken by the WA Department of Mines and Petroleum (DMP) which showed clear community opposition to gas fracking in WA. At the time, the DMP claimed that community acceptance of gas fracking would increase as communities learned more about the industry.

The reality has been exactly the opposite. The more regional communities grow to understand gas fracking the stronger their opposition.

CCWA would like to draw the attention of the Committee to some tangible examples of community opposition to gas fracking in WA.

Over the last 12 months there have been five community 'gasfield-free' declarations in the Mid-west, including the Carnamah, Greenough, Cervantes and Irwin communities. These communities cover a significant proportion of the North Perth Basin.

For an ABC report on the most recent gasfield-free community declaration in Irwin, visit this site: <http://www.abc.net.au/news/2015-06-14/wa-town-goes-frack-free/6545188>

In each of the survey areas, over 96% of residents have been opposed to gasfield and fracking developments in their region.

We urge the Committee to consider the implications of a State Government policy regime that would result in gas developments being approved in communities who have stated strong opposition to this industry.

7. Local Governments taking leadership in addressing shale gas fracking impacts

In response to community concerns which remain unaddressed by the State Government, a number of Shire Councils have adopted policies which seek to protect communities, land and water from the impacts of gas fracking.

We attach an example of such a policy from the shire of Carnamah (appendix C).

We draw the Committees attention to important aspects of these policies stating that the Shires will not support any fracking exploration or development unless fracking companies:

- can demonstrate community support for their projects;
- Maintain and protect the amenity and character of the Shire;
- Ensure zero impact on groundwater resources;
- Provide guarantees of full reparation and remediation of groundwater, land, public health etc.;
- accept a 'presumption of liability' for any groundwater contamination.

We believe these are appropriate policy responses to the threat of gas fracking in these communities and we congratulate the Shires for their local leadership on this matter. We urge the Committee to recommend similar safeguards across the State should a shale gas fracking industry be allowed to develop in Western Australia.

In summary, as the Committee investigation draws to a close we submit that the evidence to support a moratorium or total ban on gas fracking in WA on the grounds of environment, health and community opposition is overwhelming. State Government responses to date have been totally inadequate, and have led to a growing sentiment that regulators are captured by industry and are working against the interests of communities. Growing community opposition demonstrates that the gas fracking industry has failed to achieve a 'social licence' and that communities do not have confidence the industry will be regulated adequately to protect their health, livelihoods and environment amenity.

The Committee has an important role in restoring some confidence in Government and Parliament by making strong recommendations that are responsive to the very significant risks associated with gas fracking and the strong and growing community opposition to the industry. This must include a recommendation for a moratorium or total ban on gas fracking in Western Australia.

Thank you again for the opportunity to bring this additional information to the attention of the Inquiry; please let us know if you would like further information or testimony on any of the issues we raise.

Yours sincerely

Piers Verstegen
Director, Conservation Council of WA



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 years¹. 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).

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

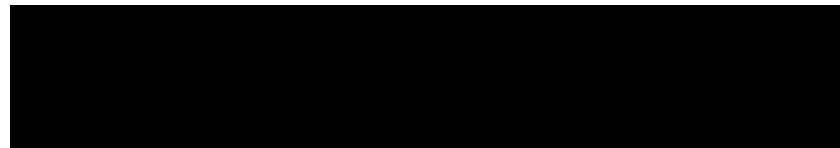
Dr. Hunter identified DMP’s requirement for proponents to develop ‘Environmental Management Plans’ (EMP) as a measure to manage environmental impact, however she also noted that *“under the current legislative framework the EMP is legally unenforceable.”*

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.

CCWA Contacts:

Piers Verstegen, CCWA Director – [REDACTED]

Jamie Hanson, CCWA Climate and Energy Program Manager - [REDACTED]



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



Published October 13th 2014

Let's be as clear as drinking water about the risks of fracking

We'd like to set the record straight regarding the impact that this industry could have on the water resources that Western Australians all depend upon.

The peak industry body representing gas companies has recently attacked the Conservation Council and other community groups, claiming that we have misled the public by over-stating the environmental and health risks of gas fracking in a newspaper ad.

They say that gas fracking has *never* polluted groundwater and that gas from fracking is a *clean fuel*.



Neither of these statements are true, however the West Australian newspaper also recently made a finding which partially upholds the gas fracking industry's claims and, their attack against CCWA.

So how can the gas industry continue making these statements, and how can they be upheld by our state's daily newspaper?

The answer lies in a trick of language that the industry continues to exploit in order to obscure reality for long enough to get their wells drilled. Like tobacco companies claiming that cigarettes do not cause cancer, the gas industry have come up their own definition of 'fracking'. Disappointingly, some people, either too lazy to do their own research or out of convenience, have fallen for it.

As you might expect, the industry's preferred definition of gas fracking excludes all the parts of the fracking process that cause pollution.

So, where the industry is as opaque as drilling mud, let us be as clear as our drinking water.

At CCWA, when we talk about gas fracking we are talking about the process of drilling tens to thousands of wells through groundwater aquifers. We are talking about pumping a cocktail of toxic chemicals into those wells at extreme pressures capable of fracturing solid rock. We are talking about the storage and disposal of millions of litres of wastewater that has been

contaminated by fracking chemicals. And we are talking about a network of gas pipelines and compressor stations across the landscape.

Commercial scale gas fracking cannot take place without these things, and this is where the problems lie.

The truth that the gas industry doesn't like to acknowledge is that over the last few years, fracking companies have been fined time and again by State Governments in the USA for polluting groundwater, rivers and aquifers and spilling chemicals into the environment.

Scientific and regulatory reviews document hundreds of cases of well-casing failure, methane migration, chemical spills and waste dumping. In fact, one preferred method of disposing used chemicals after fracking is to inject the waste at high pressure into the earth. If that is not polluting then we don't know what is.

Even the gas industry's preferred scientific source, the *Australian Council of Learned Academies* states that "...there have been some high profile examples of groundwater contamination due to fracking".

With the possibility that thousands of gas wells could be drilled through our groundwater aquifers in WA (a figure which industry have not disputed), it's important to understand whether those wells will leak into our water supplies.

Over the course of time it is reasonable to assume that all gas wells will break down and eventually fail, but as fracking is a relatively recent industry we have only a decade or two of real data to go on.



From that short experience we know that corrosion, cracking and leakage from steel and concrete well casings is one of the most common causes of pollution in fracking operations.

The most recent comprehensive study of well failure and leakage published in the *Journal of Marine and Petroleum Geology* found that the percentage of wells that have had some form of 'well barrier or integrity failure' is highly variable (1.9%–75%). Of fracking wells targeting the Marcellus shale in Pennsylvania inspected between 2005 and 2013, 6.3% of these have been reported to the authorities for infringements related to well barrier or integrity failure.

One of the reasons why the gas industry can get away with making their claims in the face of overwhelming evidence is that the WA Department of Mines and Petroleum also use this trick of language in their promotional material about gas fracking. As the agency that is responsible for regulating the environmental and other impacts of this industry, we have a right to expect much better.

But for the gas fracking industry, their attack is not about facts. It's about attacking the credibility of community organisations who are trying to protect their water, their health and their environment.

It is about discrediting the growing global movement led by farmers, conservationists, doctors, mothers, churches, universities and local community leaders who are saying NO to gas fracking, and who are in many cases succeeding in stopping this industry.

Here in WA, community-based conservation groups from across the state have agreed that stopping gas fracking is the highest priority environmental issue for the sector as a whole.

Churches and universities around the country are dumping their investments and withdrawing their share holdings in companies involved in gas fracking.

Earlier this month, the Anglican Diocese of WA voted to withdraw all investments in fossil fuels and [published a statement of concerns](#) regarding fracking.

Across the Mid West and the Kimberley, people are organising against fracking in one of the fastest-growing examples of grass-roots community organising ever to take place.

With over 96% of residents opposing fracking, communities like Greenough are coming together to declare their local areas 'Gasfield free'.

Local shires are passing policies against fracking and speaking out in support of their concerned constituents.

Aboriginal Traditional Owners are opposing fracking on their cultural lands, for they know that protecting their groundwater is critical to the health of their people and their country.

Farmers and pastoralists supported by the *WA Farmers Federation* are calling for veto rights over gas fracking on farmland. Far from a radical protest movement, even the *Country Women's Association* have called for a halt to fracking.

Farm by farm and street by street, landowners are locking their gates to the fracking rigs.

And when necessary, farmers, community members and Traditional Owners around the world are putting their bodies on the line to stop the drilling. Buru Energy's proposed fracking sites in the Kimberley are already the subject of permanent protest camps occupied by Traditional Owners.

It's not surprising that communities are standing up against gas fracking given our almost total reliance on groundwater in Western Australia.

Currently, there is nothing to prohibit gas fracking in the catchments and aquifers that supply our drinking water. This is alarming given that around 25% of all of WA's drinking water reserves have [oil and gas exploration permits over them](#).

Earlier this year AWE Energy drilled the first exploration fracking well in a drinking water catchment in the Mid-west

If fracking is allowed to go ahead in WA at a commercial scale, there could be tens of thousands of wells across some of the most beautiful, and fragile parts of WA including the Mid West wildflower region, the Carnarvon foodbowl and the Kimberley.

That is a dangerous scenario for our state that the Conservation Council will continue to work to avoid.

CCWA has been a strong voice for the environment for 45 years and we will not be silenced by cynical attacks from the gas fracking industry.

What we will do is continue to stand up to protect the environment, our water and the health of our communities.

Piers Verstegen

Director, Conservation Council of Western Australia

Advertising Complaint – The West Australian, October 11-12, 2014

DETERMINATION

Facts

On page 2 of *The Weekend West* of 11-12 October 2014 the Australian Petroleum Production and Exploration Association Limited (APPEA) published the following advertisement:



On 15 October 2014 Patricia McAuliffe complained that the advertisement was misleading and deceptive (Attachment 1).

Complaint Process

As a member of the Publishing Advertisers Bureau WAN has, as it is obliged to do, considered the complaint and this is its response.

Submissions

On 15 October 2014 Patricia McAuliffe made submissions in support of the complaint (Attachment 2)

On 3 November 2014 APPEA made submissions in response (Attachment 3).

Specific Complaints

Patricia McAuliffe complains, in essence, that the advertisement was misleading and deceptive when it:

1. said, in essence, "hydraulic fracturing has been used for decades in this state to extract natural gas from various geological formations"
2. described natural gas as "safe, clean.... natural gas"

3. said “Western Australia’s natural gas industry.... helps.... reduce greenhouse gas emissions across the globe.”

Findings

Complaints (1) and (2) are upheld. Complaint (3) is not upheld. The reasons for those findings are as set out below.

Reasons

A statement of fact in an advertisement will be misleading when, in the context in which the statement is made and having regard to the message that is sought to be conveyed, the dominant message conveyed by the statement is materially incorrect. The statement, in isolation and at a high level of generality, might be correct. But in the context and for the purpose it is conveyed it may convey a false impression.

Statements in an advertisement raising technical environmental issues mislead or deceive readers, if it is more likely than not that the statements do not reflect contemporary scientific views held by reputable scientific experts in that field of science; and those statements are likely to lead readers into error in relation to the scientific position and consequences of the circumstances described.

The reader who must have been misled or deceived is the ordinary reasonable reader. That is a reader of average intelligence, not an expert in the particular scientific area but not a person incapable or disinterested in scientific issues of general public interest. The ordinary reasonable reader will not be avid for scandal nor unsympathetic to the expression of concerns in relation to environmental matters.

The ordinary reasonable reader will not be trained in, or conversant with, fine technical scientific details or issues. Such a reader will not be concerned with unlikely or unusual exceptions to the general scientific state of affairs. While a statement may be true or false, or debatable, or susceptible to different views at a high level of scientific detail such a reader will not be interested in, and will be incapable of discerning, scientific niceties at such a level of minute detail.

Complaints generally

As identified in APPEA’s submissions the precise wording of the complaints does not reflect the precise wording of the advertisement the subject of complaint. Nevertheless, the essence of the complaints can be identified, as set out below, and as has been addressed by APPEA’s submissions.

Complaint 1

“The statement that “hydraulic fracturing has been used for decades in this State to extract natural gas from various geological formations” is misleading.

“Fracturing” (also known as “fracking” or “fraccing”) is a generic term used to describe the process where fractures are created in underground rock in which oil and gas are trapped. The fractures created increase the extraction of oil and gas and by doing so increase the productivity of oil and gas wells.

Fracturing was first used in the oil industry in the 1860’s in America. The process was then known as oil well “shooting”. It involved the stimulation of shallow, hard rock vertical oil wells in Pennsylvania, New York, Kentucky and West Virginia by breaking up (at the time called “rubblising”) the oil-bearing rock formation with an explosion, using liquid or solidified nitro-glycerin detonators. For a description of the historical development of hydraulic fracturing, from which these facts and those below are taken, see

<http://www.ourenergypolicy.org/wp-content/uploads/2013/07/Hydraulic.pdf>

http://www.law.uq.edu.au/documents/publications/hunter/hunter_aer_29_3.pdf

<http://aoghs.org/technology/hydraulic-fracturing>. American Oil & Gas Historical Society.

<http://137.229.113.30/webpubs/usgs/p/text/p1570.pdf>

(Ben E. Law and Charles W. Spencer, 1993, "Gas in tight reservoirs-an emerging major source of energy," in David G. Howell (ed.), *The Future of Energy Gasses*, US Geological Survey, Professional Paper 1570, p.233-252)

<http://igs.indiana.edu/OilGas/HydraulicFracturing.cfm>

On 25 April 1865, American Civil War veteran Col. Edward A L Roberts was granted a patent for this "exploding torpedo" process. Nitro-glycerin is an unstable substance and the process was occasionally hazardous and often used illegally and with adverse environmental consequences. The use of Nitro-glycerin was widely banned, which led to Alfred Nobel developing dynamite in 1867.

In the 1930's acids instead of explosive fluids were used to stimulate the release of oil and gas from hard rock vertical wells. Fluid acid was injected under pressure into a well creating "pressure parting" of rock. The fractures created would not close completely because of acid etching leaving a channel through which oil and gas could be retrieved enhancing the productivity of the wells.

In 1947 Floyd Farris of Stanolind Oil & Gas Corporation developed a fracturing process based on pressure alone rather than breaking up oil and gas bearing rock using explosives or etching the rock using acid. This process, first performed in Grant County Kansas, used naphthenic acid and palm oil (napalm) thickened petrol and sand from the Arkansas river injected under pressure to fracture the rock and release oil and gas. A patent was issued for this process in 1949 under the name "Hydrofrack".

Between 1947 and 1952 napalm was replaced as a fracturing fluid by refined and crude oils. They were cheaper and required less pumping pressure due to their lower viscosity.

In 1953 water, in combination with chemical gelling agents, became the preferred fracturing fluid. It was a cheaper product than oil and was environmentally less invasive.

In 1968 Pan American Petroleum developed an hydraulic vertical well fracturing technique used to extract gas from rock with low permeability (unblocked flow pathways in the rock). Until then it had not been possible to economically extract gas and oil from low permeable rock. This technique was called "high-volume hydraulic fracturing" because it required the use of a much greater quantity of fracturing fluid.

In 1991 "high-volume hydraulic fracturing" was combined with horizontal drilling for the extraction of gas from low permeable shale. Shale deposits run horizontally, so a horizontal well (opposed to a conventional vertical well) releases much more of the gas resource trapped in the shale rock.

<http://law.case.edu/journals/LawReview/Documents/63CaseWResLRev4.6.Article.Robbins.pdf>

The latest major development in fracturing technology is called “slickwater fracturing”. It was first used in 1997 by Mitchell Engineering in Texas, USA. This process involves fracturing fluid comprising water and chemical friction reducers (commonly referred to as “slickening agents”).

http://thebreakthrough.org/archive/shale_gas_fracking_history_and
http://en.wikipedia.org/wiki/Society_of_Petroleum_Engineers
http://thebreakthrough.org/archive/interview_with_dan_steward_for

The slickening agents reduce the friction of the water in the well and the viscosity of the fluid. Because the fluid is less viscous and the water is lighter more volume is needed to carry the same amount of proppant (for example sand which is used to prop open the fractures that drain the gas) in the fluid.

Much higher pressure is also needed to pump the fracturing fluid which in turn creates more fractures and greater productivity. The absence of fracturing gel in this process also allows greater flow back of gas.

<http://www.oilandgasbmps.org/resources/fracing.php>

This “slickwater fracturing” technique is materially different from other fracturing technologies in that it uses less chemical additives, much greater quantities of water (70-300 times more than other techniques -<http://frack-off.org.uk/if-fracking-has-been-happening-since-1947-what-is-there-to-worry-about>) and operates at far higher pressure (100bbl/min compared to 60bbl/min for non-slickwater hydraulic fracturing <http://www.gofrac.com/services/slick-water.html>) The technique is particularly suited to the more efficient and cost effective extraction of gas from shale because:

- (a) Shale is a low permeability rock. Non slickwater fracturing is not able to flush the gels from small fractures to enable the most efficient flow and collection of gas from low permeability rock. The absence of gel also allows for a quicker and easier placement of proppant into the fractures enabling a quicker flow back of gas.
- (b) Slickwater fracturing at high pressure stimulates more and more complex rock fractures leading to a greater harvesting of gas.
- (c) The use of less chemical makes the process cheaper.
<http://www.fas.org/sgp/crs/misc/R40894.pdf>

These attributes of slickwater fracturing are significant for Western Australia because estimates are that the State’s shale gas resources are significant and potentially twice that of it’s known off shore gas reserves.

[http://www.dmp.wa.gov.au/documents/Natural_Gas_from_Shale_and_Tight_Rocks -
An overview of Western Australia regulatory framework.pdf](http://www.dmp.wa.gov.au/documents/Natural_Gas_from_Shale_and_Tight_Rocks_-_An_overview_of_Western_Australia_regulatory_framework.pdf)

In response to this complaint APPEA makes three points:

1. APPEA’s advertisement states that *“Hydraulic fracturing has been used for decades in this State to extract natural gas from various geological formations.”* This is fact. In WA, more than 800 wells have been hydraulically fractured without incident, the first in 1958.
<http://www.dmp.wa.gov.au/documents/Petroleum-Hydraulic-Fracture-Stimulation.pdf>

2. I note the complainant specifically premises this claim by referring to the practice of “slickwater fracking” as a newer technology. “Slickwater” is an industry term that refers to a specific water based fluid mixed with friction reducing agents. It is one of several types of fluid that can be used. It is important to note that other (non-slickwater) treatments are becoming more popular.
<http://acola.org.au/PDF/SAF06FINAL/Final%20Report%20Engineering%20Energy%20June%202013.pdf>
3. The general public, environmental groups (including the Conservation Council of WA), government, academics and industry do not make a distinction between hydraulic fracturing using slickwater fluid and other hydraulic fracture stimulations using other fluids. Changes in fracking technology do not change the fact that it is a long-standing, well-understood technique that has been used safely around the world for many decades; nor does it make APPEA’s advertisement misleading.

The statement in the first point made by APPEA accurately reproduces only part of the information in the from a Government of Western Australia, Department of Mines and Petroleum fact sheet entitled “Natural Gas from Shale and Type Rocks Fact Sheet Hydraulic Fracture Stimulation” dated September 2014.
(<http://www.dmp.wa.gov.au/documents/Petroleum-Hydraulic-Fracture-Stimulation.pdf>). That fact sheet goes on to say

“Historically, hydraulic fracturing involved pumping a small amount of fluid under relatively low pressure into a target rock formation to open up small gaps in the rock to increase oil and gas flow.

Recent developments in technology mean higher pressures can now be used to create small fractures to release gas from shale and type rock. Since 2005, seven exploration wells have undergone this type of hydraulic fracturing in WA”.

The “recent developments” referred to are the “slickwater fracturing” technique described above.

The statement in the second point is not accurate. The ACOLA report referred to does not say that “.... other (non-slickwater) treatments are becoming more popular”. It says:

“Whilst most fracture treatments in shales are water with a friction reducer (“slickwater”) plus chemicals, hybrid hydraulic fracturing (mixtures and separate stages) is becoming more common, in which slickwater is first used, followed by gels and cross-linked gels which thicken the water in order to suspend the sand and maintain fluid viscosity as the temperature increases.”

Further, while it might be correct to say that “slickwater” is an industry term that refers to “a specific water based fluid mixed with friction reducing agents,” “slickwater fracturing”, the “practice” referred to by the complainant is a newer technology that is a materially different form of hydraulic fracturing that has only been used since 1997.

Nor is the third point accurate. The complainant in this matter (who is representative of the general public aligned in thinking with environmental groups), environmental groups,

government, academics and industry do make a distinction between slickwater hydraulic fracturing and hydraulic fracturing using other fluids. The differences between slickwater fracturing and other methods of hydraulic fracturing is the subject of debate and controversy. In fact the statement the subject of this first complaint that hydraulic fracturing has been used for decades is itself the subject of controversy in government, environmental and academic circles. <http://thebakken.com/articles/711/the-slickwater-story>)
<http://stopfyldefracking.org.uk/latest-news/how-does-high-volume-slick-water-hydraulic-fracturing-of-shale-differ-from-traditional-hydraulic-fracturing/>

It is misleading to say that “hydraulic fracturing has been used for decades in this State to extract gas from various geological formations” because:

1. The cost effectiveness of slickwater fracturing, the substantial undeveloped shale gas reserves in Western Australia, the projected increase in the forecast demand for electricity in Western Australia of 60% by 2030 and the significant benefits to the State in employment, regional growth and royalties all mean that slickwater fracturing will likely be the technique (perhaps in a hybrid fashion) used in the development of shale gas production in Western Australia.
(<http://igs.indiana.edu/OilGas/HydraulicFracturing.cfm>)
2. Although “slickwater fracturing” is, in the generic sense, fracturing, it is materially different from other forms of fracturing in relation to the quantity of water used, the quantity of chemicals used, the pressure applied in the course of the process and the extent of the fracturing of shale rock resulting.
3. Slickwater fracturing is not a long standing, well understood technique and has not been used around the world for many decades. It was first used in 1997. In Western Australia it has been used on seven occasions since 2005.
4. In the context of the advertisement, the overall purpose of the advertisement was to give the impression that slickwater fracturing has been used in Western Australia for such a period of time that it can be regarded as a tried and trusted technique without environmentally adverse consequences. This is how the ordinary reasonable reader would view the advertisement. While hydraulic fracturing itself is not new the particular technique of slickwater fracturing, involving substantially and materially higher pressure and water usage with greater fracturing capacity than previously implemented hydraulic fracturing techniques is new and has not been used in Western Australia, or elsewhere, for decades.

Complaint 2

“Natural gas is safe and clean”

The submissions in support of the complaint are couched in very wide terms directed at “many risks associated” with “the whole process” of hydraulic fracturing. The submissions said:

“The whole process from seismic surveying, drilling, extraction, storage, and transport to end use has many risks associated which have been widely researched and documented.”

There is no doubt that there are risks associated with the process of hydraulic fracturing.

In the determination of 17 September 2014 (www.appea.com/ccwa) which is referred to in the advertisement, the subject of this complaint, the fact that there were risks associated with the process was recognised. However, the CSIRO has published the following view:

“Although there are risks associated with hydraulic fracturing, a combination of research from around the world shows us that the risks are low. The largest risks with unconventional gas extraction are associated with surface activities such as ensuring well integrity, water treatment of flowback, vehicle movements, and chemical handling. The risk of contaminating agricultural and drinking water from shale gas extraction is very low in most cases, as the fractures generated by hydraulic fracturing itself are deep under the earth. <http://www.csiro.au/Outcomes/Energy/Energy-from-oil-and-gas/UnconventionalGas/Hydraulic-fracturing.aspx>”

As recorded in the APPEA submissions similar views have been published by the Australian Council of Learned Academies and other independent scientific bodies:

“The evidence suggests that provided appropriate monitoring programs are undertaken and a robust and transparent regulatory regime put in place (and enforced), there will be a low risk that shale gas production will result in contamination of aquifers, surface waters or the air, or that damaging induced seismicity will occur.”

<http://www.publications.parliament.uk/pa/cm201012/cmselect/cmenergy/795/795.pdf>
<https://royalsociety.org/~media/policy/projects/shale-gas-extraction/2012-06-28-shale-gas.pdf>

The UK Department of Energy and Climate Change (DECC) has (2012) concluded that *‘In the light of robust controls in place... to protect the environment and ensure safe operation, DECC see no need for any moratorium on shale gas development.*

This is also the view of the (UK) Energy and Climate Change Select [parliamentary] Committee, which held an inquiry into shale gas in 2012. It concluded that any risks that do arise are more likely to be related to well integrity, and are no different to issues encountered when exploring for petroleum from conventional sources.

The UK Royal Society and the Royal Academy of Engineering (2012) found that if regulated properly and with investment in safeguards, hydraulic fracturing can take place quite safely, without hurting the local environment.
<https://royalsociety.org/~media/policy/projects/shale-gas-extraction/2012-06-28-shale-gas.pdf>

The APPEA Code of Environmental Practice, The Code of Practice for Hydraulic Fracturing and State and Federal Government Mining and Environmental Legislation will all play a part in the regulation of the shale gas industry.

The advertisement does not, however, make the statement that “the whole process of hydraulic fracturing is safe and clean”. It says, in effect, “natural gas is safe and clean”.

The complainant asserts that in describing natural gas as “clean” the advertisement is misleading. The reason put forward in support of this contention is that natural gas produces CO₂ when burned and methane (a primary component of natural gas) during its production and use, primarily through leaks and losses during extraction and transport to end users. Natural gas used for electricity generation emits about 50% less CO₂ compared with a coal fired electricity generation plant.

Accordingly, using CO₂ emissions alone natural gas is cleaner than coal.

In this context the Government of Western Australia, Department of Mines and Petroleum in its February 2014 publication “natural gas from shale and type rocks, an overview of Western Australia’s regulatory framework” says this:

“Development of a shale and tight gas industry has the potential to deliver benefits to Western Australia including energy security, a cleaner energy mix and economic growth.

Currently, WA’s energy demands are primarily met by natural gas (55 per cent) followed by oil (30 per cent), black coal (13 per cent) and renewable energy (2 per cent).

The State’s energy demand for electricity is forecast to rise 60 per cent by 2030. Almost three quarters of this increased demand is expected to be met by natural gas. The demand for natural gas is increasing globally because it is a relatively clean source of energy compared to more carbon-intensive fuels such as coal or oil.”

http://www.dmp.wa.gov.au/documents/Natural_Gas_from_Shale_and_Tight_Rocks_-_An_overview_of_Western_Australia_regulatory_framework.pdf (page 5)

A similar issue was considered by the Advertising Standards Authority UK in a complaint made against Peabody Energy Corporation. The adjudication in relation to that complaint was handed down on 20 August 2014 (http://www.asa.org.uk/Rulings/Adjudications/2014/8/Peabody-Energy-Corporation/SHP_ADJ_266168.aspx#.VHWPbZ2Q-9I)

In that matter Peabody Energy Corporation had published an advertisement described in the adjudication as follows:

“Let’s Brighten the Many Faces of Global Energy Poverty...3.5 billion people in the world lack adequate access to energy ... 4 million people - one every eight seconds - die each year from energy poverty ... Untold millions around the world must choose between paying for food or power... Energy

poverty. It's the world's number one human and environmental crisis. It holds people and societies down, cripples health and damages the environment. Access to energy is an essential gateway to modern living, longer lives and powerful economies. That's why Peabody Energy is working to build awareness and support to end energy poverty, increase access to low-cost electricity and improve emissions using today's advanced clean coal technologies. We call it Advanced Energy for Life. Because clean, modern energy is the solution for better, longer and healthier lives. Together we can brighten the faces of billions by improving energy access for all. Be part of the solution in your community and around the world ... Campaign powered by Peabody Energy""

The relevant complaint was in these terms

“the term “clean coal” was misleading and implied that the advertiser’s impact on the environment was less damaging than was actually the case”

The complaint was upheld in these terms

“The ASA understood that the phrase “clean coal” was the term given to a branch of research and innovation aimed at reducing the environmental impact of using coal, such as filtering out particulates and preventing or neutralising the emission of waste gases. However, we also understood that this technology was not able to prevent CO₂ from being emitted during the use of coal, relying instead on carbon capture and storage, and that although emissions such as sulphur dioxide were reduced, they were still produced. We also noted that the line immediately following this claim stated “We call it Advanced Energy for Life. Because clean, modern energy is the solution for better, longer and healthier lives” and considered that consumers were likely to assume that this referred to Peabody Energy’s ‘solution’ of “clean coal”. Although we noted that the ad stated “clean coal” technologies would “improve emissions”, we considered that this was not sufficient to make clear the nature of this technology, particularly in the context of the word “clean”. Notwithstanding the fact that “clean coal” had a meaning within the energy sector, we considered that without further information, and particularly when followed by another reference to “clean, modern energy”, consumers were likely to interpret the word “clean” as an absolute claim meaning that “clean coal” processes did not produce CO₂ or other emissions. We therefore concluded that the ad was misleading.”

The advertisement the subject of this complaint is in similar terms, stating that natural gas is “clean” and helps “improve” air quality and reduce greenhouse gas emissions.

The ordinary reasonable reader, in the context of this advertisement, is likely to interpret the advertisement the subject of this complaint in the same way as consumers were found to have been likely to interpret the word “clean” in the Peabody Energy Corporation advertisement.

The use of the word “clean” in the advertisement the subject of this complaint is misleading and deceptive because an ordinary reasonable reader is likely to interpret the word “clean” as an absolute claim meaning that natural gas does not produce CO₂ emissions (or methane emissions – see Complaint 3 below). That is not the case.

Complaint 3

“Western Australia’s natural gas industry helps improve air quality and reduce greenhouse gas emissions across the globe”.

Greenhouse gas emissions involve both the release of CO₂ into the atmosphere when fossil fuels are burned and the release of methane when fossil fuels are mined, processed, transported and used for energy generation.

The scientific debate the subject of this complaint concerns the relative greenhouse impact of both these sources of greenhouse gases between coal and natural gas.

While natural gas produces about 50% less CO₂ than coal on combustion it also results in the release of methane into the atmosphere during its “total lifecycle use” from being mined to being used. (<http://epa.gov/cleanenergy/energy-and-you/affect/natural-gas.html>)

The “global warming potential” of methane is 34 times that of CO₂ over a 100 year period and 86 times that of CO₂ over a 20 year period. However, CO₂ remains in the atmosphere about ten times longer than methane. (http://opinionator.blogs.nytimes.com/2013/09/24/is-natural-gas-clean/?_r=0)

Scientific views about the relative merits of the global warming potential of natural gas compared to coal are sharply divided.

<http://web.stanford.edu/group/efmh/jacobson/Articles/I/NatGasVsWWS&coal.pdf>

<http://www.sciencemag.org/content/343/6172/733.summary>

<http://iopscience.iop.org/1748-9326/9/9/094008/article>

http://www.eeb.cornell.edu/howarth/publications/Howarth_2014_ESE_methane_emissions.pdf

<http://www.smithsonianmag.com/science-nature/natural-gas-really-better-coal-180949739/>

<http://www.energypost.eu/wishful-thinking-natural-gas-fossil-fuels-cant-solve-problems-created-fossil-fuels/>

<http://www.desmogblog.com/fracking-the-future/myth.html>

Apart from the debate as to whether it is appropriate to model relative greenhouse effects on a 20 year or a 100 year time frame, scientific views conflict in relation to estimates of methane emissions during the production and use of natural gas, and the contribution that can be made by “green technologies” to reduce methane loss in the shale gas production process.

Some studies conclude that the use of natural gas and, in particular the use of new technologies such as slickwater fracturing will make it cheaper to produce and use natural gas which will only slow down the demand for renewable energy from wind, hydro and solar sources and so will be counter productive to the urgent need for greenhouse gas reduction. In this context shale gas production is criticised for not being a “bridge” between coal fired power generation and renewable energy

The main difficulty is that there is insufficient measured data and analysis available upon which concluded scientific views can be formed on the relative greenhouse impact of the use of natural gas v coal in the production of energy. Further, the studies that have been performed have made estimates based upon conditions existing in the USA which may not be applicable to Australia.

The two reports that are of some relevance to the issue and concern Australian conditions are:

CSIRO – October 2012:

http://www.huntervalleyprotectionalliance.com/pdf/CSG%20-CIRO_FugitiveEmissionsReportFinal_Oct2012.pdf

ACOLA – May 2013

<http://acola.org.au/PDF/SAF06FINAL/Final%20Report%20Engineering%20Energy%20June%202013.pdf>

The CSIRO report expresses no concluded view on the relative greenhouse gas impact of the use of coal as against the use of natural gas.

The ACOLA report concludes that with the implementation of the best “green completion technologies” and higher efficiency gas turbines reductions in greenhouse gas emissions of a substantial degree could be achieved.

“Government projections indicate that gas may grow to 30% of the technology mix by 2030. Based on gas supplying either 30% or 50% of electricity generation in 2030, analysis indicates that this could lead to reductions of either 54 or 103 M tonne CO₂ per annum, or 27% or 52% respectively in terms of the current GHG emissions for electricity production. These are mean value estimates (from distributions of uncertainty) and are applicable to low values of CO₂ in the gas stream being vented to atmosphere during processing. The large amount of gas required for this to occur could be provided, in part, by shale gas. Given that Australia has obligations under the second commitment period of the Kyoto Protocol (to achieve GHG emissions of 99.5 percent of 1990 levels by 2020 or the option to move up to a 25% reduction on 2000 levels by 2020), the Expert Working Group believes that deployment of higher efficiency gas turbines (and in the case of shale gas the use of green completion technologies) have the potential to make a substantial contribution to the achievement of Australia’s GHG obligations over this timeframe.”

That being the best scientific view currently available in relation to the Australian position, and with the commitment to environmental protection as clearly stated in the submissions by APPEA in answer to this complaint, it is not misleading to say that “Western Australia’s gas industry helps reduce greenhouse gas emissions across the globe”.

Tony McCarthy
Group General Counsel



The West Australian | 7 | 7two | 7mate | Qunkka

West Australian PUBLISHERS | Countryman | Regional


Standing Committee on Environment and Public Affairs,
Legislative Council, Parliament House,
GPO Box A11 Perth WA 6837



12 September 2014

Dear  and Members of the Committee,

Additional evidence for inquiry into gas fracking – Risks to groundwater resources in Western Australia from gas fracking: the Drover-1 case-study

We write to provide additional evidence to the Inquiry into the Implications for Western Australia of Hydraulic Fracturing for Unconventional Gas. This additional evidence relates to Drover-1 fracking proposal by AWE Energy near Green Head in the Mid West.

As one of the first fracking wells approved in Western Australia and the first to be approved within a drinking water catchment area (that we are aware of), we believe that the regulatory framework and approvals process for this development can and should be taken as a case-study to examine the adequacy of the processes currently in place for the protection of groundwater resources from gas fracking.

As such, we write to request that the Inquiry examine a number of specific matters relating to this proposal.

We have examined the proposal documentation for Drover-1 in detail, conducted site visits and obtained additional material through Freedom of Information. This investigation has identified what we believe are a number of critical failures in the assessment process for this fracking proposal, which in turn place the drinking water supply, environment and community health at risk.

Our key concerns are addressed in detail in Attachment A - *The Drover-1 fracking proposal and its implications for gas fracking in groundwater areas* and other attachments referred to in that document.

Concerns relating to this approval include:

- In granting approval for this proposal, **both the EPA and Department of Mines and Petroleum relied substantially on advice from the Department of Water (DoW)** regarding risks of contamination to the drinking water aquifer.
- **The DoW did not realise their advice would be used to approve fracking in the well and did not investigate contamination risks relating to the fracking of the well.**
- **Dow's advice does not include any assessment of risk to groundwater from well casing failure or migration of fluid or gas from the fracking zone – the 2 most likely causes of groundwater water contamination.**
- **DoW were either unaware of, or chose to ignore the presence of an abandoned well (Gairdner 1) close to the Drover-1 well.** The risk that this well could act as a pathway for contamination into the drinking water aquifer was not assessed.
- **The proponents groundwater report says that the natural faults and fractures in the rock separating the fracking zone and the aquifer have not been investigated.**
- **The catchment area and recharge zone for the Mt. Peron Bore-field has not been not mapped by the DOW,** even though the fracking well is likely to be within this zone.
- **The priority-1 Public drinking water supply protection zone does not cover the catchment and recharge area for the bore-field – a fact that is not understood by the lead regulator.**
- **The groundwater monitoring plan for the project is only designed to detect surface spills and contamination and results of groundwater monitoring will not be publicly disclosed.**
- According the Department of Environmental Regulation, **under current legislation the proponent may not be held responsible in the event of contamination.**
- **Alleged breaches of the Environmental Management Plan for the operation have not been adequately investigated.**

We also draw to the attention of the Committee:

- Letters signed by over 80 residents of Green Head and Leeman calling for fracking in the Drover-1 well to be suspended pending a full inquiry into the risks to drinking water and public health (**Attachment L**)
- Motions passed by the Shire of Coorow supporting the above call for the fracking in Drover-1 to be suspended, and opposing any further fracking in the Shire pending full public assessment of environmental, health and agricultural impacts. (**Attachment M**)

Given the above, we submit to the Inquiry that:

- a) Fracking activity in the Drover-1 well must be immediately suspended pending a full investigation into the approval process for this project and the risks of groundwater contamination from the operation; and
- b) Fracking proposals elsewhere in WA (but particularly within groundwater areas) must be put on hold pending an investigation into the assessment, approvals, and regulatory process for Drover-1, and until these processes are amended to ensure the issues associated with Drover-1 are not replicated in the future.

Thank you for the opportunity to bring these issues to the attention of the Inquiry; please let us know if you would like further information or testimony on any of the issues we raise.

Yours sincerely,



Piers Verstegen
Conservation Council of WA

Attachments:

- A: The Drover-1 fracking proposal and its implications for gas fracking in groundwater areas
- B: CCWA summary briefing note on Drover-1
- C: DoW advice on the Drover-1 proposal
- D: Documents tabled by DoW at meeting with CCWA
- E: Geological profile diagram for Drover-1
- F: Rockwater Groundwater Report on Drover-1
- G: CCWA letter to DER, 23 July 2014-09-08
- H: DER response to CCWA
- I: CCWA Correspondence to DMP reporting alleged breaches of EMP
- J: DMP response to CCWA on alleged breaches of EMP
- K: AWE Letter to Leeman and Green Head Residents May 2014
- L: Letters from Green Head and Leeman Residents Re. Drover-01 fracking proposal
- M: Motions passed by the Shire of Coorow re. Drover-01 fracking proposal

10.2.3 PROPOSED POLICY – PETROLEUM, MINING AND EXTRACTIVE INDUSTRIES

Applicant:	N/A
Location / Address:	N/A
File Ref:	ADM0072
Disclosure of Interest:	Nil
Date:	3 rd November 2014
Author:	Chief Executive Officer
Attachments:	Draft Policy – Petroleum, Mining and Extractive Industries

SUMMARY

This report recommends that Council adopt the attached draft policy on Petroleum, Mining and Extractive Industries.

BACKGROUND

For the last two years there have been concerns about the emergence of the unconventional gas (fracking) industry in the region, particularly with respect to the potential impact on the environment, water aquifers and landholders rights. In September, Mr Ray Hortin and Mr John Brown of the Eneabba P.O.W.E.R group made a presentation to Council on the concerns associated with Companies carrying out fracking within the Shire of Carnamah. Amongst other things in its presentation, the P.O.W.E.R group raised the following concerns:

In this area what can we expect?

- 1) We can expect many wells to be drilled and fracked. It is impossible to say how many but it is likely that it will be thousands. High impact.*
- 2) It will have much infrastructure; pipelines, compressor stations, roads, well pads, etc*
- 3) It will have greatly increased activity, with full on drilling, fracking, pipe laying and the construction of processing and other infrastructure.*
- 4) Where will the workforce live and how many will be local?*
- 5) Property owners what can they expect? They do not own the Gas?*
- 6) What can locals living in the area expect?*
- 7) What will happen to property prices: For houses, for farming properties?*
- 8) How safe are our pristine water aquifers?*
- 9) What will happen to Nature Reserves and National Park?*
- 10) And what will happen to our environment.*

Further to the presentation, the Shire has included references to the P.O.W.E.R group presentation in its local newsletters to help in raising community awareness.

COMMENT

Within the Shire of Coorow there is also consternation about fracking operations and at the Coorow Shire Council's Meeting of the 17th September 2014, the Shire adopted a policy on *Petroleum, Mining and Extractive Industries*. This was circulated to Council at its October meeting and considered to be a good example which could be replicated by the Shire of Carnamah.

Mr Darren Friend, the CEO of the Shire of Coorow, kindly consented to Carnamah adapting the material within the policy adopted by Coorow to use in formulating a policy of its own. Accordingly, a draft policy for the Shire of Carnamah has been prepared and attaches to this report.

It has to be noted however that because of the lack of jurisdiction that local government has over petroleum, mining and extractive industries, in practical terms the only influence that it can exert is through advocating community concerns.

CONSULTATION

Mr Darren Friend CEO Shire of Coorow

STATUTORY ENVIRONMENT

Petroleum and Geothermal Energy Resources Act 1967

POLICY IMPLICATIONS

If the proposed policy is adopted it will be included in the Shire of Carnamah Policy Manual and will be subject to periodical review.

FINANCIAL IMPLICATIONS

Nil

VOTING REQUIREMENT

Simple Majority

OFFICER RECOMMENDATION

ITEM: 10.2.3

That Council adopt the attached draft policy on Petroleum, Mining and Extractive Industries.

11.21

Petroleum, Mining and Extractive Industries

Policy Statement:

The Shire of Carnamah supports the expansion of industry that helps deliver economic prosperity to its residents however, in providing this support Council supports every effort being undertaken to ensure that the initial assessment as well as compliance and monitoring of any activity is carried out at a level that protects the amenity of the natural and built environment and that of residents.

Objectives:

- To ensure that local values relating to lifestyle and quality of life, including public health, amenity, biodiversity, water (both surface and ground), and other economic sectors (such as agriculture and tourism) are adequately considered and protected from the development or expansion of any extractive industry activity in the Shire of Carnamah.
- To ensure that any future or existing extractive industry activity is thoroughly assessed, monitored and managed effectively to meet all conditions of development consent, and endeavour to continuously improve operational practices to reduce environmental impacts wherever practicable.
- To ensure petroleum and mining companies build a commitment to best practice standards for petroleum and mining activity in the Shire of Carnamah, and actively participate in local communities.

Guidelines:

The principal role for Council is to advocate on behalf of the Shire of Carnamah and its communities. Council is not the determining authority for mining applications, but no other organisation has the interests of the communities of the Shire of Carnamah as its principal focus.

The primary economic land use within the Shire of Carnamah is food production through agriculture.

The Shire of Carnamah's communities and businesses are dependent on access to clean groundwater. The protection of water resources and infrastructure (including underground aquifers, catchment and recharge areas, rivers, creeks, lakes, wetlands, dams, wells and bores) from pollution or over-use is therefore of paramount importance to the sustainability of the local economy and communities in the region.

The Shire of Carnamah contains areas of natural vegetation that are unique and of global ecological significance. These areas not only provide a basis for nature-based tourism industries, but are worthy of protection in their own right in order to support the maintenance of ecosystem services including clean air, water and biological diversity.

Large areas within the Shire of Carnamah are subject to petroleum exploration leases and there is limited existing petroleum production within the Shire. The exploration and production of these onshore resources is likely to require hydraulic fracture stimulation (fracking) technology which is new to the Shire.

In respect to current and future proposals for on-shore petroleum or other extractive industries, Council will;

- a. Effectively consult communities within the Shire regarding onshore petroleum developments and represent the concerns and interests of these communities in decision-making on all matters relating to these developments;
- b. Assume a leadership role in negotiating with the State Government and resource companies to ensure that any petroleum or mineral resource projects in the Shire provide benefit to the community, and individuals within the community where appropriate;
- c. Ensure that the protection of the health of communities and the protection of groundwater resources is afforded the highest priority in decision-making by the Shire;
- d. Support and advocate for the rights of communities and residents within the Shire to clean water, clean air, and enjoyment of land without pollution or nuisance;
- e. Support and advocate for the existing economic land uses within the Shire to continue to operate unhindered by impacts of petroleum or extractive industries.
- f. Facilitate an open dialogue and discussion within the community of all stakeholders, based on the sharing of accurate information to encourage an informed debate about issues related to mining.

Council support for specific onshore petroleum development or exploration proposals

- a. Council does not support further petroleum resource development within the Shire (including exploration) which has not first undergone thorough and independent assessment of environmental, health, agricultural and socio-economic impacts (including cumulative impacts) by the Environmental Protection Authority, Department of Health and other relevant agencies.

- b. The Shire of Carnamah will consider each proposal for petroleum resource development or exploration within the Shire by applying the follow criteria for decision-making. To be supported by the Shire, exploration and development must;
- Undertake thorough community consultation and achieve demonstrated broad community support for development;
 - Maintain and protect the amenity and character of the Shire, and its existing communities and land uses;
 - Ensure zero impact on groundwater resources used for drinking, agriculture or other existing uses, including the catchment and recharge areas for these resources;
 - Ensure zero impact on the health of communities or individuals within the Shire;
 - Ensure that the impacts on Council infrastructure are adequately compensated for in the immediate and future life of that asset, and that the full costs are recovered for any additional infrastructure required;
 - Provide full transparency to the community regarding all environmental compliance and monitoring data, including air quality and groundwater monitoring results, chemicals used, and any other relevant information which must be disclosed in a timely manner.
 - Accept a 'presumption of liability' for any groundwater pollution that is detected in the vicinity oil and gas extraction operations and which can reasonably be associated with those operations.
 - Provide guarantees of full reparation and remediation of groundwater, land, infrastructure, public health or other unplanned impacts that arise from the development.
- c. The Shire of Carnamah is not willing to provide its support or assistance to proponents or other parties (including the State Government) who seek to undertake or promote petroleum activities within the Shire that do not meet these standards.

Conservation Council of Western Australia Submission to Standing Committee on Environment and Public Affairs - Additional evidence for inquiry into gas fracking

Attachment A

The Drover-1 fracking proposal and its implications for gas fracking in groundwater areas

See also:

Attachment B - CCWA summary briefing note on Drover-1

Introduction

From examination of documents produced as part of the approval process, it is clear to us that there has been a fundamental failure by various regulatory bodies to assess the potential contamination of groundwater by the Drover-1 project

1) Consideration of risk to groundwater by regulators based on DoW advice

The advice provided by the Department of Water (DoW) on this project is central to how other regulatory bodies including the EPA and DMP have assessed and mitigated groundwater pollution risks and is therefore of significant interest as a critical part of the approvals decision-making.

The EPA relied exclusively on the advice of the DoW in its analysis of groundwater and surface water contamination risks. It was on the strength of this advice that the EPA determined these risks to be low and that therefore, environmental impact assessment (EIA) for the proposal was not necessary. The appeals process re-examined this decision, with the Minister and Appeals Convener again relying on the DoW advice to uphold the EPA's decision not to require EIA.

Similarly, the DMP have also relied on DoW advice in the setting of conditions to manage the risks of water contamination as part of the Environmental Management Plan (EMP) for the project, including the groundwater monitoring plan. This is evident from correspondence between the agencies on the issue as well as public statements. For example, in an interview with ABC's 7.30 report¹, when asked about impacts of the Drover-01 project to groundwater, the DMP representative stated "*This is where we rely on the advice of the experts in the Department of Water*".

After examination of the DoW advice on this project (**attachment C**), we conclude that the advice is fundamentally flawed in a number of respects, having totally ignored or only provided cursory examination of a number of significant risk factors associated with the proposed fracking activity.

2) Misunderstanding of the approvals process and purpose of advice by DoW

During the course of meetings with senior DoW staff on 24 July 2014 we learned that the agency was not aware that fracking had been approved to commence at the Drover-1 well. Documents were tabled by the DoW at that meeting confirming this error (**see attachment D**). This demonstrates that the DoW did not understand that their departmental advice to the EPA and DMP had been (or would be) relied upon to provide approval for fracking to take place.

At the meeting it was also confirmed that the DOW advice had not fully examined the risks associated with fracking in the Drover-1 well, and that the advice had been given on the basis that the well was a conventional 'exploration' well that may undergo fracking at some time in the future (subject to some further assessment including additional advice on the fracking of the well from DoW).

¹ <http://www.abc.net.au/news/2014-08-08/mid-west-community-unhappy-with-fracking-plans/5659766>

3) Severely limited scope of DoW advice

The above misunderstanding of purpose explains why the DoW advice focussed on the potential for water contamination from surface spills at the drilling pad (as is the standard practice for conventional petroleum wells i.e. not fracking), and gave only passing mention of the risks of contamination from the fracking activity itself. This also explains why the groundwater monitoring suggested by the DoW consisted only of shallow bores, capable only of detecting contamination from surface spills - i.e. the standard groundwater monitoring requirements that would apply to conventional petroleum well.

As a result of this, the groundwater monitoring regime required in the EMP for the project is incapable of detecting contamination arising from two of the most likely causes of pollution from fracking wells; well casing integrity failure, and migration of fracking chemicals and gas from the fracking zone.

Because the DoW did not conduct a full assessment of risks to groundwater from fracking in the Drover-1 well, a number of critical factors were totally overlooked by the agency in preparing their advice.

4) No examination of risk related to abandoned well in close proximity to Drover-1

The first, and possibly most alarming risk factor which is not even mentioned in the DoW advice is the presence of an abandoned well drilled in the 1990's (Gairdner-1) in very close proximity to Drover-1. (See Attachment E - Geological profile diagram for Drover-1) This abandoned deep gas well extends down to the depth of the fracking zone, and is within a distance that fractures could reasonably be expected to propagate from the Drover-1 well.

At the time of writing, DMP have been unwilling or unable to provide any information regarding the Gairdner-1 well, including what condition the well is in and how the well was decommissioned. We have no idea what condition the well-liner is in, whether the cement job on this well is sound, how (or if) and to what depth the well is plugged or capped, and when the last inspection of this well was undertaken. We can only assume that this well is in deteriorating condition.

We believe that the presence of a deteriorating abandoned well in very close proximity to a fracking well presents a potential pathway for contamination from the fracking zone (which will be pressurised to an extreme degree) into the shallower groundwater aquifers. Gas and fracking chemicals could be forced up inside the abandoned well itself, or more likely, around the outside of the rusting well casing. The failure to examine, or even consider this risk is a fundamental shortcoming of the DoW advice.

5) No examination of risk related to migration of gas or chemicals through natural faulting in target shale formation

The DoW advice and the proponents groundwater study state that the Kockatea shale separates the base of the aquifer from the fracking zone.

The proponents own groundwater study confirms that this shale formation is naturally fractured and faulted, providing an explicit caveat that the faults have not been investigated and are not well understood.

The study states that... *"The hydraulic properties along faults in the area are difficult to assess without specific investigations which have not been undertaken ... Faults that cut the strata are potential conduits for vertical movement of fluids."*²

² Drover-1 Groundwater Study (Rockwater Pty Ltd.) – Attachment F

The well is in close proximity to the Beagle Fault, however the full extent and characteristics of this fault system are not understood.

The potential for high-pressure fluid and gas migration through natural fault systems presents a possible or likely pathway for contamination of the drinking water aquifer however this has not been investigated as part of the DoW advice.

6) Failure to examine risk arising from proximity to, and location within catchment of Mt. Peron bore-field.

While the Drover-1 well has been drilled within the region described as the catchment area for the Mt. Peron borefield in the Management Plan for the water resource, it has become apparent through our investigations that the DoW have not accurately mapped the extent of this catchment zone and as a consequence cannot absolutely confirm whether the Drover-1 well is in fact within this catchment area or not.

Clearly this is of material significance when it comes to assessing the potential for groundwater contamination to pollute the drinking water resource, and yet the DoW failed to investigate this in their advice to EPA or DMP.

Similarly, the DoW have not conducted any groundwater flow modelling to determine how long it might take for groundwater or surface water contamination to find its way from the fracking well to the bore-field. It is understood that the prevailing direction of groundwater flow in the region is in a North-westerly direction (i.e. directly from the fracking well to the bore-field). Again, this is a matter of material significance to the likelihood of contamination entering a drinking water resource. Despite this, the DoW made no attempt to further characterise the groundwater flow regime, and even omitted to mention the direction of groundwater flow in their advice.

7) Inadequacy of statutory protections for drinking water resources, and misunderstanding of statutory protection zones by lead regulator.

As is the case for other drinking water resources, under the Water Source Protection Plan³, the Mt Peron water resource is afforded some limited protection from activities likely to cause pollution by a Priority 1 Public Drinking Water Protection Area.

In the case of the Mt. Peron resource, the P1 Protection zone extends to an area covering a 500m radius of the Bore-field however this protected area offers no protection for:

- a) The catchment area from which water is drawn for the bore-field (which is much larger than the P1 Area)
- b) The aquifer that the bore-field draws from
- c) The recharge zone from which the aquifer is recharged

In addition, the shape of the protection zone takes no account of surface or groundwater flow regimes and in this respect arbitrary.

Despite these limitations, the lead regulator in the DMP confused the P1 protection zone around the bore-field with the catchment zone for the bore-field, with the DMP's Jeff Haworth stating on the ABC 7.30 report⁴ that the Mt Peron Bore-field has a "very small catchment area only 500m across". Clearly there is confusion within the lead regulator as to the nature and purpose of the P1 protection areas.

³ <http://www.water.wa.gov.au/PublicationStore/first/77203.pdf>

⁴ <http://www.abc.net.au/news/2014-08-08/mid-west-community-unhappy-with-fracking-plans/5659766>

8) Reliance on inadequate and outdated Water Source Protection Plan

For the larger catchment area outside the P1 protection zone, the *Mount Peron and Leeman (Midway) Water Reserve Drinking Water Source Protection Plan* Management Plan⁵ for the Drinking water resource provides the principal guidance for land-use planning decisions in water resource areas. It is also this Management Plan which provides the principal guidance for advice provided by DoW to other regulators on proposals for land-use change within drinking water catchments.

Groundwater Management Plans list various types of land-uses, ranked according to the level of risk to groundwater resources. These plans are updated periodically to account for new or newly identified risks to the water resources that they cover, however the Mt. Peron Groundwater Management Plan has not been updated to include gas fracking, and the plan provides no guidance on how gas fracking proposals should be assessed or managed.

As such, the principal planning document for the management of risk to groundwater resources was outdated, and provides no guidance whatsoever on gas fracking.

9) Inadequacy of Groundwater Monitoring plan and non-disclosure of groundwater monitoring results to public or other regulators

As outlined above, the groundwater monitoring regime required in the EMP for the project has been designed to detect contamination from surface spills and contamination events only. This program of groundwater monitoring using shallow bores is incapable of detecting contamination arising from two of the most likely causes of pollution from fracking wells; well casing integrity failure, and migration of fracking chemicals and gas from the fracking zone.

We are advised by the DMP that groundwater monitoring results obtained as part of these groundwater monitoring requirements will not be publicly disclosed for at least 2 years, and that disclosure of this and other critical information is currently prevented under the PGER Act.

DoW advised that the Minister for Mines and Petroleum may override this confidentiality, to provide groundwater monitoring results to the DoW if the Minister sees fit. DoW may then alert water users such as the Water Corporation, or owners of private bores if they are known by the DoW (we understand that there may be numerous private bores in use throughout the region that are not known to or licensed by DoW).

It is not known what circumstances would trigger the Minister for Mines and Petroleum to make this information available to other regulators, or whether the need for the release of information would even be brought to the attention of the Minister, and if so by whom.

It is not known what water contamination thresholds would trigger the release of this information and whether there is a process within the DMP to cause the Minister to be advised about groundwater monitoring results.

Clearly this is inadequate.

We believe that the transparency of compliance information such as groundwater monitoring results, and the timeliness of their release is of paramount importance. It is critical that both regulators, and water users (i.e. members of the public) have full access to information regarding any impacts on, or pollution of what is a publicly owned asset that is relied upon by communities and businesses in the region.

The lack of transparency in this regard is extremely concerning and results in a fundamental lack of confidence in the regulatory system.

⁵ <http://www.water.wa.gov.au/PublicationStore/first/77203.pdf>

10) Inability to take enforcement action in the event of pollution (Defence against environmental offences under the Environmental Protection Act)

After reaching the conclusion based on the available evidence that the planned fracking operation in the Drover-1 well presented a significant and unacceptable risk of pollution to a drinking water resource, we wrote to the Department of Environmental Regulation on 23 July to request that they issue a Pollution Prevention Notice to AWE. (Attachment G)

The response we received back was highly alarming in several respects.

The refusal of the DER to issue such a notice is alarming in itself, but perhaps even more concerning is advice contained in the letter (Attachment H) regarding the powers of the agency to take enforcement action under the *Environmental Protection (EP) Act* in the event of a pollution incident.

The letter suggests that if pollution were to occur at the site, the proponent would have a legal defence against any enforcement action that could otherwise be taken under the *EP Act* as a result of the approval that has been granted under the *Petroleum and Geothermal Energy Resources (PGER) Act*.

The implication of this is that if the fracking activity is conducted in accordance with the requirements of the PGER approval and pollution is caused, the State would have no recourse or regulatory powers to prosecute, or otherwise hold the proponent to account for this pollution.

As we have stated in previous evidence to the inquiry, the Environmental Management Plan (EMP) required under the PGER approval is also likely to be unenforceable (as identified in report by Dr. Tina Hunter into the DMP's regulatory framework for gas fracking).

This suggests that if the proponent is compliant with the EMP and causes pollution there is no regulatory recourse available to the State, and if the proponent breaches the EMP there is no regulatory recourse for the breach itself (although if pollution were to occur, the EP act may apply).

Clearly, this is an unsatisfactory situation which must be urgently remedied before fracking is allowed to go ahead in the Drover-1 or any other wells.

The Letter from DER also confirms that the fracking activity is exempt from the normal requirements for pollution control licensing under Part V of the EP Act, because fracking is not listed as a 'prescribed premises' to which this part of the EP Act applies.

The implication of this is that the proponent is not subject to the normal pollution monitoring and reporting requirements that are requirements of Pollution Control Licenses. As such, it is highly unlikely that pollution would be detected or reported to the DER if it were to occur, especially given the extreme limitations of the groundwater monitoring regime required as part of the EMP.

11) Inadequate enforcement of Environmental Management Plan by DMP following third-party allegations of non-compliance.

After an initial community well inspection conducted from the boundary of the nearby Mt Lesueur National Park, we identified a number of potential breaches of the proponents EMP.

The breaches related to the management of surface water runoff on the well-pad and associated access road with a resultant risk of dieback being spread into Mt. Lesueur National Park (which is down-hill from the well site).

We reported these potential breaches to the DMP, requesting that they investigate and take enforcement action as appropriate. (Attachment I)

The response we have received from DMP is most unsatisfactory (Attachment J). It is clear from the photographic evidence we obtained that the well-pad is not draining surface-water away from the park and that parts of the access road are not graded away from the park boundaries as required in the proponents EMP.

The DMP have not addressed these issues, nor provided any evidence that the proponent has used gravel that is certified dieback-free as required in the EMP. We speculate that the DMP do not have the legal powers necessary to enforce the EMP, and that this is the reason for the inadequate response and overlooking of non-compliance issues we raised with the DMP.

12) Insufficient and potentially misleading community consultation by AWE Energy.

Finally, it appears that believe consultation with the local community regarding fracking in the Drover-1 well by AWE has been be totally inadequate.

Several very large community-initiated meetings recently held in the nearby towns of Leeman and Green Head to discuss the fracking identified a very low level of awareness of the fracking in these communities. We believe that the proponents have deliberately down-played the fracking plans in the consultation meetings that have occurred so as to obscure the nature and risks of their planned activity.

We submit as evidence to the Committee a notification letter (Attachment K) sent to Green Head and Leeman Residents in May 2014 entitled: AWE Limited Project Update –Drover Exploration Well.

This letter is misleading in that it does not mention that fracking would take place as a part of the exploration and appraisal program for the Drover-01 well. In fact, the letter states that “*This phase of the project will use conventional drilling methods...*”

The letter also states that the well is located on ‘*pastoral land*’ which is also misleading given that the well is located on freehold farmland.

The proponent have taken a similar approach to misleading local communities in Dongara, describing their Senecio project as involving one 'conventional well', while at the same time the company have been informing shareholders of plans to use 'multi-stage horizontal hydraulic fracturing' as part of the exploration and appraisal process prior to developing the Senecio field with a larger number of fracking wells.

Clearly communities have a right to be informed, and to raise responses and objections to fracking activities before they occur on adjacent lands or in proximity to groundwater resources that are relied upon for drinking, agriculture, or other purposes.

We believe the failure of AWE to undertake effective community consultation for both the Drover-1 well and the Senecio project warrant the examination of the Committee, with a view to identifying how community consultation processes can be improved for these and future fracking projects, and how community effective consultation can be and adequately monitored and enforced by the DMP as the lead regulator.

The imminent threat of drinking water contamination from gas fracking in the Lesueur Aquifer (summary of information)

The risk of chemical contamination of drinking water contamination from Drover-1 Well

- The Mt Peron borefield is operated by the Water Corporation and supplies the drinking water for the Leeman and Green Head communities from the Lesueur Aquifer (see pictures below)
- The Drover-1 fracking site is located approximately 4km from the borefield and within the recharge area of the aquifer (see map below).
- The prevailing direction of groundwater and surface water flow is North-west – (i.e. towards the borefield from the fracking site) and there is direct hydrological conductivity between the well site and the borefield.¹
- There has been no assessment of the time it would take for groundwater to flow from the fracking site to the borefield, however the aquifer comprises medium to coarse sands and sandstone². Groundwater flow rates are likely to be relatively high.
- The very small DOW groundwater protection zone for this resource only extends a few hundred meters around the borefield, even though water is drawn from a much larger area including the area where fracking is occurring.
- There is a vertical separation distance between the base of the aquifers and the Fracking zone of 700-900 metres. The fracking zone is at 1600m depth. The connected Lesueur and Woodada Formation aquifers extend to 900m depth.³
- The potentially highly fractured Kockatea Shale separates the base of the aquifer from the fracking zone. The proponents groundwater study notes that *“The hydraulic properties along faults in the area are difficult to assess without specific investigations which have not been undertaken ... Faults that cut the strata are potential conduits for vertical movement of fluids.”*⁴
- Advice from the Department of Water (revealed by FOI) notes that: *Methane leakage arising from a poorly constructed well or well failure is hard to assess. Regulators must be reliant upon the information provided to them by the operators. It is suspected that adverse findings would not be reported as these may have negative effects on the ongoing viability of the project.*⁵
- The Drover-1 well is being drilled at or very near to the site of an abandoned conventional gas well drilled in the 1990's (no production took place). The presence of this abandoned, corroding well very near to the Drover-1 well presents a significant potential contamination pathway for high-pressure fluids and gas to migrate into groundwater⁶. This risk was not assessed and there is no mention of the presence of the abandoned well in the approvals documentation or the EMP.

¹ Mount Peron Water Reserve and Leeman (Midway) Water Reserve Drinking Water Source Protection Plan (DoW)

² Mount Peron Water Reserve and Leeman (Midway) Water Reserve Drinking Water Source Protection Plan (DoW)

³ Drover-1 Groundwater Study (Rockwater Pty Ltd.)

⁴ Drover-1 Groundwater Study (Rockwater Pty Ltd.)

⁵ Advice to the EPA from DOW released via FOI

⁶ Marine and Petroleum Geology, Volume 56, 2014 *Oil and gas wells and their integrity: Implications for shale and unconventional resource exploitation*, Davis et.al.

What assessments have been done and what groundwater protection measures are in place for the Drover-1 well?

- The EPA decided not to assess this proposal despite 242 public submissions calling for an assessment to be undertaken. Unsurprisingly, the proponent documents submitted to the EPA made virtually mention of the presence of an important public drinking water supply source and no assessment of risks to this resource.
- The Department of Water has not published any assessment of contamination risk. In their advice to the EPA, the DoW do not adequately raise the presence and significance of the Priority 1 Public Drinking Water supply area, and the potential risks of fracking within the 'catchment area' for this borefield.
- The EPA public advice report contains no explicit reference whatsoever to the Mt Peron Priority 1 Public Drinking Water Source Area, no mention of the presence of an abandoned gas well nearby, does not disclose that the depth separation of fracking from the aquifer is as little as 700 metres, and makes no mention of the absence of any investigation of fault pathways for contamination from the fracking zone.
- The DoW advice notes that groundwater monitoring would only be aimed at *"identification of the infiltration of chemical and hydrocarbon spills on the drill pad... It is not feasible for sampling of groundwater from the deeper basal portions of the Lesueur Aquifer"* Presumably this means there will be no groundwater monitoring for fracking chemicals, methane, or other derived or naturally released chemicals from the fracking zone.
- There is no publicly-available information on what groundwater monitoring will be undertaken, what contaminants will be tested for in groundwater, and where and when monitoring will occur. Under the DMP regulations, the groundwater monitoring data will not be disclosed to the public and any breaches or contamination detected would not be reported publicly for a minimum of 2 years.⁷
- The fracking activity is exempt from the normal licensing requirements which are the main way of controlling pollution for other polluting industries under the *Environmental Protection Act*. No 'Part V' pollution control license is required and no pollution limits will be set or regulated by the DER.
- There has been no health impact assessment despite the Department of Health calling for such assessments of fracking activity⁸.
- The Department of Mines and Petroleum are currently re-writing the regulations that apply to gas fracking however this project falls under the existing regulatory framework which the agency has acknowledged has major shortcomings.
- The regulatory approach taken by DMP is based on the assumption that *"there have been no cases internationally where hydraulic fracturing associated with the extraction of shale and tight gas has inadvertently intersected a water source to cause contamination."*⁹ This statement is highly misleading (see below).

⁷ Revealed through Questions in Parliament

⁸ Department of Health submission to Environment and Public Affairs Standing Committee Parliamentary inquiry into gas fracking in Western Australia

⁹ Department of Mines and Petroleum, 2014 – Natural Gas from Shale and Tight Rocks – an overview of the regulatory framework in Western Australia

What is the likelihood of ground or surface water contamination from this fracking activity?

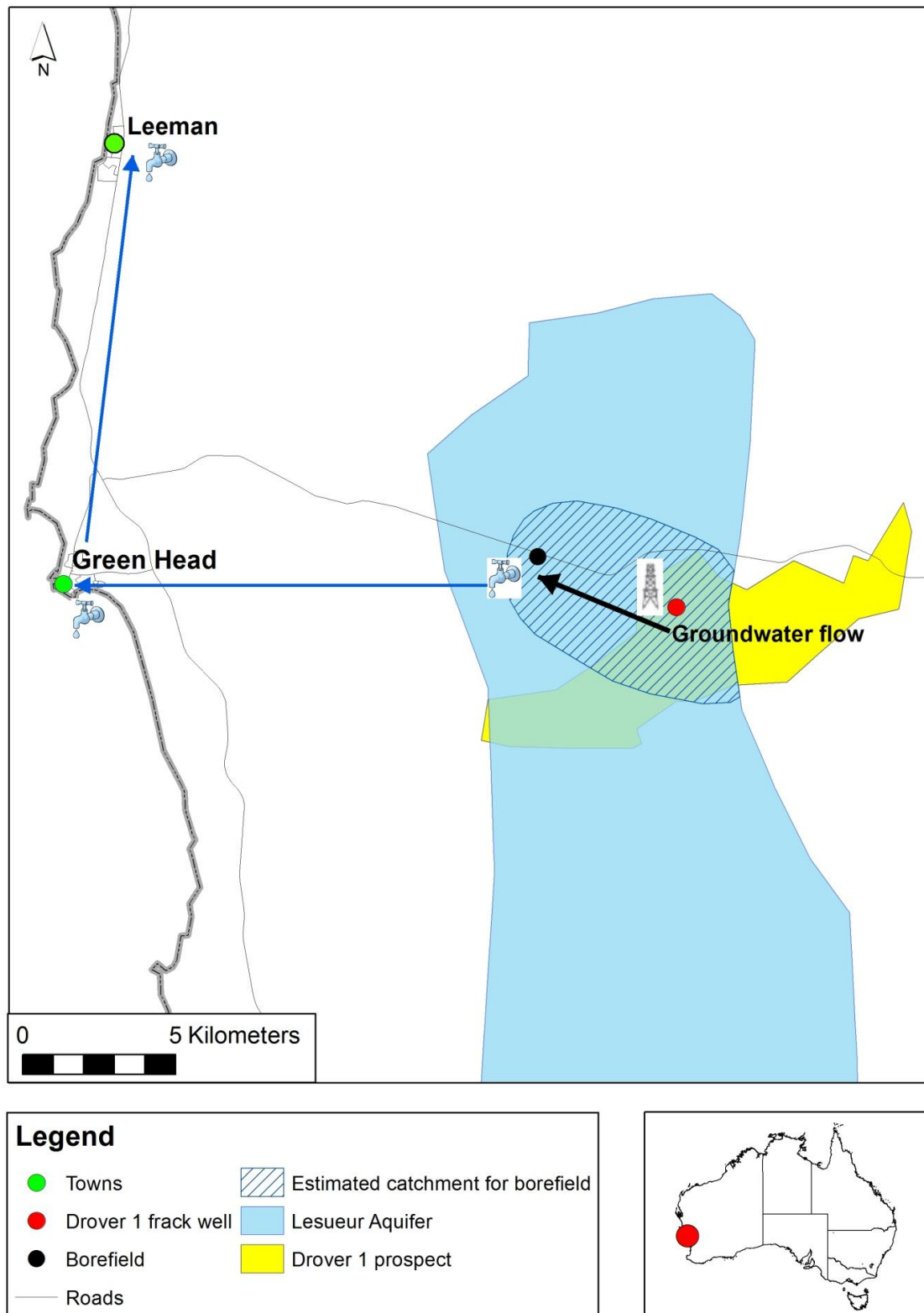
Numerous examples of water contamination from shale gas fracking operations shows that the greatest risks of groundwater contamination with gas or chemicals are from well leakage directly into the groundwater zone, or wastewater and chemical handling on the surface. Fracking chemicals and gas can also leak from the fracking zone, particularly if geological faults are present.

The most recent comprehensive study of well failure and leakage rates in onshore gas development has found well barrier or integrity failure rates of up to 75%. The report found barrier or integrity failure in 6.7% of wells in the Marcellus Shale in Pennsylvania between 2005 and 2013. This report notes that there are very high numbers of abandoned wells for which no monitoring is undertaken so well failure rates cannot be determined.¹⁰ Other research in the USA by Professor Anthony Ingraffea of Cornell University areas shows that 6-7% of fracking wells leak in the first year. Another recent study by Princeton tested abandoned fracking wells and found that every well they tested was leaking methane.

Serious health impacts from gas fracking have occurred in the USA (Shale gas) and Queensland States (Coal Seam Gas). These have been attributed to air emissions and contamination of drinking water. There have been numerous payouts made to families and individuals affected by fracking – most settled out of court with associated non-disclosure agreements. [This case](#) is one of the few examples where the full case has been publicly reported.

Health impacts have included blood noses, skin rashes, difficulty breathing, headaches, and more serious neurological disorders.

Map showing Drover-1 fracking well in Lesueur aquifer and catchment for Mt. Peron Bore-field¹¹



¹¹ Lesueur Aquifer and borefield catchment estimated from information contained in *Mount Peron Water Reserve and Leeman (Midway) Water Reserve Drinking Water Source Protection Plan (DoW)*. Drover1 prospect and well location area taken from Rockwater Report.

The Drover-1 Fracking well being drilled prior to fracking

(Picture taken from boundary of Mt Leseuer National Park)



The Mt. Peron Drinking Water Source Bore Field and Storage Tank



QUERIES RAISED BY THE CONSERVATION COUNCIL RELATING TO THE DROVER 1 PETROLEUM WELL

The following queries have been raised by the Conservation Council of WA (CCWA) relating to the AWE's Drover 1 petroleum exploration well in the mid west.

CCWA Questions/comments	Response
<p>a. The Mt Peron borefield is operated by the Water Corporation and supplies the drinking water for the Green Head community from the Lesueur Aquifer.</p>	<p>Correct</p>
<p>b. The Drover-1 fracking site is located approximately 4km from the borefield and within the recharge area of the aquifer.</p> <p>c. There is direct hydrological conductivity between the well site and the borefield;</p> <p>d. the prevailing direction of groundwater and surface water flow is towards the borefield from the fracking site.</p>	<p>The following responses relate to the three queries b, c, d:</p> <p>The location of the Drover 1 well is some 4km east south east of the Mt Peron wellfield. The Beagle Fault is a groundwater divide, between the Drover 1 well and the Mt Peron wellfield. This is likely to impede groundwater flow but there will still be movement of groundwater across the fault.</p> <p>Recharge to the aquifer being sourced by the Mt Peron wellfield occurs south-east of the wellfield within the Lesueur National Park, which is covered in native vegetation. For more information refer to the DoW report HG3, "Hydrogeology of the Coastal Plain Between Cervantes and Leeman, Perth Basin, 1997". Additional hydrogeological cross sections and further explanations will be provided at the meeting.</p> <p>As stated in the DoW's Mt Peron Water Reserve and Leeman (Midway) Water Reserve Drinking Source Protection Plan, 2008, the risk of contamination of the local aquifer from land uses in the recharge area is considered low due to the distance of the recharge areas from the wellfield and the storage capacity of the aquifer.</p>
<p>e. The very small DOW groundwater protection zone for this resource only extends a few hundred meters around the borefield, even though water is drawn from a much larger area.</p>	<p>The water reserve boundary is limited to a few hundred meters as the risks of contamination from areas further away were considered to be low at the time the PDWSA was established.</p>

<p>f. The greatest risks of groundwater contamination with gas or chemicals are from well leakage directly into the groundwater zone, or wastewater and chemical handling on the surface.</p>	<p>In a correspondence to the OEPA, dated 13 November 2013, the DoW, based on the information currently available, considered the spillage of chemicals stored on site to be the greatest risk of contamination of the Lesueur aquifer.</p> <p>To minimise this risk to the water resources the DoW recommended to the OEPA the need for:</p> <ul style="list-style-type: none"> • Plans for management of water, drilling fluids and additives. • Measures for ground and surface water monitoring. • Contingency plans (including remediation if required). • Planning for closure to avoid impacts to ground and surface water after well abandonment.
<p>g. The proposed depth of the fracking zone in the Drover¹ well is 1600 metres - around 1000metres beneath the Lesueur aquifer</p>	<p>Should AWE apply to undertake fracking, the shallowest fracking targets are expected to be at depths of approximately 1600m, well below the Lesueur aquifer.</p>
<p>h. The 'aquitard' separating the fracking zone from the aquifer is not continuous and there is a pathway for contamination into the aquifer via the nearby Beagle Fault.</p>	<p>Department of Mines and Petroleum have not yet received an application to hydraulically fracture Drover 1. The current work being undertaken by AWE is to construct the Drover 1 well and obtain the necessary core samples for analysis. Depending on the analysis of the core samples, AWE may apply to the DMP to hydraulically fracture certain horizons. That application will be supported by the relevant studies, plans etc required under the Petroleum and Geothermal Energy Resources Act (PGERA) and relevant regulations and guidelines. The application will be assessed before a determination will be made of whether to allow AWE to undertake fracking.</p> <p>If fracking is undertaken it is likely to target horizons below the Woodada Formation and the Kockatea Shale, which forms a barrier (around 1000 meters thick) between the fracking activity and the bottom layers of the Lesueur Sandstone aquifer. Any fracking at those depths are unlikely to create pathways into the Lesueur Sandstone aquifer.</p> <p>Also, any proposal to drill a horizontal well after completion of the Drover 1 well will need an application from AWE to DMP.</p>
<p>i. The EPA decided not to assess this proposal despite 242 public submissions calling for an assessment to be undertaken.</p>	<p>Please refer to the Office of Environmental Protection Authority.</p>

<p>j. The fracking activity is exempt from the normal pollution control regulations that apply to other polluting industries under the Environmental Protection Act. No 'Part V' pollution control license is required and no pollution limits will be set or regulated by the DER.</p>	<p>Please refer to the Office of Environmental Protection Authority and the Department of Environmental Regulation.</p>
<p>k. the proponent documentation submitted to the EPA made virtually no mention of the presence of an important public drinking water supply source and no assessment of risks to this resource</p>	<p>Please refer to the Office of Environmental Protection Authority.</p>
<p>l. the Department of Water failed to adequately advise the EPA of the presence and significance of the P1 PDWSA and the potential risks of fracking within the 'catchment area' for this borefield;</p>	<p>The DoW provided a letter to the OEPA dated 13 December 2013, regarding the Drover 1 well, where it specified that " The site (of the Drover 1 well) is 4 km east south east of the Mount Peron water reserve and the nearest licensed (water) user which is the Water Corporation".</p>
<p>m. The DOW Advice notes that: Methane leakage arising from a poorly constructed well or well failure is hard to assess. Regulators must be reliant upon the information provided to them by the operators. It is suspected that adverse findings would not be reported as these may have negative effects on the ongoing viability of the project</p>	<p>Leakage from poorly constructed wells is a risk irrespective if the well is an oil or a mineral or a water well. The draft resource and administration regulations developed by the DMP aim to reduce the risks of poorly constructed wells. These regulations will be finalised after consideration of public comments.</p>
<p>n. The EPA public advice report contains no explicit reference whatsoever to the Mt Peron Priority 1 Public Drinking Water Source Area.</p>	<p>Please refer to the Office of Environmental Protection Authority.</p>

Water for growth strategy

- For which water resources or regions have the sustainable yields or allocation limits been increased under this new strategy?
- For each of these, what scientific information or research has supported these revisions? (Please provide copies of reports etc.)
- Has any of this science been published and if so where can it be accessed by members of the public? –

“*Water for Growth*” is an overview of the current status of water supply and water resource investigations, rather than a strategy.

As such “*Water for Growth*” has resulted in no changes to allocation limits, but it does reflect expectations about possible future changes based on interim results. There has been no decision on how any additional water identified through these investigations and assessments will be released.

The groundwater investigations may result in changes to allocation limits once the work is fully assessed. The RfR investigation, and other hydrogeological work in the West Canning Basin has already informed an initial change to an allocation limit further to the Pilbara groundwater allocation plan.

Reports from the current RfR groundwater investigations will be published once the investigation work is completed and assessed. The assessment will underpin any future changes to allocation limits. We typically set allocation limits as part of developing or reviewing water allocation plans, but may make changes during the life of an allocation plan based on assessment of the resource or performance indicators. All current water allocation plans and their supporting documents are available from the DoV's website. The Jurien water allocation plan and supporting documents are available at:

<http://www.water.wa.gov.au/Managing+water/Allocation+planning/Mid+West+Gascoyne+Region/Jurien+groundwater/default.aspx>, including the:

- Jurien groundwater areas reference sheets.
- Jurien groundwater allocation plan – frequently asked questions
- Review of the Jurien and Arrowsmith groundwater allocation limits.
- Environmental considerations for groundwater management of the Northern Perth Basin.
- Groundwater investigation program in Western Australia (2005 - 2020)
- The hydrology of groundwater dependant ecosystems in the Northern Perth Basin.
- Hydrogeology of the coastal plain between Cervantes and Leeman, Perth Basin.

In developing the plans, the DoV also uses previous reports by the Geological Survey of WA as well as other government departments which are also publicly available.

<ul style="list-style-type: none"> • If new or additional water resource areas have been identified, please provide detailed reports on them. 	<p>The current allocation limits and allocation status for all resources can be found in our <i>Water Resources Inventory 2014</i>.</p>
<ul style="list-style-type: none"> • Given the widely accepted inadequacy of existing statutory and regulatory arrangements for water allocation, how does the DoW consider the 'Water for Growth' strategy can be implemented responsibly and without creating major water over-use and contamination crises across WA. 	<p>Current statutory and regulatory arrangements are not considered inadequate. Reform proposals are targeted at future needs to respond to high demands for all sectors, and respond to reduced water availability as a result of drying climate. "Water for Growth" provides an overview of the direction to face these challenges, through resource investigations to support more precise management – in areas where the resource is highly utilised - and quantify water availability in more remote, less studied resources. "Water for Growth" highlights the need to manage our water resources sustainably, use them more effectively, and where necessary turn to alternative manufactured, recycled, fit-for purpose or more remote resources to fill the supply gap.</p>

<p>Interaction between groundwater resources and gas fracking- Mt Peron Priority 1 Public Drinking Water Source Area</p> <p>Gas fracking is about to occur very close to the Mt. Peron drinking water supply borefield. The management plan shows that there is a zone around the borefield that extends only a few hundred metres which is the declared drinking water protection 'reserve'.</p>	
<ul style="list-style-type: none"> • How was the declared drinking water protection area around this borefield determined? 	<p>The determination of the boundaries of a PDWSA is guided by Water Quality Protection Note No 36 – Protecting Public Drinking Water Source Areas.</p> <p>Consideration of a number of factors contributed to the size and shape of the Mt Peron Water Reserve, including that the <i>Mount Peron Water Reserve and Leeman (Midway) Water Reserve Drinking Source Protection Plan</i> determined that the depth of the production bores would mean that the risks from rural land uses surrounding the area was low, and that the recharge area for the water reserve is in the National Park south-east of the bore, which also has a low contamination risk.</p>

<ul style="list-style-type: none"> Does it take into account the hydrogeology of the surrounding area and the potential for water from further afield to be drawn into these wells over a period of time? 	<p>Yes it does take into account the hydrogeology of the area. Locally in the Mount Peron wellfield area, the aquifer is a leaky semi-confined aquifer with upward hydraulic head. Groundwater within the Lesueur Sandstone flows north westerly towards the wellfield discharging via upward leakage into the overlying superficial sediments (Kern, 2005).</p> <p>Provided the wellhead remains sealed, the current land uses do not pose a significant risk to the source because the semi-confined nature and upward hydraulic head within the aquifer at this location results in groundwater within the Lesueur Sandstone discharging into the overlying superficial formations (Water Corporation, 2005).</p>
<ul style="list-style-type: none"> What potential range or area could these bores draw water from over the next 200 years? 	<p>Modelling was not undertaken for this source.. Groundwater monitoring is undertaken by the Water Corporation at Mt Peron. If the risks of contamination increases, further investigations will be undertaken (which may include modelling).</p>
<ul style="list-style-type: none"> Where are the recharge areas for the aquifer that feeds this borefield (can we have maps please?) 	<p>The Lesueur Sandstone is a medium to very coarse-grained sand and sandstone with minor layers of siltstone, claystone and conglomerate (Baddock and Lach, 2003). Regionally, the aquifer varies from unconfined, where it outcrops, to confined, where it is overlain by the superficial formations. Locally in the Mount Peron wellfield area, it is a leaky semi-confined aquifer with upward hydraulic head. Recharge occurs south-east of the wellfield where the formation outcrops on the Gingin Scarp (2008 DoW Mt Peron Water Reserve and Leeman (Midway) Water Reserve Drinking Source Protection Plan).</p>
<ul style="list-style-type: none"> Do these recharge areas have any sort of water quality protection in place? 	<p>Recharge occurs south-east of the wellfield within the Lesueur National Park, which is covered in native vegetation. The risk of contamination of the local aquifer from land uses in the recharge area are considered low due to the distance from the wellfield and the storage capacity of the aquifer (2008 DoW Mt Peron Water Reserve and Leeman (Midway) Water Reserve Drinking Source Protection Plan).</p>
<ul style="list-style-type: none"> Has there been any correspondence with or from the Water Corporation regarding the potential threat of gas fracking to water quality or quantity in this or any other public drinking water resource area? If so what issues have been raised? Can you provide copies of this correspondence? 	<p>The proposed well is outside the Mt Peron PDW/SA.</p>

<ul style="list-style-type: none"> Does the DoW believe that the integrity of the drinking water supply for Green Head has been adequately protected via the assessment and approval process for the Drover 1 fracking operation? If so how. 	<p>DMP has advised that there is no application for undertaking fracking in the Drover 1 well. The Drover 1 Well is only an exploration well to obtain the necessary core samples for AWE to assess and decide on whether to undertake fracking. If fracking is required, AWE will need to apply to the DMP to undertake the activity providing all the supporting information required under the DMP regulatory regime.</p> <p>The DoW responded to a request for advice to the OEPA on 13 November 2013 that, based on the information available, the likelihood of impact to the water resources is considered to be from contamination of the Lesueur aquifer from surface spills of chemicals stored on site.</p> <p>To minimise this risk to the water resources the DoW recommended to the OEPA the need for:</p> <ul style="list-style-type: none"> Plans for management of water, drilling fluids and additives. Measures for ground and surface water monitoring. Contingency plans (including remediation if required). Planning for closure to avoid impacts to ground and surface water after well abandonment.
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Other drinking water supply areas that could potentially interact with gas fracking	
<ul style="list-style-type: none"> What other declared drinking water protection areas are there in the Mid-West, Carnarvon basin and Canning Basin (Can we have detailed maps please?) 	<p>A list of PDWSAs in the Department of Water Mid-west region and the Carnarvon and Canning basins will be tabled at the meeting. This list includes online links to detailed maps of the PDWSAs. These maps are contained within the drinking water source protection reports developed for the PDWSAs. A map showing all PDWSAs Statewide will also be tabled for your information.</p>
<ul style="list-style-type: none"> Do they take into account the recharge areas of the aquifers, and /or the potential area that water could be drawn from into the future? 	<p>Yes. When the boundaries of PDWSA's are developed the hydrogeology, groundwater and surface water flow directions, are considered as well as past, current and foreseeable future land uses.</p> <p>Refer to Water Quality Protection Note No 36 – Protecting Public Drinking Water Source Areas for background information.</p>

<ul style="list-style-type: none"> What is the process for declaration of these areas and is there any trigger for the revision of the areas that are protected. 	<p>The process in brief entails</p> <ul style="list-style-type: none"> A new drinking water supply source is needed or is to be established which prompts the need for a new PDWSA. The location and shape/size of proposed PDWSA determined using best available information. State water supply and demand needs are considered by the DoW. A Drinking Water Source Protection Report (DWSPR) is developed. The DWSPR proposes: a PDWSA boundary, priority areas (P1, P2 and P3) and protection zones (Wellhead and Reservoir, WHPZ/RPZ). PDWSA boundaries are proclaimed under related water legislation, after a public consultation process. The relevant legislation is the Metropolitan Water Supply Sewerage and Drainage Act, 1909 and the Country Areas Water Supply Act, 1947. PDWSA boundaries are assessed for any required revisions during the ongoing review process for drinking water source protection reports. An earlier review of a report can be triggered by issues such as significantly changing land uses within a PDWSA. <p>Please also refer to water quality protection note No 87 – <i>Identification, assessment and protection of public drinking water source areas.</i></p>
<p style="text-align: center;">Recommendation for buffer zones</p> <ul style="list-style-type: none"> DoW and the Water Corporation recommended a 1.5km buffer zone around the declared drinking water source areas in evidence submitted to the Parliamentary Inquiry on gas fracking (Ref: Water Corporation submission page 14). What was the science or rationale behind this recommendation? Have you had any correspondence or dealings with the DMP on this matter and if so, what has their response been? Is the DoW planning any action to put such a buffer zone in place? 	<p>The possible imposition of a buffer zone extending past the PDWSA boundaries was based on experience from the United States, the likely propagation of the fractures and the need for fractures to remain outside the boundaries of a PDWSA.</p> <p>This is part of ongoing discussions with the DMP.</p> <p>This is part of ongoing discussions with the DMP.</p>

<ul style="list-style-type: none"> What instrument would be used to put such a buffer zone in place and how would this be enforced? 	<p>These matters form part of ongoing discussions with DMP. Legislative and policy options exist under both agencies Acts.</p>
Recharge areas for other aquifers	
<ul style="list-style-type: none"> Where is the recharge area for the Yarragadee aquifer located? (Can you please send a map on this area)? 	<p>The recharge areas of the Yarragadee aquifer in the Perth Regions are described in the public document – Hydrogeology and Groundwater Resources of the Perth Regions Western Australia Bulletin 142, by the Geological Survey of Western Australia. They are located where there is a hydraulic connection between the Leederville and the Yarragadee aquifers north of Perth, east of Yanchep and along the Darling Fault.</p>
<ul style="list-style-type: none"> Are there any protections over this area regarding water quality or contamination? 	<p>Where DoW licenses the abstraction of water from the Yarragadee for public drinking water supplies then a PDWSA will be established to protect these sources from possible contamination. This provides the necessary protection of the source under the MWSSD Act or CAWS Act and their by-laws.</p>
Regulation of water quality outside of declared public drinking water supply areas	
<ul style="list-style-type: none"> What responsibility does DoW have over water quality outside DWPPAs? 	<p>There are numerous government agencies that have responsibility for water quality.</p> <p>The DoW has a general responsibility to protect the state's water resources. It has legislative tools to protect the water resources within PDWSAs. The DoW also advises other decision making authorities as well as industries of issues associated with the protection of water quality.</p>
<ul style="list-style-type: none"> What water quality guidelines are applied by the DoW in these areas (if any)? 	<p>The DoW publishes a range of water quality protection notes that outline best management practices to minimise the risks to the water resources. These notes are publicly available on the DoW's website www.water.wa.gov.au/.</p>

<ul style="list-style-type: none"> • What other agencies manage or regulate water quality outside DW/PAs? 	<p>Government agencies responsible for managing water quality include, the Office of Environmental Protection Authority, Department of Environmental Regulation, Department of Mines and Petroleum, Department of Health, water service providers, Department of Planning, local government authorities, etc.</p>
<ul style="list-style-type: none"> • What water quality guidelines are applied by these agencies (if any)? 	<p>The DoW develops water quality protection notes, water quality protection guidelines, advisory brochures and water quality information sheets, although other departments also have their own guidelines.</p> <p>The DoW, water quality guidance information is available online at the DoW website, www.water.wa.gov.au/ follow the following links > <i>Managing water > Drinking water ></i> and scroll down to the section "<i>Publications relating to drinking water source protection planning and best management practices can be accessed via the below links.</i>"</p>



Environmental Protection Authority

DOCUMENT NO: 4

Department of Water	
RECORDS SERVICES RECEIVED	
TRIM Ref	W128485
23 OCT 2013	
FILE	RF124-3-03
OFFICER	[REDACTED]
Scanned?	Y N

[REDACTED]
[REDACTED]
Assessment & Allocation
Department of Water
PO Box K822
PERTH WA 6842

Our Ref ER04-2013-0028
Enquiries [REDACTED]
Email [REDACTED]

ATTENTION: [REDACTED]
[REDACTED] Mid-West Region

Dear [REDACTED]

REQUEST FOR INFORMATION/ADVICE Under s38A of the Environmental Protection Act 1986

PROPOSAL: Drover 01 exploration well
PROPONENT: AWE Limited

The above proposal has been referred to the Environmental Protection Authority (EPA) under section 38 of the *Environmental Protection Act 1986* (EP Act). The EPA is seeking additional information about the proposal to enable it to make a decision on required level of environmental assessment under Part IV of the EP Act.

Background

The proposed exploration has been referred to the EPA because of its proximity to Mount Lesueur National Park. The proposal will include hydraulic fracturing (fracking).

Stage in the Process

The EPA has yet to make a decision on the appropriate level of environmental assessment.

Key issues

EPA bulletin 15 *Hydraulic fracturing of gas reserves* notes the importance of ensuring that cement casings meet best practice industry standards and of maintaining well integrity in order to reduce the risk of blow outs and potential impacts to groundwater and surface water systems. The bulletin further notes that adequate contingency plans are important in this regard.

However the referral information does not provide any detailed information on these issues or on proposed water monitoring.

Advice requested

Department of Water advice is requested as to the likely risk to ground water, surface water and biota, and as to the adequacy of:

- proposed plans for management of water, drilling fluids and additives;
- proposed measures for ground and surface water monitoring;
- contingency plans (including remediation if required); and
- planning for closure to avoid impacts to ground and surface water after well abandonment.

It is also understood that the proposal is situated near a naturally-occurring fault (the Beagle Fault) and to the Diamond of the Desert Spring and your Department's advice is also sought as to whether / how much this increases the risk profile of the operation.

The Office of EPA is also seeking advice from the Department of Mines and Petroleum and the Department of Parks and Wildlife on matters relevant to their respective areas of expertise.

Reference documents and location/access

Background information on the proposal can be found in the proponent's referral information which is available on the EPA website.

Please note that EPA decision-making is subject to statutory timelines. It would be appreciated if you could respond to this request for additional information by 25 October 2013. If you cannot respond within this time, or if you need further information, please contact [REDACTED] on [REDACTED] as soon as possible. Please also respond if you have no comments.

Your response should be sent by post to the Office of the Environmental Protection Authority, Locked Bag 10, East Perth WA 6892. Please include in your response the reference details noted above and mark it to the attention of the person cited above.

Yours sincerely

[REDACTED]

[REDACTED]

Assessment and Compliance Division

16 October 2013

[REDACTED]

From: [REDACTED]
Sent: Wednesday, 6 November 2013 3:25 PM
To: [REDACTED]
Subject: RE: Drover 1 - EPA request advice

Hi [REDACTED]

The Diamond of the Desert is situated at the contact between the fault and inclined Lesueur Sandstone (Aquifer) and the Beagle Fault acting as a hydraulic boundary. There may be some correspondence to the presence of the Gingin Scarp which is a marine erosional feature, that is probably present (in part) to a change in lithology – softer Eneabba Formation (clay/sandy clay) to harder Lesueur Sandstone. A combination of barrier and erosional cutaway has provided the conditions for the development of the Diamond.

- You are correct, at 7 km to the west south west, impact from development of the Lesueur Aquifer would be minimal.
- Drover 1 is not going to have any major water requirements, some few 100 000 kL for a restricted period
- Jurien Water Reserve is located west and south of Drover 1 and west of the Beagle Fault system.
- The Beagle Fault system trends to the north north west and comprises a series of sub parallel faults.
- No contamination risk expected !

From: [REDACTED]
Sent: Wednesday, 6 November 2013 3:11 PM
To: [REDACTED]
Subject: RE: Drover 1 - EPA request advice

Hi [REDACTED]

Just a couple of questions that I thought of from the layman's perspective:

- At nearly 7km from the Drover site, the Diamond of the desert isn't likely to be impacted, but is it east or west of the Beagle fault? If its west then this might mean it is further protected?
- The Mount Peron water reserve is about 4km west north-west of Drover. I am guessing at this distance it would be safe from surface contamination risks?
- Along the same thinking, are the Jurien water reserve and its recharge area west of the Beagle fault, so again extra protection from contamination risk?

Overly cautious I know, so feel free not to include if the risk is insignificant for the water reserves.

Thanks for the opportunity to review, [REDACTED]

From: [REDACTED]
Sent: Wednesday, 6 November 2013 2:09 PM
To: [REDACTED]
Cc: [REDACTED]
Subject: Drover 1 - EPA request advice

Good afternoon [REDACTED]

Attached is a draft DoW memo prepared in response to the EPA request (TRIM Reference WI 28485 – 23 October 2013) from [REDACTED] to [REDACTED] attention myself. Please review and provide comment and/or amendment as required. I assume that the final will need to be provided to the OEPA on DoW letterhead, such that a cut & paste will be necessary.

From: [REDACTED]
 Sent: Thursday, 7 November 2013 10:50 AM
 To: [REDACTED]
 Cc: [REDACTED]
 Subject: RE: Drover 01 - groundwater abstraction

Hi [REDACTED]

The current 5C groundwater licence application with the MWG allocation team is for 10 000 kL, comprising 6 000 kL for drilling and 4 000 kL for hydraulic fracture stimulation (HFS). The licence has not been issued as the MWG team is awaiting clarification on the bore to be used (existing farm bore or new production bore).

10 000 kL is a small allocation and one that will be in use for a short and restricted period of time. I suspect that the groundwater will be developed from the Lesueur Aquifer. However, due to the small quantity required and restricted time envelop covering drilling and HFS; the requirement for testing will be limited. AWE has already submitted a hydrogeological report that meets the DoW H1 requirements. I would envision that a simplistic "step rate" pump test will be conducted to determine the appropriate pump rate and that this data could be used to estimate aquifer characteristics.

The proposed water abstracted will be done so under licence. I would not anticipate the need for the construction of any observation bores. There are a number of local bores documented in the hydrogeological report that may be used, but I suspect that there will be no observed drawdowns unless the observation bore is within 50 m of the production bore. However, this is dependent upon the proposed pump rate, which hasn't been provided.

I trust that this helps.

From: [REDACTED] [mailto:[REDACTED]]
 Sent: Thursday, 7 November 2013 9:18 AM
 To: [REDACTED]
 Subject: Drover 01 - groundwater abstraction

Hi [REDACTED]

One of the issues the public is concerned about is the water supply for the fracking operation and potential for groundwater depression and impacts on people's groundwater bores. Will you include comments on this in the advice coming up to us? My understanding is that it is good quality groundwater but that it is not a proclaimed groundwater area – If this is the case are you able to regulate groundwater abstraction? If not, who would then have this responsibility?

Cheers

Mining and Industrial (South) Branch
 Office of the **Environmental Protection Authority**

The Atrium, Level 8, 168 St Georges Terrace, Perth
 Locked Bag 10, EAST PERTH WA 6892
 direct: [REDACTED] | reception: 08 6145 0800 | fax: 08 6145 0856



Government of Western Australia
Department of Water

Memorandum

TO: [REDACTED]

FROM: [REDACTED]

CC: [REDACTED]

DATE: 5 November 2013
RE: AWE Drover 1
FILE NO: RF1243-03, Trim Reference WI28485

I refer to the request (ref ER04-2013-0028) from the [REDACTED] Assessment and Compliance Division, Environmental Protection Authority dated 16 October 2013 seeking information on the Drover 1 exploration well. The information is required by the EPA to enable a decision on the required level of environmental assessment under Part IV of the Environmental Protection Act.

Key issues noted include the importance of ensuring that cement casings meet best practice industry standards and of maintaining well integrity.

Advice requested from the Department of Water comprises the "likely risk to ground water, surface water and biota" together with the adequacy of:

- "proposed plans for management of water, drilling fluids and additives"
- "proposed measures for ground and surface water monitoring"
- "contingency plans (including remediation if required)" and
- "planning for closure to avoid impacts to ground and surface water after well abandonment"

The EPA request also notes the occurrence nearby of the Beagle Fault and Diamond of the Desert spring and asks for advice from DoW regarding increased project risk associated with these features.

Introduction

The proposed Drover 1 exploration drill location is situated within the AWE exploration permit EP455 approximately 16.5 km east of Greenhead. The proposed Drover 1 bore will be drilled near 321504 mE and 6671240 mN (Zone 50). The Lesueur National Park forms the western border of EP455.

EP455 is underlain by Quaternary surficial sediments consisting of unconsolidated and unsaturated sand and laterite formed by reworked Bassendean Sand and totally weathered residual Lesueur Formation. The surficial veneer overlies Lesueur Sandstone, Woodada Formation, Kockatea Shale, Beekeeper Formation, Carynginia

I believe the final response needs to go back to the OEPA [REDACTED] via [REDACTED]. However, as this is an interagency reply; it may need to go from the Regions [REDACTED] / RD&R Directorate [REDACTED] to the S&P Directorate [REDACTED]. Your advice on the appropriate way to transmit the finalised reply to [REDACTED] in the OEPA would be greatly appreciated.

[REDACTED] has requested completion of the reply by Friday 08 November 2013.

Thanks

Sincerely

[REDACTED]
Mid West Gascoyne Region
Department of Water

[REDACTED]@water.wa.gov.au

Mobile: [REDACTED]

Desk: [REDACTED]



Formation, Irwin Coal Measures, High Cliff Sandstone and Holmwood Shale. The area is bounded in the east by the Peron Fault and to the west by the Beagle Fault System. The structural geology is present as a series of block faults up - thrust towards the west with formation stratigraphy dipping in a westerly direction. The Gingin Scarp, located west of EP455, delineates sediments of the Swan Coastal Plain from that to the Arrowsmith Plateau.

The primary target for hydrocarbon exploration is the High Cliff Sandstone, with secondary targets being in the basal portion of the Kockatea Shale, Carynginia Shale and Irwin Coal Measures. The shallowest of the hydrocarbon targets is the Kockatea Shale at a depth exceeding 1 600 m below ground level.

The principle aquifer system underlying EP455 is the Lesueur Aquifer that overlies the Woodada Formation with the formation contact located about 580 m bgl. An unsaturated unconsolidated surficial veneer of Bassendean Sand and totally weathered sediments derived from the Lesueur Sandstone overlies the Lesueur Aquifer. Recharge to the Lesueur Aquifer is through rainfall infiltration across the local area with groundwater moving in a westerly direction down the hydraulic gradient. The Beagle Fault system forms a hydraulic boundary to the westerly flow of groundwater within the Lesueur Sandstone. A decrease in the thickness of the sediment veneer overlying saturated Lesueur Aquifer at the western edge of the Gingin Scarp has allowed the upwelling of the groundwater that supports a number of wetlands including the Diamond of the Desert Spring located 6.9 km southwest of the proposed Drover 1 drill site (315880mE & 6667433mN).

Requested Advice

1) Proposed plans for management of water, drilling fluids and additives

The highest risk is considered to be associated with chemicals and fuel stored at the site. It is understood that chemicals will be stored in a bunded enclosure. Best practice methods have been cited to ensure that the risk of fuel leakage is minimised with contingency guidelines for leak clean up. Chemical leakage and fuel spills would infiltrate vertically into the unconfined groundwater system in the basal portion of the surficial veneer or upper saturated portion of the Lesueur Aquifer.

The targets for hydraulic fracture stimulation (HFS) at the Drover 1 site are deep, with the shallowest being approximately 1600 m bgl. The risk of leakage of chemicals involved in the HFS operation would be minimal if only associated with fractures in the target horizon.

Methane leakage arising from a poorly constructed well or well failure is a risk that is difficult to assess. Regulators must be reliant upon the information provided by the operators. It is suspected that adverse findings would not be reported as these may have negative effects on the ongoing viability of the project.

Management options available to the Department of Water would be limited to monitoring bores located or construction in the important water resource and



subsequent measurement of key contaminants such Methane (CH₄) and Boron (fracture stimulation fluids).

2) Proposed measures for ground and surface water monitoring

Groundwater monitoring would be designed to measure contamination within the unconfined groundwater resources comprising the Lesueur Aquifer. It is not feasible for construction of and sampling of groundwater from the deeper basal portions of the Lesueur Aquifer. The proposed measures would be aimed at the identification of the infiltration of chemical and hydrocarbon spills on the drill pad.

3) Contingency plans (including remediation if required)

The primary aim would be the identification of a potential spill as soon as practicable.

Contingency planning would involve mapping of contaminant location and movement within the groundwater system. This may require construction of a series of observation bores and analysis of groundwater samples.

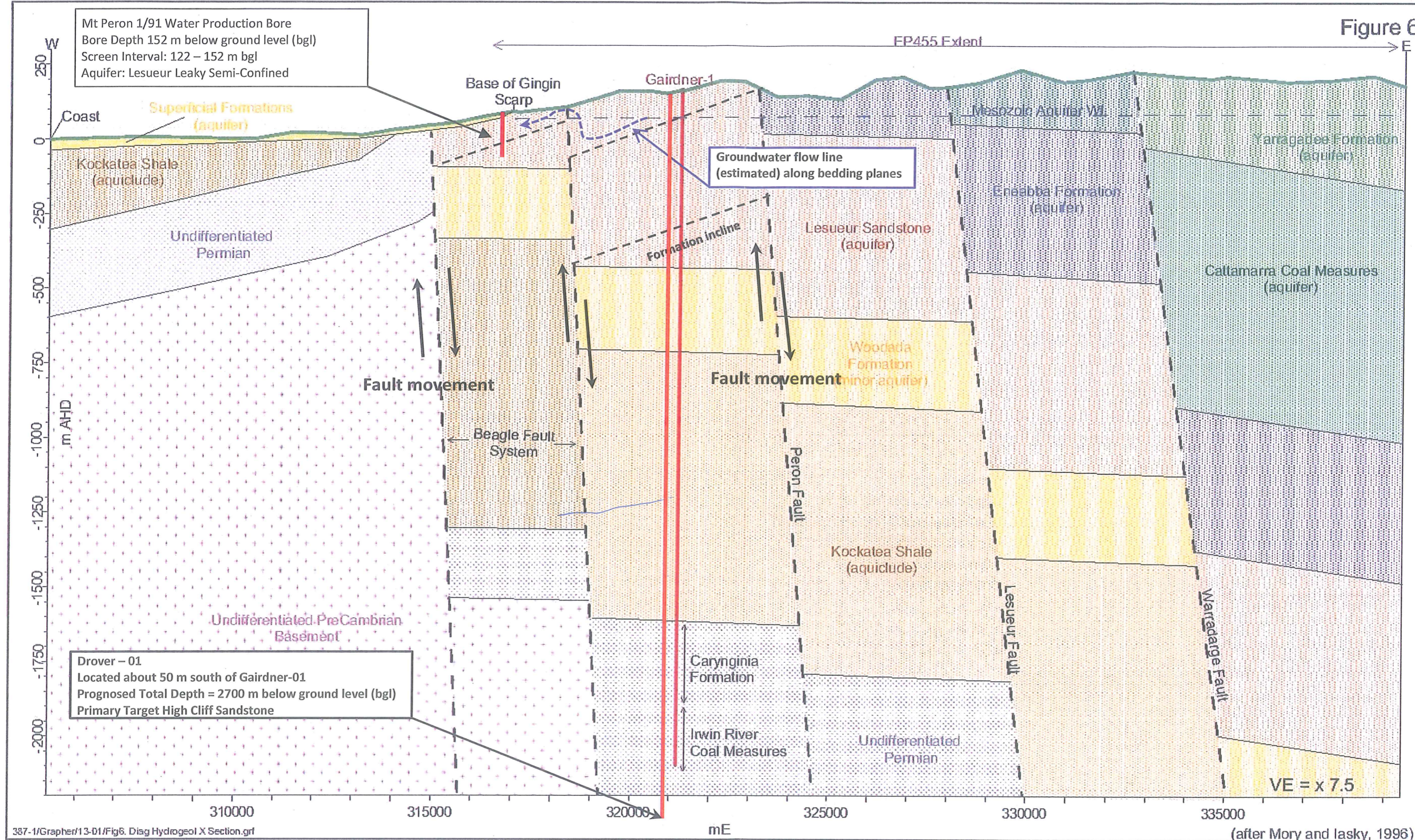
Contingency and subsequent remediation would be dependent upon the chemicals involved. It is envisioned that hydrocarbons (diesel) spillage could be bio remediated

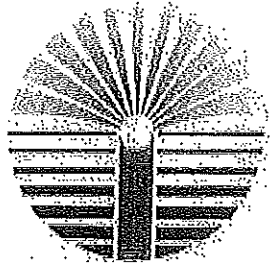
4) planning for closure to avoid impacts to ground and surface water after well abandonment

Closure and decommissioning of hydrocarbon drilling has been the responsibility of the DMP under the Petroleum and Geothermal Energy Resources Act, 1967 and subsequent petroleum regulations. The DoW has an advisory role but closure and decommissioning of petroleum wells is not covered under the RIWI Act 1914.

It is understood that all wells are cased to the target horizon such that leakage beyond the target horizon is not permitted. The risk to intersected aquifers would be associated with movement along the drill stem which would be considered to be minor in a properly constructed well.

Figure 6





Rockwater
P R O P R I E T A R Y L I M I T E D

DROVER-1 GROUNDWATER STUDY

May 2013

**REPORT FOR
AWE LIMITED**

(Report No. 387-1/13/01)

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1 INTRODUCTION

AWE Limited (AWE) is planning to drill and core a well on their exploration permit, EP455, 16.5 km east of Greenhead. If the results are favourable, a hydraulic fracturing programme will be undertaken. The preferred location of the site, to be known as Drover-1, is on cleared land adjacent to abandoned well Gairdner-1 (Fig. 1). The target reservoirs are in the basal Kockatea Shale, Carynginia Shale, Irwin River Coal Measures and High Cliff Sandstone; at depths of greater than 1,600 m.

As part of the environmental assessment of the project, AWE has commissioned Rockwater to undertake a study of the groundwater system at the site. Groundwater use for the project is estimated to be 6 ML for the drilling operation and up to 4 ML for the hydraulic fracturing programme (assuming 4 stimulations). As anticipated groundwater use is expected to be minimal and the target reservoirs are at significant depths below aquifers, the hydraulic fracturing programme is anticipated to be of negligible risk to the groundwater system. Nevertheless, as the Drover-1 site is located adjacent to Lesueur National Park and has a minor component of surface infrastructure and potential contaminants, AWE is aiming have a thorough hydrogeological understanding of the site so any potential risks can be minimised.

2 GEOLOGY

2.1 STRATIGRAPHY

The stratigraphic sequence beneath EP455 is summarised in Table 1 and incorporates interpretations by AWE, Lipski (1991), Mory and Iasky (1996) and Kern (1997).

Gairdner-1 intersected sedimentary rocks of Permian to Late Triassic age over a total depth of 2,172 m as illustrated in Figure 2. Although not noted in the Gairdner-1 lithological descriptions, the surface geology over the majority of the study area is mapped as Tertiary laterite and associated sand (Fig. 3). A sequence of Jurassic strata is mapped at the surface east of the Drover-1 site.



Table 1: Strata within EP455

Formation	Age	Regional Lithology
Laterite and associated sand	Tertiary	Leached quartz sand over pisolitic to massive ferruginous laterite
Yarragadee Formation	Mid to Late Jurassic	Sandstone with siltstone and claystone beds; up to 2000 – 4000 m thick
Cadda Formation	Mid Jurassic	Shale, siltstone, and sandstone, locally limestone
Cattamarra Coal Measures	Early to Mid Jurassic	Sandstone, carbonaceous siltstone; minor coal
Eneabba Formation	Early Jurassic	Sandstone, multicoloured siltstone and claystone; minor coal
Lesueur Sandstone	Mid to Late Triassic	Sandstone, coarse-grained, pebbly; minor siltstone and conglomerate
Woodada Formation	Early to Mid Triassic	Sandstone, fine-grained, and carbonaceous siltstone
Kockatea Shale	Early Triassic	Shale, dark, siltstone, and minor sandstone and limestone
Carynginia Limestone	Late Permian	Probably equivalent to the Beekeeper Formation (Hall and Kneale 1992) – sandstone, skeletal limestone, and shale
Carynginia Shale	Early Permian	Siltstone, micaceous and carbonaceous, lesser sandstone and conglomerate
Irwin River Coal Measures	Early Permian	Alternating sandstone, siltstone, carbonaceous shale, and coal.

The stratigraphic sequence is described below, from oldest to youngest and a Tertiary subcrop geology map is presented as Figure 4.

2.1.1 Permian

The Permian section consists of the Irwin River Coal Measures and the Carynginia Formation. Although not intersected by Gairdner-1, the High Cliff Sandstone, which comprises interbedded sandstone, conglomerate and minor siltstone, is interpreted to underlie the Irwin River Coal Measures at this location.

The Irwin River Coal Measures, comprising coal and carbonaceous shale interbedded with sandstone and siltstone was intersected over the lowermost 138 m of Gairdner-1 and was not fully penetrated. It has a maximum known thickness of 307 m in Arrowsmith-1, about 25 km to the north (Fig. 3, Mory and Iasky 1996).

The overlying Carynginia Formation is informally divided by AWE and Lipski (1991) into a lower shale member and an upper limestone member (Fig. 2). However, Mory and Iasky (1996) interpret the limestone in this part of the stratigraphic section to correlate with the Beekeeper Formation, which they indicate sits unconformably on the Carynginia Formation. The Carynginia shale member, capping the Irwin River Coal Measures, is 259 m thick in Gairdner-1 and the overlying Carynginia limestone member is 35 m thick.

The High Cliff Sandstone, Irwin River Coal Measures and the Carynginia Shale are potential targets of the drilling and hydraulic fracturing investigation.

2.1.2 Triassic

Three formations comprise the Triassic-age strata in Gairdner-1: Kockatea Shale, Woodada Formation and Lesueur Sandstone. Based on the data from Gairdner-1 the base of the Triassic is at 1,740 m below rotary table (brt) and strata of that age continue to the surface.

The lowest unit, the Early Triassic Kockatea Shale, is 852 m thick in Gairdner-1. The geophysical logs indicate consistently shaley strata (Fig. 2). The basal 100 m of this shale is another potential target of the hydraulic fracturing investigation.

The Mid Triassic Woodada Formation, which consists predominantly of sandstone and siltstone, is 311 m thick in Gairdner-1. Geophysical logs from Gairdner-1 suggest that the formation is a thinly-bedded, fine-grained unit (Fig. 2).

The Late Triassic Lesueur Sandstone is predominantly a coarse-grained sandstone with traces of claystone and siltstone. The unit is 577 m thick in Gairdner-1 (Fig.2) and has been logged from the surface where it outcrops in places (Fig. 3 and 4).

2.1.3 Jurassic

Although not intersected by Gairdner-1, four Jurassic-age formations are recognised in the eastern part of EP455: Eneabba Formation, Cattamarra Coal Measures, Cadda Formation and Yarragadee Formation (Fig. 4).

The lowest unit, the Early Jurassic Eneabba Formation, is characterised by multicoloured siltstone and claystone with sandstone interbeds and is known to be up to 854 m thick.

The Early to Mid Jurassic Cattamarra Coal Measures is up to 1,500 m thick and consist of fine- to coarse- grained sandstone interbedded with carbonaceous siltstone and claystone, with coal seams of up to 11 m thickness.

The Mid Jurassic Cadda Formation has a maximum known thickness of 290 m (Mory and Iasky 1996) and consists of shale, siltstone and medium to very coarse grained sandstone grading to a shelly limestone at some locations.

The Yarragadee Formation is of Mid to Late Jurassic age and consists of fine to coarse grained feldspathic sandstone, siltstone and claystone with minor conglomerate and coal. It is known to be between 2,000 m to 4,000 m thick, thickening to the east.

2.1.4 Tertiary

Laterite and associated sand are widespread across the Arrowsmith Region, which occurs east of the Gingin Fault where Drover-1 is to be located (Fig. 3). This unit was not noted in the lithological log for Gairdner-1.

2.2 GEOLOGICAL STRUCTURE

The Mesozoic strata of the Perth Basin in the Drover-1 environs dip at very low angles, generally downwards to the east and north. They are cut by regional faults that trend mainly northerly: the Beagle and Coomallo Faults, that delineate the Cadda Terrace (on which Drover-1 is located), and several lesser faults that produce negligible displacement and trend to the north-west and east (Figs 3 and 4). The strata are essentially continuous over the Cadda Terrace, which is about 25 km wide (E-W) and more than 100 km long (N-S).

The faults within the Drover-1 prospect are indicated in Figure 5. The map shows that the proposed Drover-1 is at least 4 km distance from the closest regional fault, the Beagle Fault to the west, and 3.3 km from the High Cliff Sandstone Marker Faults (part of the Peron Fault system) to the north-east.

3 HYDROGEOLOGY

3.1 SETTING

The Drover-1 site is in the Eneabba Plain Sub-Area of the Arrowsmith Groundwater Area, for Department of Water (DoW) management purposes (DoW 2010). The aquifers that are recognised in this subarea are listed in Table 2 (in order from shallowest to deepest).

Table 2: Aquifers in the Eneabba Plains and Twin Hills Sub-Areas

Aquifer	Formation	Typical Bore Yield (L/day)	Groundwater Quality*	Distribution
Superficial	Bassendean Sand Tamala Limestone	small to moderate	marginal to brackish	Not present in study area – occurs west of Gingin Scarp
Yarragadee	Yarragadee Formation	large >1000	fresh to brackish	Not present at Gairdner-1 but occur beneath the eastern portion of BP455 (Fig. 4), within the Twin Hills Sub-Area
Cattamarra	Cattamarra Coal Measures	moderate >500	brackish to saline	
Eneabba	Eneabba Formation	moderate 500-1000	fresh to brackish	
Lesueur	Lesueur Sandstone	Large up to 2000	fresh to marginal	Occurs from surface in study area

Modified after DoW (2010)

*Fresh = <500 mg/L TDS; Marginal = 501-1500 mg/L TDS; Brackish = 1,501-5000 mg/L TDS; Saline = 5,001-50,000 mg/L TDS; Hypersaline = >50,000 mg/L TDS.

Of these recognised aquifers, the only one that is present at the Drover-1 site is the Lesueur aquifer, which is discussed in detail in Section 3.2. The underlying Woodada Formation is

noted by Kern (1997) to be a minor multilayered aquifer, with confining argillaceous beds, which is in hydraulic connection with the overlying Lesueur aquifer. At one test site (WL12 5 km east of Jurien) it contained relatively fresh groundwater but the salinity is more marginal elsewhere where the formation comprises thicker beds of fine-grained sandstone and siltstone.

The Eneabba, Cattamarra and Yarragadee aquifers occur to the east of the study site within the EP455 boundary (Fig. 4) but are within the adjacent Twin Hills Groundwater Sub-Area.

The relationships between the aquifers in the vicinity of EP455 are depicted in Figure 6.

3.2 LESUEUR AQUIFER

3.2.1 Groundwater Levels and Flow

Accurate groundwater level data in the vicinity of the study area are limited and data from the DoW's WIN database near the site include numerous irregularities (Fig. 7). For example, two bores (WIN ID 20007603 and 20007604) located 900 m and 150 m north-west of the proposed Drover-1 site have recorded water levels of 36 m AHD and 144 m AHD, respectively. Other data to the east of the site (e.g. WIN ID 20007589 and 20007602) indicate that some bores may access perched groundwater resulting in relatively elevated groundwater levels.

Isopotential data for the top of the Mesozoic Formations, recorded in May 1993 and presented by Kern (1997), are considered to provide a better estimate of groundwater heads in the Lesueur aquifer at the site (Fig. 7). These data, which include four measurement points within a 13 km radius of the site, indicate heads in the Lesueur aquifer decline from an elevation of about 76 m AHD, just west of the Peron Fault (2 km east of Drover-1), to about 63 m AHD, 6.4 km to the west where the Kockatea Shale/Carynginia Formation subcrops. The data imply that groundwater flow is towards the west to north-west. However, these 1993 groundwater level data are dated. Hydrographs for the shallower Leeman Shallow Project bores on the WIN database indicate that water levels have risen by between 0.8 and 2.5 m since 1993. WIN data for the Water Corporation's Leeman 1-91 bore, however, appears to include only pumping water levels (which are drawn down below the standing water level due to the pumping), with the level reported by Kern (1997) the only standing water level that is readily available.

The isopotentials from Figure 7 were used to estimate depth to groundwater at the site (Fig. 8). The derived data indicate that the depth to groundwater in the vicinity of Drover-1 and in the areas of Lesueur National Park, directly to the west and south of the site, is considerable (>100 m below ground level). To the west, near the boundary of the impermeable Kockatea Shale, the data suggest that the groundwater heads may approach

artesian. To the east, the plotted depth to groundwater and the WIN database data again do not correlate well, and the actual depth to groundwater is uncertain as discussed previously.

Surface water flow at the site is expected to follow topographic gradients, which generally slopes downwards towards the west to north-west.

3.2.2 Groundwater Recharge and Discharge

Groundwater recharge to the Lesueur aquifer in this area is derived predominantly from rainfall where the aquifer occurs at the surface or beneath thin surficial deposits. The aquifer outcrops within the Lesueur National Park, to the south, and sub-crops beneath a thin cover of Tertiary laterite and sand over the remainder of the area between the Beagle and Peron Faults. Therefore, there is a considerable area over which there is potential for rainfall recharge to occur. Some groundwater flow into the Lesueur aquifer, from the Eneabba Formation and Cattamarra Coal Measures, is likely to occur from the east across faults.

*no mention
that well
is in
this
recharge
zone!*

The water level data presented in Figures 7 and 8 suggest that groundwater discharge from the Lesueur aquifer occurs near the edge of the Beagle Fault system, along the eastern boundary of the Kockatea Shale. Upwards hydraulic head gradients in the Lesueur aquifer near this boundary result in discharge into the Superficial aquifer, which is present west of the Gingin Scarp (Fig. 8). Several springs occur close to this boundary (Section 4.2).

3.2.3 Groundwater Quality

Groundwater in the Lesueur aquifer typically has fresh to marginal salinity which most likely increases with depth. Salinities of water sampled from bores within the study area screened in the upper portion of the aquifer range from 450 mg/L to 1,435 mg/L Total Dissolved Solids (TDS) (Fig. 9). However, one bore, Amax Greenhead No.1 (WIN ID 20007614) which is constructed deeper in the aquifer (680 m bgl), has a reported salinity of 3,620 mg/L TDS. It is likely that the groundwater salinity in the Lesueur aquifer is slightly higher close the contact with the Eneabba Formation, which is known to contain more brackish groundwater; however, there are limited data within the study area to support this.

3.2.4 Aquifer Connectivity

The major regional confining layer between the hydrocarbon exploration targets (the basal 100 m of the Kockatea Shale, Carynginia Formation, Irwin River Coal Measures and the High Cliff Sandstone) and the overlying aquifers is the Kockatea Shale. The formation is 852 m thick in Gairdner-1 and geophysical logs indicate consistently shaley strata (Fig. 2). Elsewhere in the area the Kockatea Shale may be more than 1,100 m thick (in Eneabba-1 oil well; Mory 1994). The Kockatea Shale is recognised as a primary regional seal for

hydrocarbon plays in the northern Perth Basin (D'Ercole 2003) and, as such, would also form a major hydraulic confining layer.

The major aquifer, the Lesueur aquifer, and the underlying minor aquifer, the Woodada Formation, are likely to have some degree of hydraulic connection. However, they, both contain minor confining layers, which may impede or restrict vertical groundwater movement.

The hydraulic properties along faults in the area are difficult to assess without specific investigations, which have not been undertaken. There could be groundwater flow between adjacent aquifers where permeable strata are juxtaposed across a fault, such as the contact between the Lesueur aquifer and Eneabba Formation across the Peron Fault (Fig. 6). Additionally, faults that cut the strata are potential conduits for vertical movement of fluids. No significant faults have been identified in the vicinity of the hydraulic fracturing operations.

no investigation!

4 EXISTING GROUNDWATER USE

4.1 GROUNDWATER USERS

Groundwater extraction is licensed by the DoW and the available resources are managed for allocation purposes within defined areas. The Drover-1 site is located within the Eneabba Plain Sub-Area of the Arrowsmith Groundwater Area, although EP455 also intersects the Twin Hills Sub-Area of the Arrowsmith Groundwater Area, to the east, and the Cervantes, Nambung and Bagingarra Sub-Areas of the Jurien Groundwater Area, to the south (Fig. 10).

Active DoW licences to extract groundwater (GWLs) near Drover-1 are shown in Figure 10 and are summarised in Table 3. Only shallow domestic and stock watering bores are exempt from licensing. Such bores provide only small supplies, generally from the Superficial aquifer, and are the most numerous water-supply bores in the area.

Table 3: DoW GWLs Held Near Drover-1

GWL	GW Area Name	GW Subarea Name	Aquifer Name	Allocation (kL/a)
65700	Arrowsmith	Eneabba Plains	Lesueur	470,000
57960		Twin Hills	Yarragadee	70,000
171512		Twin Hills		24,000
167278		Dongara	Superficial	3,000
111221	Jurien	Cervantes	Superficial	55,000
175401				400,000

The data show that there is limited licensed groundwater use in the area directly surrounding Drover-1. The closest licence, GWL 65700 held by the Water Corporation (Leeman 1-91)

allowing 470,000 kL/a of groundwater to be extracted from the Lesueur aquifer, is located 4.2 km north-west of the proposed Drover-1 site. This is the only current GWL in the Lesueur aquifer within this sub-area and represents 26% of the allocation limit of 1,800,000 kL; with 1,330,000 kL/a currently available for allocation. The proposed 10 ML to be used by AWE in the drilling and hydraulic fracturing testing at Drover-1 would represent only 0.5% of the total annual allocation of the Lesueur aquifer.

The Yarragadee aquifer in the Eneabba Plains and Twin Hills Sub-Areas is the major groundwater resource, with the largest available allocation and currently allocated resources (Table 4). Most of the extraction from this aquifer occurs in the north-eastern parts of these sub-area where this aquifer outcrops or occurs at shallow depth.

Table 4: Groundwater Allocation Summary for Eneabba Plains and Twin Hills Groundwater Sub-Areas

Sub-Area	Aquifer	Allocation Limit (kL/a)	Licensed Allocation (kL/a)	Total Allocated, Committed and Requested (kL/a)	Allocated Resources (%)
Eneabba Plains	Cattamarra Coal Measures	100,000	0	0	0%
	Lesueur	1,800,000	470,000	0	26%
	Eneabba	2,000,000	800,000	1,400,000	70%
	Superficial	14,470,000	281,300	1,281,300	9%
	Surficial	0	0	0	0%
	Yarragadee	20,440,000	15,510,711	20,400,711	100%
Twin Hills	Cattamarra Coal Measures	500,000	0	0	0%
	Lesueur	200,000	0	0	0%
	Parmelia	3,400,000	46,000	46,000	1%
	Superficial	0	0	0	0%
	Surficial	490,000	0	0	0%
	Yarragadee	42,830,000	18,138,250	19,138,250	45%

Data from the DoW - dated 25 March 2013

4.2 GROUNDWATER DEPENDENT ECOSYSTEMS

The depth to groundwater at the Drover-1 site is estimated to be in excess of 100 m based on isopotentials published by Kern (1997), with the closest expression of groundwater of less than 20 m depth being 4 km to the west (Fig. 8). It appears unlikely that the Lesueur National Park within (at least) a 2 km radius of Drover-1 contains groundwater dependent vegetation considering the comparatively deep water table.

The DoW WIN database contains contradictory information; the depth to groundwater at WIN site 20007604, located 150 m northwest of the proposed Drover-1 site, is recorded to be 24 m bgl, whereas the depth to groundwater at WIN site 20007603, located approximately

900 m north-north-west of the site is recorded as 146 m. The exact depth to groundwater at the site needs to be ascertained but given the relatively high topographic elevation of the site (approximately 170 m AHD), it would be unlikely that the depth to groundwater is shallow (<20 m bgl). Therefore, there is minimal likelihood of GDE in the vicinity of the site.

The study undertaken by Rutherford *et. al* (2005) identifying groundwater dependent ecosystems (GDE) in the Northern Perth Basin, considered only sites that had a depth to groundwater of less than 20 m to be potentially reliant on groundwater. The closest GDE identified by the study is a natural spring, named "Diamond of the Desert", located 7 km to the southwest (Fig. 8). Here the impermeable Carynginia Shale is juxtaposed against the Lesueur Sandstone along the Beagle Fault causing upward discharge of groundwater into the Superficial formations. This GDE is well outside the area of influence expected for the operations at Drover-1.

5 RECOMMENDED MONITORING

There are three existing bores near the proposed Drover-1 site that may be useful for groundwater monitoring (Fig. 8); the details of which are summarised in Table 5 and locations shown in Figure 8. The condition and availability of these bores needs to be ascertained but, if deemed suitable, they could be used for groundwater level and quality monitoring.

If the existing bores are unsuitable or unavailable, at least two monitoring bores would be required to be installed; ideally one as close as practical to the Drover-1 hole (say offset 150 m) and one downgradient (say 0.5 to 1.0 km west-north-west depending on access). This would allow the depth to groundwater and the hydraulic gradient to be confirmed. Note that if the existing bores are suitable and available for monitoring these additional bores would not be required.

To establish whether operations have any effect on the groundwater system, bores should be installed with groundwater loggers which record the groundwater level, electrical conductivity, pH and temperature. These should be installed as soon as possible to establish baseline trends prior to operations. Data should be downloaded and manual groundwater level measurements taken at least quarterly.

Comprehensive water analyses should be undertaken on groundwater samples collected from each of the available monitoring bores prior to commencement of operations and at say 6-monthly intervals thereafter. The exact timing will depend on the duration of operations. Sampling and monitoring should continue for at least 2 years following the completion of operations. The comprehensive analysis suite should be supplemented with hydrocarbons and any other additives specific to the hydraulic fracturing operations.

Table 5: Summary of Lesueur Aquifer Bore for Potential Monitoring Use

WIN Site ID	AWRC Name	MGA mE	MGA mN	Drilled Depth m bgl	Slotted Interval m bgl	Year Constructed	Elevation ^A m AHD	Water Level m bgl	Water Level m AHD	TDS from WIN	Distance and direction from Drover-1
20007603	BORE	321,282	6,672,32	220	192-198	?	182	116	36	500	150 m NE
20007604	BORE	321,287	6,671,297	9164	54-60	1990	158	24	144	930	900 m NNE
20007613	FARM NO 1	318,330	6,671,559	5182	?	1974	108	40	68	1,570	2,900 WNW
* Elevation estimated from Google Earth											

A rainfall and barometric gauge should be set-up at the site to allow climatic influences to be incorporated in the analysis of data.

Bores used for monitoring will need to be surveyed so groundwater levels can be compared accurately.

6 SUMMARY AND CONCLUSIONS

A groundwater study has been undertaken for the area surrounding the proposed Drover-1 site (16.5 km east of Greenhead), where AWE is considering a hydraulic fracturing programme. Although groundwater use is expected to be minimal, totalling 10 ML for the entire project, and adverse risks to the groundwater system are expected to be minimal, AWE is aiming have a thorough hydrogeological understanding of the site so that any potential risks can be minimised.

The target reservoirs for the hydraulic fracturing stimulations are expected to be at depths of greater than 1.6 km, far below the 580 m bgl base of the Lesueur sandstone, the main aquifer in the area. The hydraulic fracturing targets include the basal 100 m of the Kockatea Shale, at about 1.6 km depth, to the Irwin River Coal Measures at about 2.1 km depth. The Kockatea Shale is expected to be around 850 m thick at Drover-1 and, excluding the basal 100 m, provides a thickness of 750 m of impermeable shale between the planned targets and the overlying aquifer. Therefore, providing that the integrity of the well casing and annular cement grout at the proposed Drover-1 site are not compromised and there are no unforeseen connections of strata, the hydraulic fracturing should not affect overlying aquifers.

The main aquifer which sub-crops beneath the site is the Lesueur aquifer, which is composed of 580 m of sandstone and siltstone. Groundwater levels at the site need to be confirmed but are expected to be in excess of 100 m bgl. Groundwater salinity in the Lesueur aquifer is typically fresh to marginal and most likely increases with depth. Given the expected considerable depth to groundwater, it appears unlikely that vegetation within the adjacent Lesueur National Park is groundwater dependent.

There is limited groundwater use in the area. Within the Eneabba Plains groundwater management sub-area, only 26% of the Lesueur aquifer allocation limit of 1,800,000 kL is currently utilised. The closest groundwater user, the Water Corporation, is located 4.2 km north-west of the proposed Drover-1 site, well outside the area of influence expected for the operations at Drover-1.

Existing bores need to be visited to determine if they would be suitable or available for groundwater level and quality monitoring. If they are not, at least two monitoring bores will be required to be installed to determine the groundwater level, hydraulic gradient and

groundwater quality at the site. On-going groundwater level and quality monitoring is recommended before, during and after the operations to ensure the groundwater system is not impacted.

Dated: 10 May 2013

Rockwater Pty Ltd



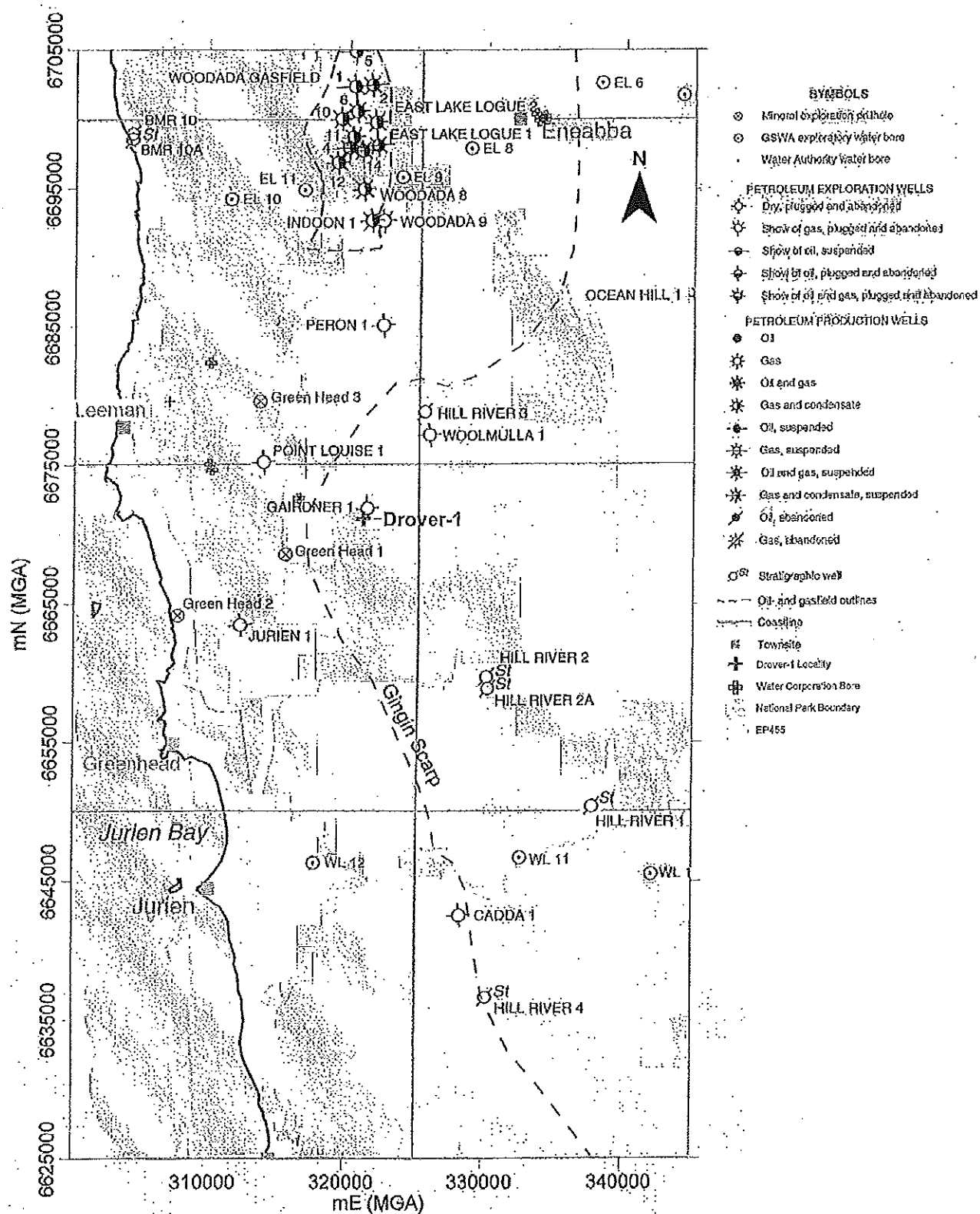
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FIGURES



Figure 1



387-1/Suiter/13-01/Fig1. Oil Well Locality art

Client: AWE Limited

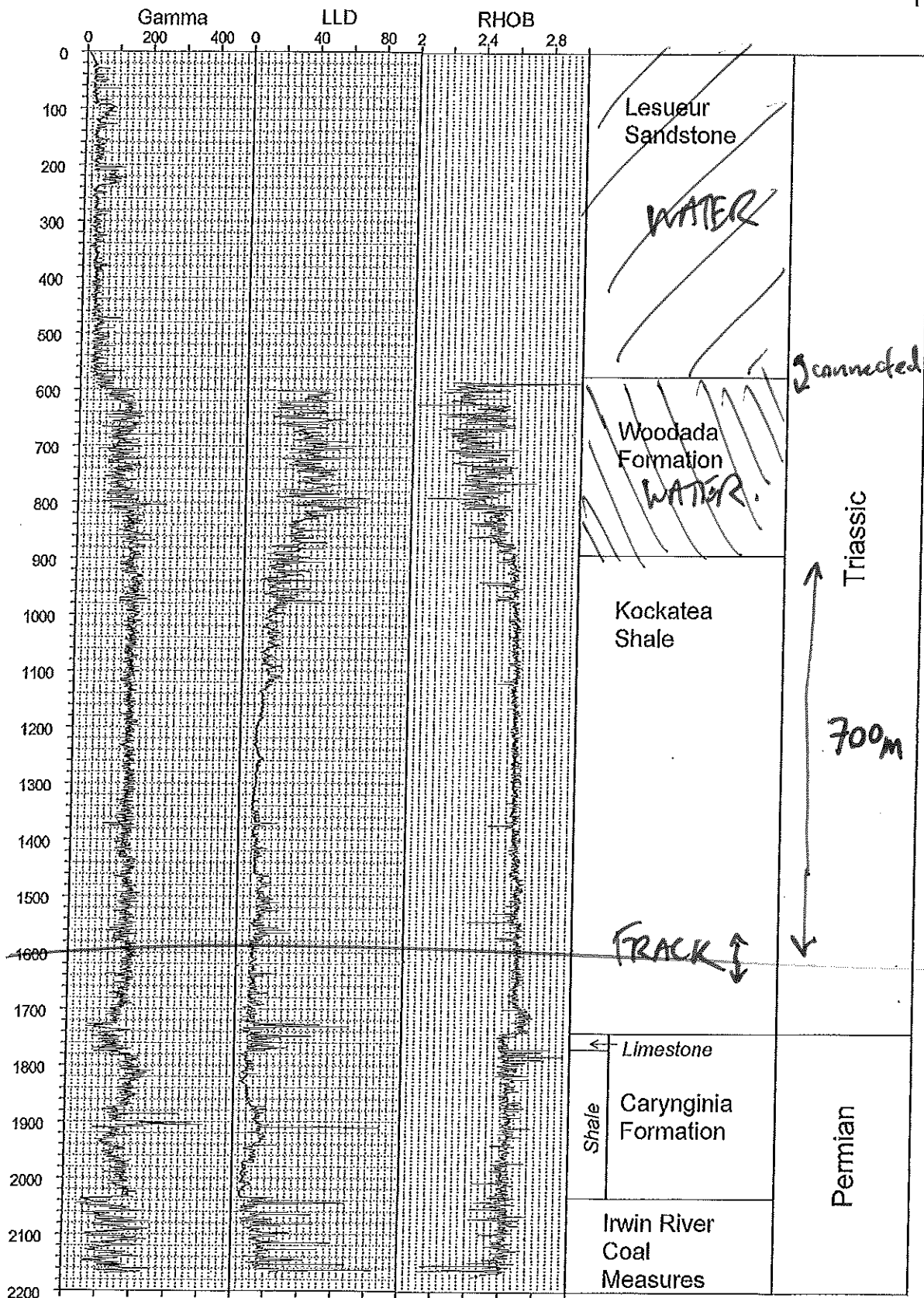
Project: Drover-1 Groundwater Study

Date: May 2013

Dwg. No: 387-1/13/1-1

REGIONAL LOCATION AND DEEP DRILL HOLES

Figure 2



387-1Kgraph13-01/Fig2, Gairdner Strat & Logs.grf

Client: AWE Limited

Project: Prover-1 Groundwater Study

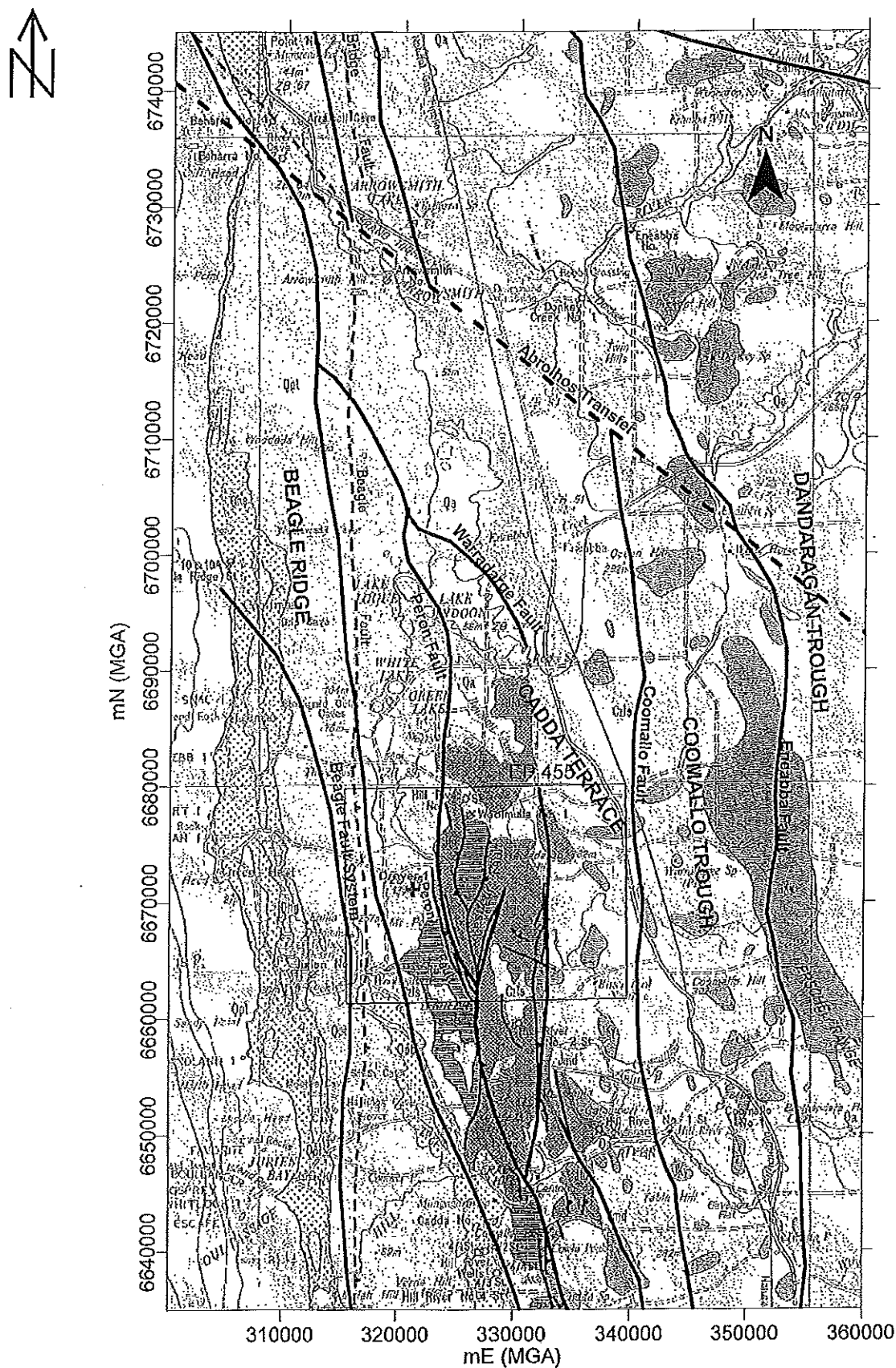
Date : May 2013

Dwg. No: 387-1/13/1-2

GAIRDNER-1 STRATIGRAPHY AND LOGS



Figure 3



387-01/Surfer/11-01/Geology/Localty.srf

Geology from Geological Survey of WA.

Client: AWE Limited

Project: Drovers-1 Groundwater Study

Date: May 2013

Dwg. No: 387-1/13/1-3

GEOLOGICAL STRUCTURE



Figure 3a

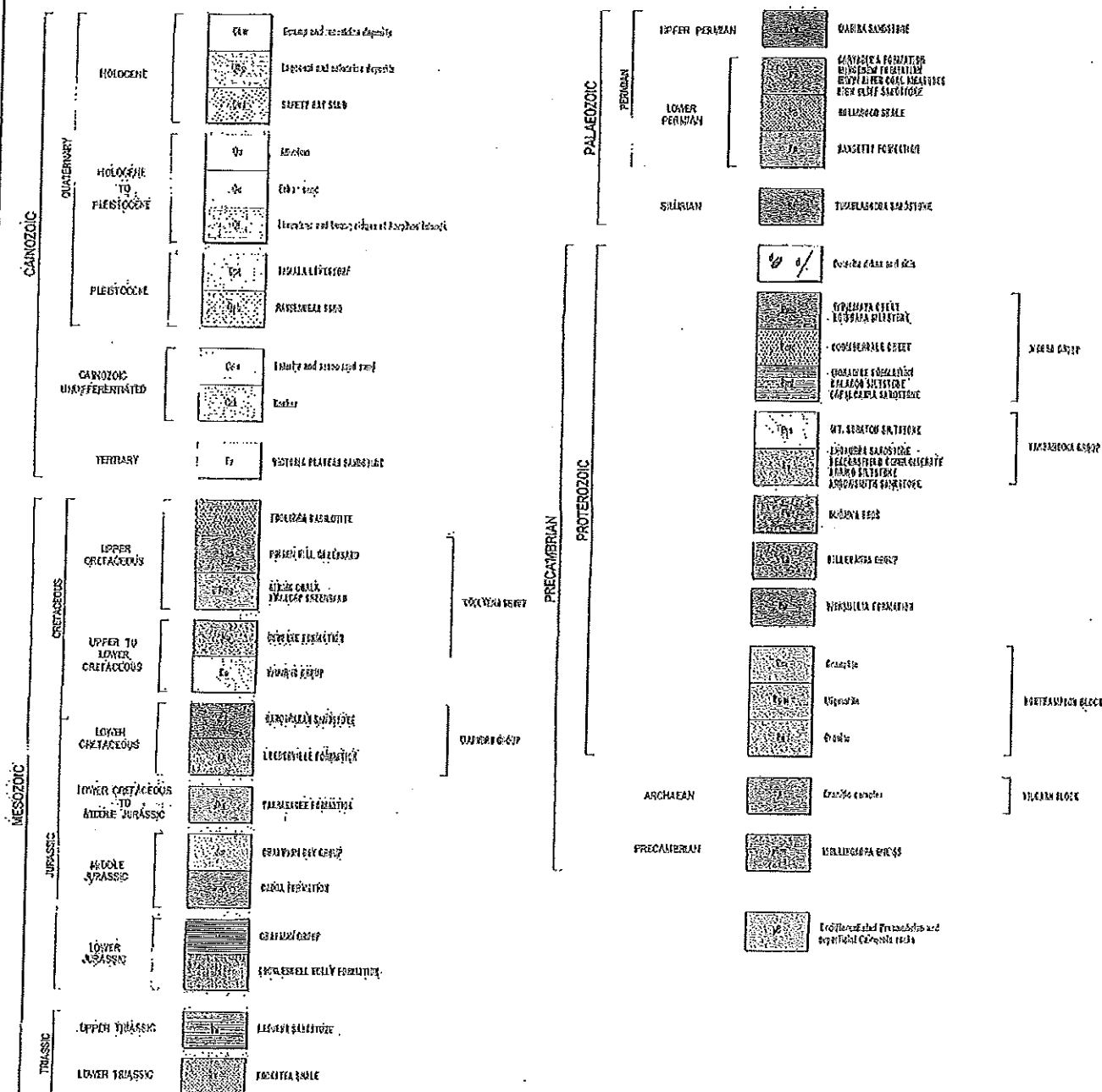
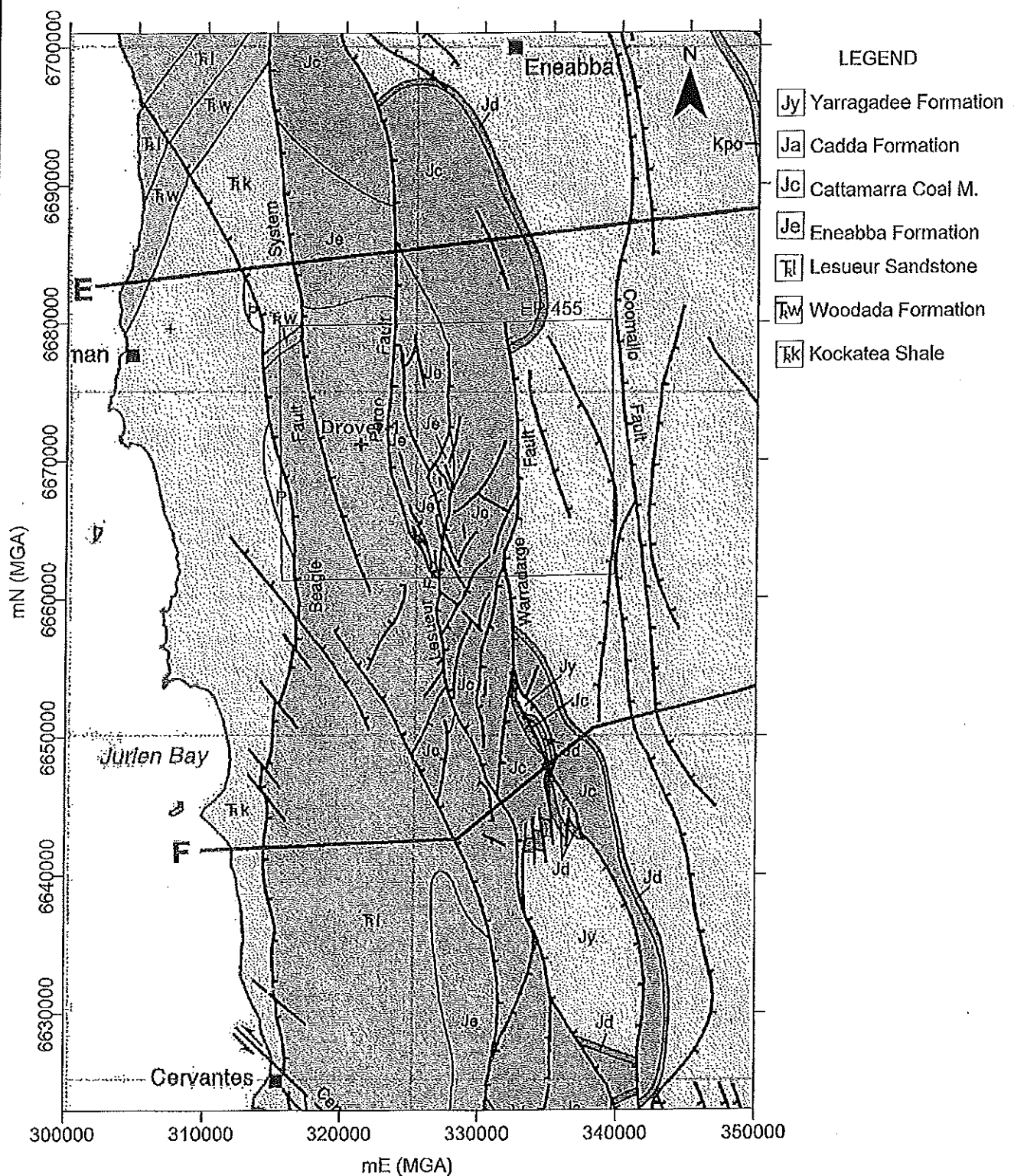


Figure 4



Map after Mory and Iasky, 1996

387-0/Surfer/13-01/Fig4, Subcrop Geology.srf

Client: AWE Limited

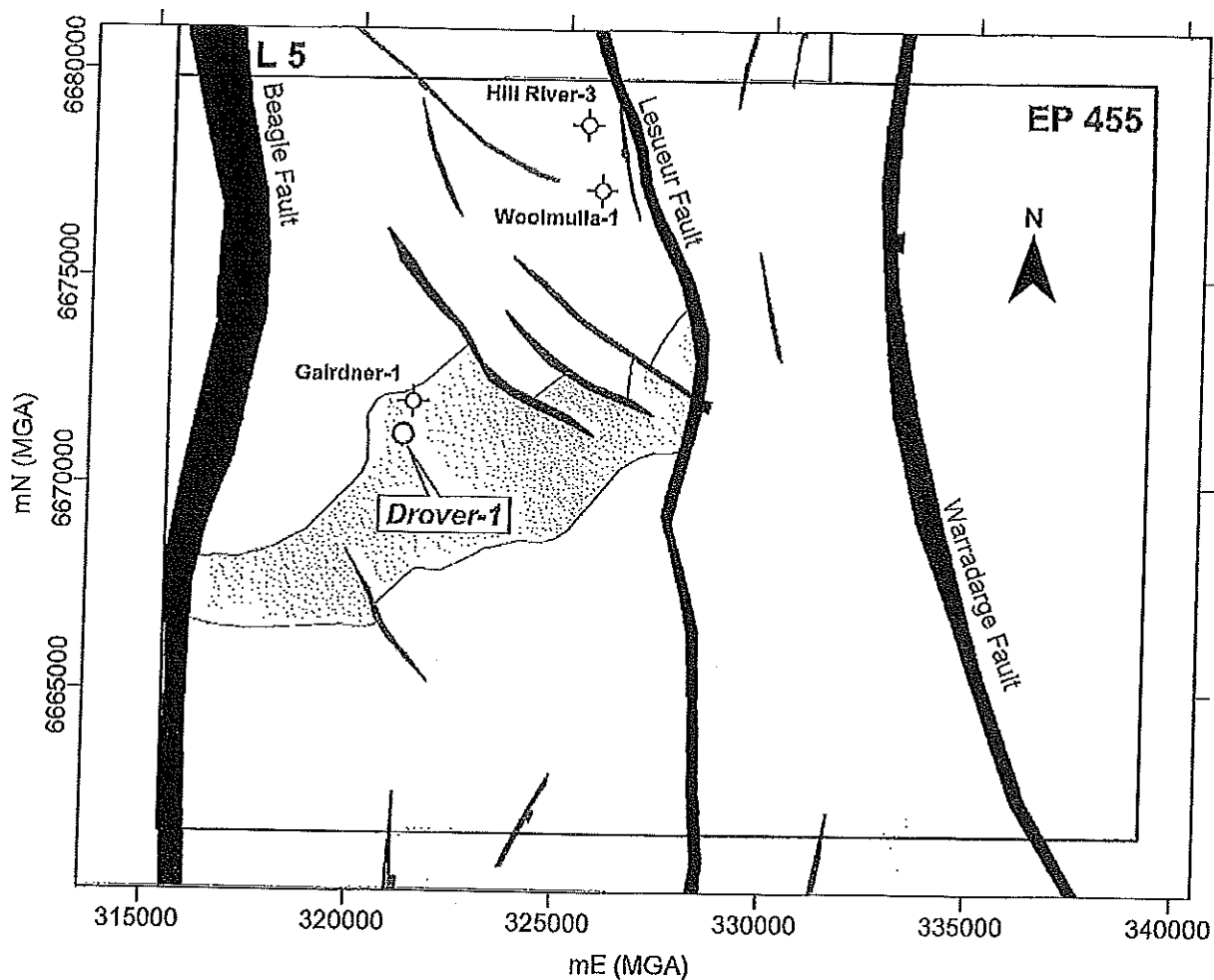
Project : Drover-1 Groundwater Study

Date : May 2013

Dwg. No: 387-1/13/1-4

TERTIARY SUBCROP GEOLOGY

Figure 5



Drover Prospect (High Cliff Sst marker) Faults

Regional Faults

Other Faults

Drover Prospect



387-01/Supp/13-01/Fig5. Local Faults.srf

Client: AWE Limited

Project : Drover-1 Groundwater Study

Date : May 2013

Dwg. No: 387-1/13/1-5

DROVER PROSPECT WITH MAPPED FAULTS



Mt Peran Bore-field

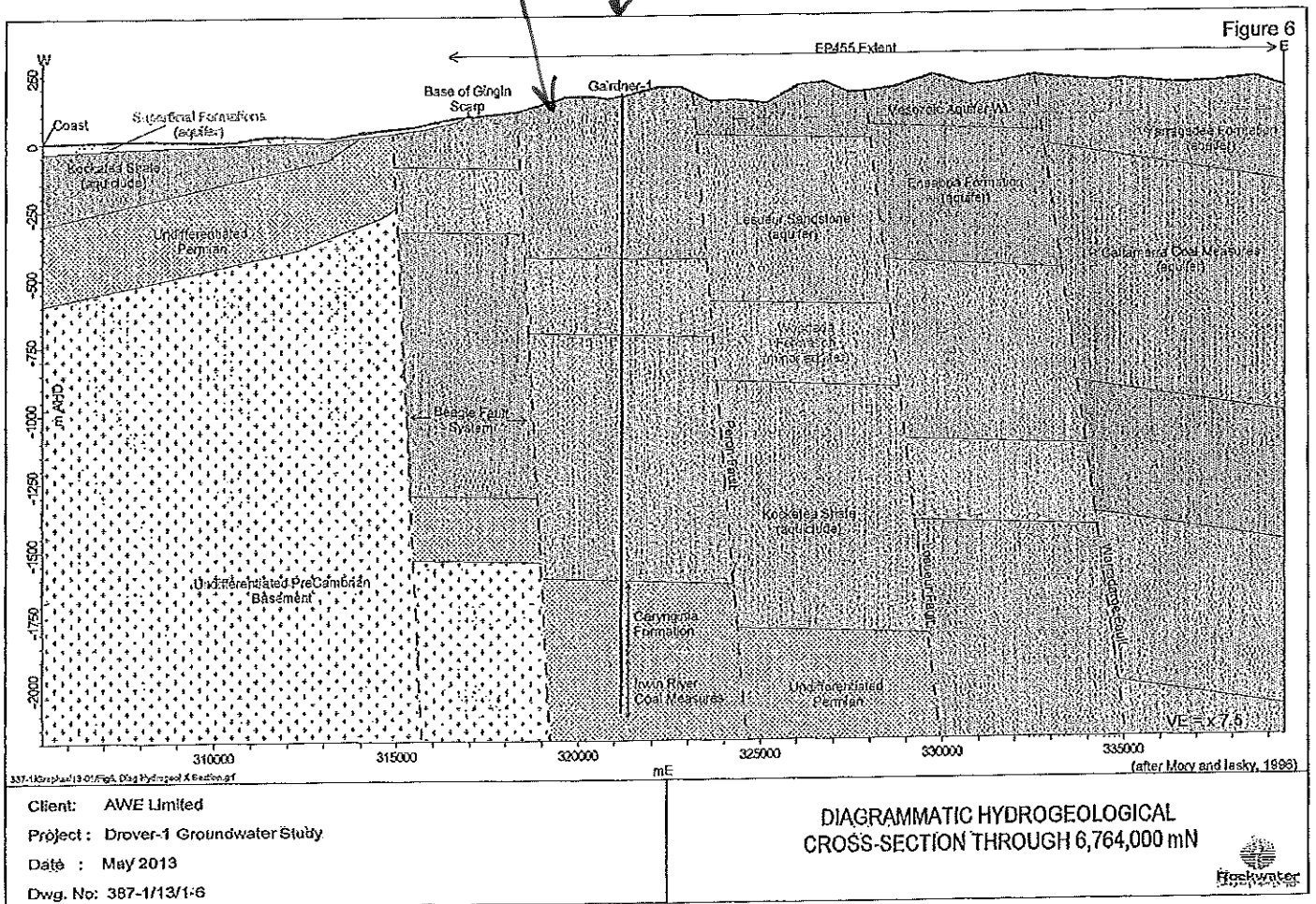
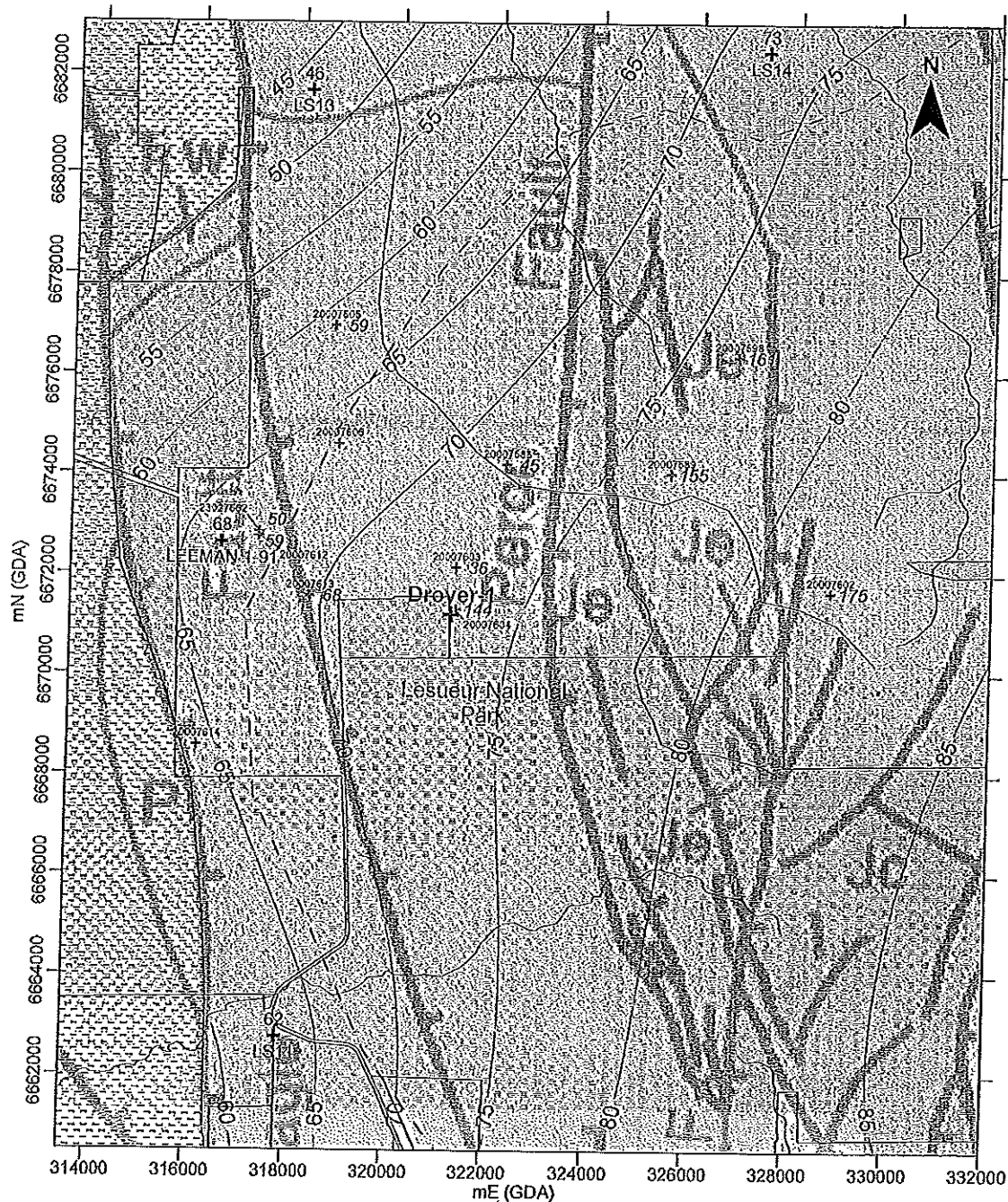


Figure 7



- 70— Isopotential - Top of Mesozoic Aquifers (m AHD)
- 62
+
LS12 Mesozoic Water Level Monitoring Point and Water Level (m AHD)
- 2007603
+36 WIN Database Water Level Monitoring Point and Water Level (m AHD)
- Aquiclude - Kockatea Shale/Carynginia Formation
- DEC Management Boundary
- Water Course

NB - Mesozoic Isopotentials from Kern, 1997
- Sub-Crop Geology Map from Mory and Iasky, 1996 with Legend on Fig. 4

387-01/13-01/Fig7. Mesozoic WLS.srf

Client: AWE Limited

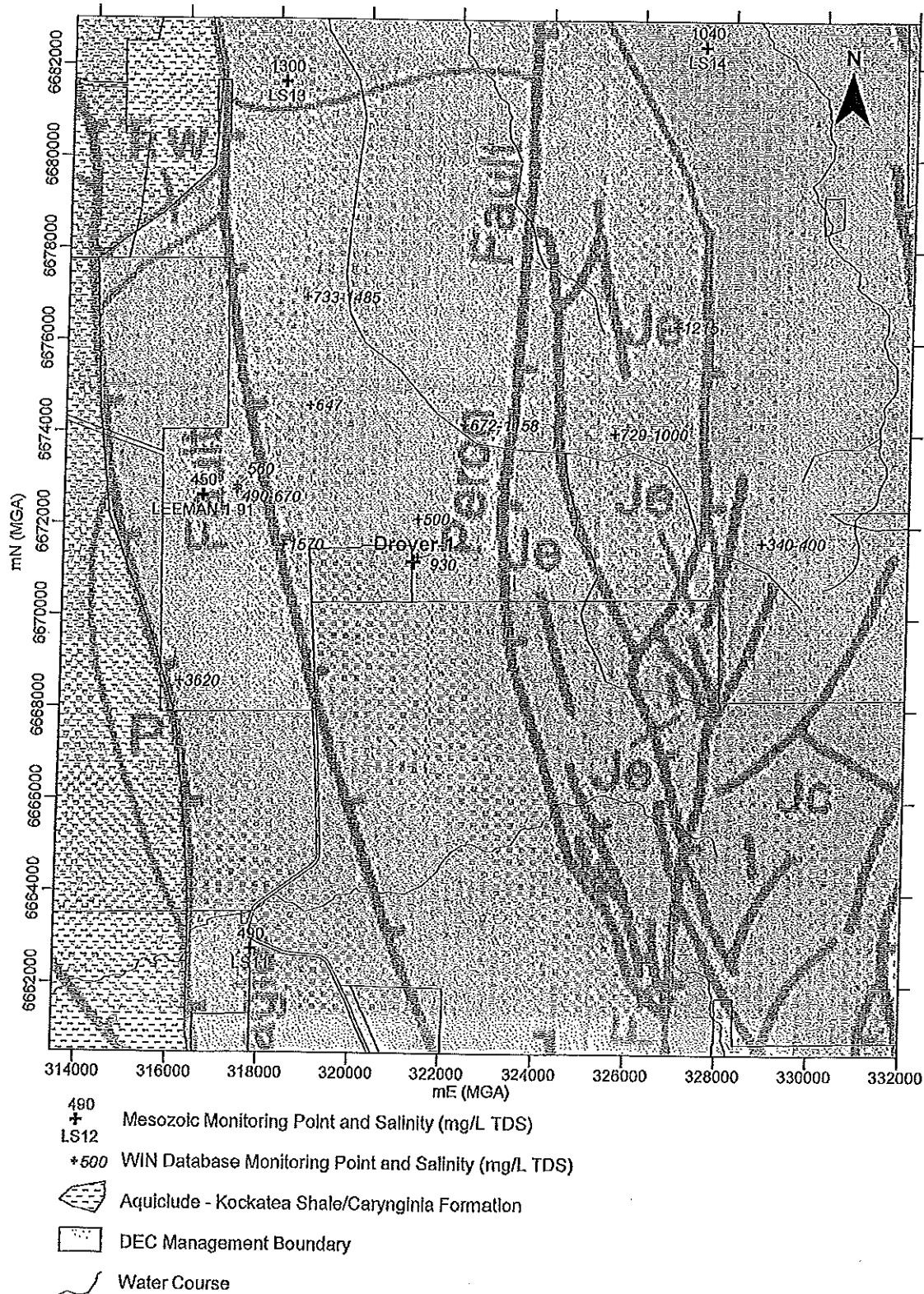
Project: Drover-1 Groundwater Study

Date: May 2013

Dwg. No: 387-1/13/1-7

ISOPOTENTIALS AT THE TOP OF MESOZOIC FORMATIONS

Figure 9



NB - Sub-Crop Geology Map
from Mory and Iasky, 1996
with Legend on Fig. 4

387-0/Surfer/13-01/Fig9_Salinity Map.srf

Client: AWE Limited

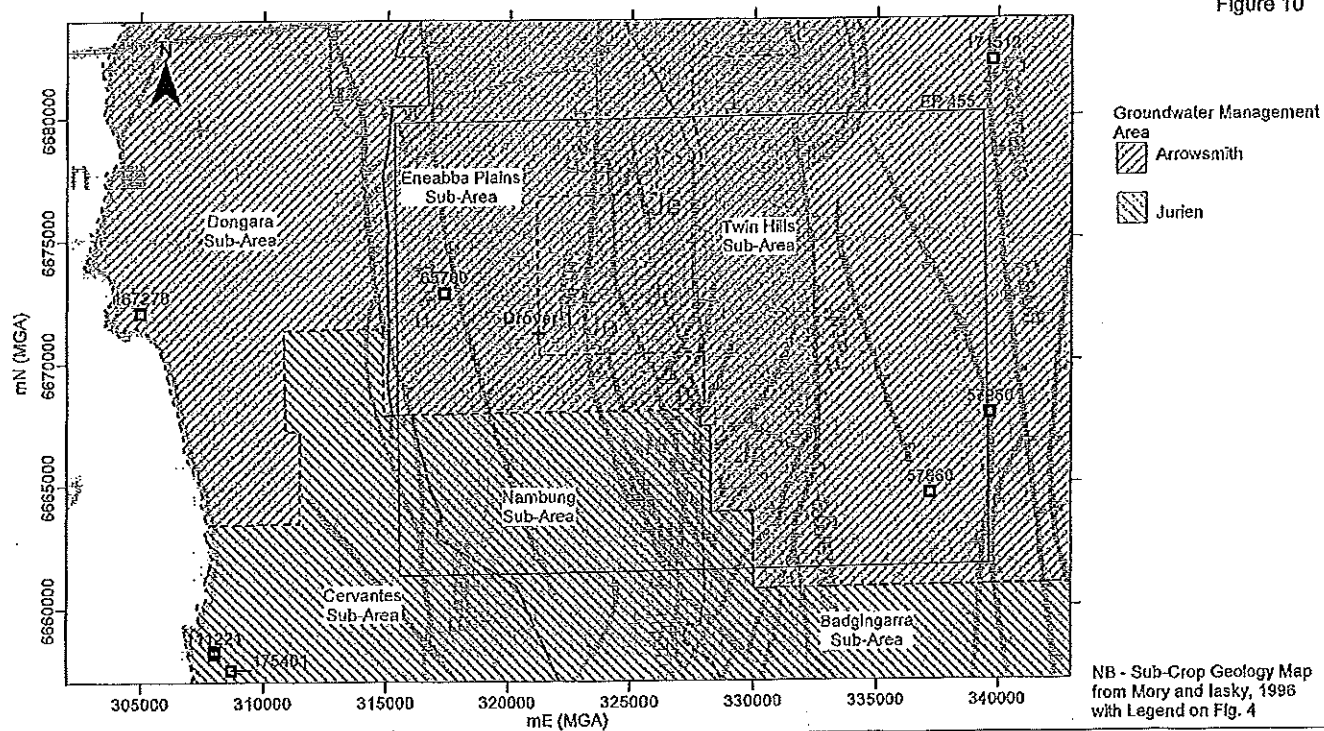
Project: Drover-1 Groundwater Study

Date: May 2013

Dwg. No: 387-1/13/1-9

GROUNDWATER SALINITY

Figure 10



Client: AWE Limited
 Project: Drover-1 Groundwater Study
 Date: May 2013
 Dwg. No: 387-1/13/1-10

LICENCES TO TAKE GROUNDWATER IN THE VICINITY OF DROVER-1





RECEIVED
23 AUG 2014

Mr Piers Verstegen
Director
Conservation Council of WA

Mr Peter Robertson
Campaigner
The Wilderness Society WA

Dear Messrs Verstegen and Robertson

REQUEST FOR URGENT ACTION TO PROTECT DRINKING WATER SOURCE AND NATIONAL PARK FROM IMMINENT CONTAMINATION RISK DUE TO GAS FRACKING

Thank you for your letter dated 23 July 2014 regarding the above.

I note your concerns with this project regarding the risk of ground or surface water contamination and the potential spread of die-back.

Environmental Protection Authority (EPA) decision

I note that this proposal has been referred to the EPA to determine whether the proposal was one which was likely, if implemented, to have a significant effect on the environment.

The EPA determined that the proposal was not a significant proposal and therefore did not require assessment, and gave public advice in relation to the proposal. In the public advice, the EPA considered the issue of potential contamination to ground and surface water and the spread of dieback and concluded that potential impacts associated with the proposal could be adequately evaluated, regulated and mitigated by the Department of Mines and Petroleum (DMP) and the Department of Water (DoW). The notice of this decision is a public document and can be viewed on the EPA's website at www.epa.wa.gov.au.

Appeal to the Minister

This decision of the EPA was appealed (Appeal Number 427 of 2013). The report of the Appeals Convenor to the Minister for Environment considered the issues of potential ground and surface water contamination and the spread of dieback. The Appeals Convenor agreed with the approach taken by the EPA and concluded there were existing statutory mechanisms administered by DMP to evaluate, regulate and mitigate potential environmental impacts associated with the proposal. Following the advice of the Appeal Convenor, the Minister for Environment dismissed the appeal. The report by the Appeals Convenor to the Minister for Environment and the Minister's Appeal Determination are available on the Appeals Convenor's website at www.appealsconvenor.wa.gov.au.

Environmental assessment and regulation by DMP

The environmental impacts of onshore petroleum proposals are regulated by the DMP under the *Petroleum and Geothermal Energy Resources (Environment) Regulations 2012* (WA) (PGER (Environment) Regulations).

The PGER (Environment) Regulations make it an offence for an operator to carry out a petroleum activity without an environment plan or contrary to an environment plan for the activity.

The Minister for Mines and Petroleum will approve an environment plan if reasonably satisfied that the plan:

- (a) is appropriate for the nature and scale of the activity; and
- (b) demonstrates that the environmental impacts and environmental risks of the activity will continuously be reduced to as low as is reasonably practicable; and
- (c) demonstrates that the environmental impacts and environmental risks of the activity will be of an acceptable level; and
- (d) provides for appropriate environmental performance objectives, environmental performance standards and measurement criteria; and
- (e) includes an appropriate implementation strategy and monitoring, recording and reporting arrangements; and
- (f) for the requirement mentioned in regulation 17(1)(b) of the PGER (Environment) Regulations - demonstrates that there has been an appropriate level of consultation with relevant authorities and interested persons and organisations; and
- (g) complies with Division 3 of the PGER (Environment) Regulations.

The Minister for Mines and Petroleum has approved an environment plan for this proposal, which is available for viewing at <https://ace.dmp.wa.gov.au/ACE/Public/PetroleumProposals>.

I note that an operator is required to revise its environment plan, and submit any revisions to the Minister for Mines and Petroleum for approval, if a significant new or increased environmental impact or risk arises which is not dealt with in the approved environment plan.

Regulatory role of DER

Under Part V Division 3 of the *Environmental Protection Act 1986* (WA) (EP Act), I may grant works approvals and licences in respect of prescribed premises and works which cause a premises to become a prescribed premises.

The proposal in question does not fall within the categories of prescribed premises set out in the *Environmental Protection Regulations 1987* (WA).

EP Act Offences

Because AWE Perth Pty Ltd (AWE) does not hold a Ministerial Statement under Part IV of the EP Act, or a licence or works approval under Part V of the EP Act, in relation to its operations, it is not able to rely on the defence set out in section 74A of the EP Act.

It is, however, a defence under section 74B of the EP Act to the offences of causing serious or material environmental harm if a person charged with that offence proves that the environmental harm was, or resulted from, an authorised act which did not contravene any other written law. In this case, this is likely to encompass the carrying out of petroleum activities in accordance the requirements of an approved environment plan under the PGER (Environment) Regulations.

Appropriateness of Environmental Protection Notice or Prevention Notice

I may issue an environmental protection notice under section 65 of the EP Act if I suspect, on reasonable grounds that,

- (a) there is, or is likely to be, an emission from any premises, and the emission —
 - (i) does not comply with or would not if it were emitted comply with a standard required by or under an approved policy or a prescribed standard; or
 - (ii) has caused or is likely to cause pollution; or
- (b) a person is doing, or is likely to do, an act in contravention of section 50A or 50B on any premises; or
- (c) an activity on premises does not comply with a standard required by or under an approved policy or a prescribed standard.

An inspector or authorised person may issue a prevention notice under section 73A of the EP Act, with my approval, if the inspector or authorised person reasonably suspects that:

- (a) any waste has been or is being discharged from any premises otherwise than in accordance with a works approval, licence or requirement contained in a closure notice or an environmental protection notice; or
- (b) a condition of pollution is likely to arise or has arisen; or
- (c) a person has done, is doing, or is likely to do, an act in contravention of section 50A or 50B.

In my view, the issues raised in your letter do not provide me with reasonable grounds to exercise the discretion to issue an environmental protection notice or a prevention notice.

The EPA, Appeals Convenor and the Minister for Environment have determined that the proposal is not a significant proposal which is likely, if implemented, to have a significant impact on the environment.

The Minister for Mines and Petroleum has approved AWE's environment plan on the basis that he was satisfied that, amongst other things, the environmental impacts and environmental risks of the activity will be of an acceptable level.

There is no information presently before me to suggest that there is risk of pollution or environmental harm that has not been considered and addressed in AWE's environment plan. I therefore do not intend to issue an environmental protection notice or prevention notice.

Yours sincerely


 DIRECTOR GENERAL

25 August 2014

cc: 



23 July 2014

██████████
Director General
Department of Environmental Regulation
Locked Bag 33 Cloisters Square
PERTH WA 6850

By email: ██████████

URGENT

Request for urgent action to protect drinking water source and national park from imminent contamination risk due to gas fracking

Having visited the location of the Drover-1 Gas Fracking well on two occasions and examined a number of documents and other evidence obtained through Freedom of Information, we believe the Drover-1 Gas Fracking well operations pose a high risk of serious and irreversible pollution via unauthorized discharges to the Mt Peron Priority 1 Public Drinking Water Supply Area (borefield and aquifer), and of serious environmental harm in the spread of dieback into the Mt. Lesueur National Park.

These risks are of particular concern in this case as no Part IV or Part V EP Act approvals have been required for the Drover-1 Gas Fracking well, and so none of the usual conditions which would apply to these risks will regulate the operations.

The fact that these EP Act approvals have not been required also means that the operations will not have the usual (section 74A EP Act) defences to pollution, environmental harm and unauthorized discharges that EP Act approved operations usually do, meaning that the operations also pose a threat of serious ongoing offences under the EP Act. It would be a significant public policy failure if the DER were to permit ongoing serious breaches of the EP Act, especially when this Act is to prevail over others in the State.

The drilling stage at Drover-1 is nearly complete and the fracking stage will potentially begin within weeks.

We write to request that you act with urgency to use your powers to prevent these serious and imminent threats of pollution and environmental harm, and of ongoing EP Act offences, before fracking commences at the site.

Specifically, we request that you urgently issue a Pollution Prevention Notice under Section 73a and / or an Environmental Protection Notice under Section 65 of the *Environmental Protection Act 1986*.

Risk to Mt. Peron Priority 1 Drinking Water source

Please find attached a document outlining the relevant information on this issue from our own investigations to date. In summary, we have identified that:

- The Drover-1 fracking well is in close proximity to the Mt Peron Bore-field and Priority 1 Drinking Water Source Area which supplies drinking water to the towns of Green Head and Leeman. Prevailing surface and groundwater flows are towards the bore field from the fracking site.
- There is a very high risk of surface and groundwater contamination from well failure or leakage in the groundwater zone, as well as chemical and wastewater storage and management in the surface. There is also a risk of contamination from the fracking zone (1600m depth) to the aquifer (connected to 900m depth), including via the Beagle fault and other faulting in the Kockatea Shale. There is a depth of 700m of potentially highly fractured shale separating the base of the aquifer from the fracking zone. The proponent's groundwater study notes that *"The hydraulic properties along faults in the area are difficult to assess without specific investigations which have not been undertaken"*.
- The Drover-1 well is being drilled at or very near to the site of an abandoned conventional gas well drilled in the 1990's (no production took place). The presence of this abandoned, corroding well very near to the Drover-1 well presents a significant potential contamination pathway for high-pressure fluids and gas to migrate into groundwater. This risk was not assessed and there is no mention of the presence of the abandoned well in the approvals documentation or the EMP.
- The DoW advice notes that groundwater monitoring would only be aimed at *"identification of the infiltration of chemical and hydrocarbon spills on the drill pad... It is not feasible for sampling of groundwater from the deeper basal portions of the Lesueur Aquifer"* Presumably this means there will be no groundwater monitoring for fracking chemicals, methane, or other derived or naturally released chemicals from the fracking zone.
- There is no publicly-available information on what groundwater monitoring will be undertaken, what contaminants will be tested for in groundwater, and where and when monitoring will occur.
- The results of groundwater monitoring will not be publicly reported and details of contamination events will not be made publicly available until 5 years after they occur. Members of Green Head and Leeman communities and other groundwater users could be exposed to pollution during that period without even knowing it.
- The proposal has not undergone rigorous environmental or health impact assessment. The Department of Water has relied on a superficial desktop groundwater study paid for by the proponent, and have not conducted any detailed or independent assessment of risks to the water resource.

We believe that there is a very high likelihood that surface and groundwater contamination from gas fracking at the Drover-1 Well site will contaminate the Leeman and Green Head town water supplies with methane and other toxic chemicals that are may be released with the gas, injected during fracking operations, or released into the surface environment during or after fracking operations.

Given the serious risk of pollution entering the Mt Peron Public Drinking Water Supply Area, the lack of investigation of this risk prior to approval for fracking operations, and the inadequacy or absence of an adequate regulatory regime to manage these risks, we believe that you must take urgent action to prevent pollution from occurring by issuing a Pollution Prevention Notice or Environmental Protection Notice under the *Environmental Protection Act*.

Risk of introduction of dieback into Mt. Lesueur National Park

In addition to the risk of water pollution, we also believe there is a significant risk of dieback being released into the Mt. Lesueur National Park as a consequence of an inadequate Environmental Management Plan and / or failure to comply with the EMP.

I attach a record of correspondence with the DMP in which we raise a number of issues regarding the management of dieback risk, including alleged non-compliance with the EMP on 14 July. We still have no indication of whether any action has or will be taken by the DMP or by the proponent to resolve this situation.

Clearly there is a serious risk of dieback entry into the National Park as a result of current drilling operations which must be rectified as a matter of the highest priority.

Once again, we call on you to take urgent action to prevent this environmental impact from occurring, by issuing an Environmental Protection Notice and / or Pollution Prevention Notice under the *Environmental Protection Act*.

Please advise us what action you will take to address this urgent request.

Yours Sincerely



Piers Verstegen
Director
Conservation Council of WA



Peter Robertson
Campaigner
The Wilderness Society WA

Att.

- 1 – The Imminent threat of drinking water contamination from gas fracking in the Lesueur Aquifer (summary of information)
- 2 – Dieback risk to Mt. Lesueur National Park – Record of correspondence with DMP

cc. Paul Vogel, Chair - Environmental Protection Authority

Attachment I and J

CCWA correspondence to DMP reporting alleged breaches of EMP and DMP response to CCWA (with annotated comments)

From: [REDACTED]
Sent: Thursday, 24 July 2014 9:48 AM
To: Piers Verstegen
Cc: [REDACTED]
Subject: FW: Urgent - Drover1 gas fracking well community inspection / compliance concerns

Piers

Thank you for your enquiry.

The DMP Environment Division has investigated the matter and inspected the Drover-01 well site on 22 July 2014.

With regards to the questions raised in your email on 14 July 2014, DMP provides the following responses:

1) Spread of Dieback

- During the DMP Environment Division's inspection of the Drover-01 well site, DMP observed that AWE's Bio-security Procedure was being implemented in accordance with the commitments outlined in the approved Drover-01 Exploration Well Environment Plan (EP).
- AWE have personnel stationed at the entrance of the access road to the Drover-01 well site who inspect all vehicles before they may proceed. When the DMP Environment Division inspected the Drover-01 well site, DMP's vehicle was subject to an inspection in accordance with AWE's Bio-security Procedure. The inspection applied the rigour that would be expected.
- AWE have provided a report to DMP confirming that an independent dieback expert approved the nearby pit from which the gravel for the well site and access track was excavated.

CCWA comment: please provide this report, where is the documentation for this 'expert approval' and what form does it take? Have test results been provided to the DMP?

DMP also made the following observations during the inspection of the Drover-01 well site:

- DMP observed that the access track leading to site was graded to fall away from the Lesueur National Park.

CCWA comment: This may be possible for the approach road but there are sections of the access track which are plainly not graded away from the park – they travel up-hill away from the park. This response is inadequate.

- DMP observed that an earthen bund was in place at the western edge of the well site.

CCWA comment: We acknowledge the presence of a bund but question its effectiveness. The bund does not extend the full width of the drill pad / approach road area especially on the Southern boundary and this is clear from the photographic evidence we provided. The bund also appears to be less than the 1.5m height requirement in the EMP as we suggested previously. This response is inadequate.

- DMP observed that the Drover-01 well site was situated approximately 400m from the boundary of the Lesueur National Park and that the likelihood of surface water run-off from the well site reaching the National Park was low.

CCWA comment: We believe that during a heavy rain event the likelihood of surface runoff entering the park from the Drill site and approach road is moderate to high. On what basis does the DMP make this claim? This response is lacking.

CCWA Comment: This response makes no reference to the requirement in the EMP for the Well pad to be graded away from the Park. I refer to previous concerns raised on 15 July 2014: "The other thing evident from the photographs is extensive erosion across the Western side of the drill pad. Clearly surface water is running off the well pad on the Western side. I cannot see how this would be occurring if the whole site was graded away from the park as required in the EMP. I think this needs to be investigated as soon as possible and before any further rain events." The response is inadequate

2) Community consultation

- AWE confirmed that community information sessions on the Drover-01 project were held in November 2013 in Leeman and further opportunities for comment were provided by the company in May 2014. Please see the attached letter and information flyer.

CCWA comment: The letter provided from AWE informing Green Hrad and Leeman Residents of the Drover-01 well is misleading. It does not mention that there will be fracking undertaken in the well, in fact it explicitly states that "This phase of the project will use conventional drilling methods" Clearly this is inadequate and misleading consultation by AWE. This response is inadequate.

- AWE have commitments to ongoing consultation in the Drover-01 EP and company contact details are provided in the EP summary.

3) Contamination clean up contingency plan

- AWE have an approved Oil Spill Contingency Plan for drilling activities that would be activated in the event of a spill.

CCWA comment: Can the DMP provide this please?

- The approved Drover-01 Exploration Well EP commits to implementing a program to recover any contaminated fluids in the event of well integrity failure in accordance with the recommendations made by the Environmental Protection Authority (EPA).

CCWA comment: What is this program? Can the DMP provide this please?

4) Inconsistencies between the EPA public advice and the summary EMP

- During the assessment of the Drover-01 EP, DMP consulted AWE and the Office of the EPA on the recommendations made by the EPA.
- AWE provided a response table to address all of the EPA's recommendations and included commitments to reflect their responses in the Drover-01 EP.
- DMP reviewed the information provided and determined that AWE had demonstrated that all potential impacts associated with the activity would be managed to as low as reasonably practicable (ALARP) in accordance with the requirements of the *Petroleum and Geothermal Energy Resources (Environment) Regulations 2012*.

CCWA comment: in this case what does ALARP mean in terms of environmental outcomes? I.e. what level of groundwater contamination is considered ALARP?

Regards

[REDACTED]

[REDACTED] | Director Operations | Operations, Environment

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] [REDACTED]

Sent: Monday, 21 July 2014 3:14 PM

To: Piers Verstegen

Cc: [REDACTED]

Subject: RE: Update - Urgent - Drover1 gas fracking well community inspection / compliance concerns

Piers

We are still investigating the matters you have raised and should be in a position to respond later this week.

Regards

[REDACTED]

[REDACTED]

Department of Mines and Petroleum

[REDACTED] [REDACTED]

[REDACTED]

From: Piers Verstegen [REDACTED]
Sent: Monday, 21 July 2014 3:11 PM
To: Piers Verstegen; [REDACTED]
Cc: [REDACTED]
Subject: RE: Update - Urgent - Drover1 gas fracking well community inspection / compliance concerns
Importance: High

Hi [REDACTED] and [REDACTED], Is there any update on this issue? Has there been any site visit or investigation by DMP or will there be?

I see there is more rain forecast for tomorrow and again on the weekend.

Could we have an update please?

Regards,

Piers.

From: Piers Verstegen
Sent: Tuesday, 15 July 2014 9:54 AM
To: [REDACTED]
Cc: [REDACTED]
Subject: Update - Urgent - Drover1 gas fracking well community inspection / compliance concerns
Importance: High

Hi [REDACTED] and [REDACTED]

I have now been able to properly examine the aerial photographs we obtained at the Drover1 Well site (some samples attached).

It appears that there is some sort of bund, not around the edge of the well pad but below it. It is not discernible whether the bund is 1.5 meters in height as required in the EMP. The bund also does not extend the full width of the site. I doubt whether this would be effective in 'managing surface water runoff away from the NP' as required in the EMP.

The photographs do confirm that there is a large section of access road draining directly towards to the park.

The other thing evident from the photographs is extensive erosion across the Western side of the drill pad. Clearly surface water is running off the well pad on the Western side. I cannot see how

this would be occurring if the whole site was graded away from the park as required in the EMP.
I think this needs to be investigated as soon as possible and before any further rain events.

Regards,

Piers.

Piers Verstegen
Director



[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
Sent: Monday, 14 July 2014 2:58 PM
To: Piers Verstegen
Cc: [REDACTED]
Subject: FW: Urgent - Drover1 gas fracking well community inspection / compliance concerns
Importance: High

Piers

As this falls within the operational area Phil has asked me to respond. We are currently reviewing your information/comments and will reply

[REDACTED]

Department of Mines and Petroleum

[REDACTED]
[REDACTED]

From: Piers Verstegen [REDACTED]
Sent: Monday, 14 July 2014 2:12 PM
To: [REDACTED]

Cc: [REDACTED]

Subject: Urgent - Drover1 gas fracking well community inspection / compliance concerns

Importance: High

Hi [REDACTED] et. al.

Sorry for the group email but I don't know who to refer this to in your compliance branch!

A number of people from various organisations took part in a field trip to the Mid-West on the weekend to do a community inspection of fracking activities.

One of the sites we visited was the Drover-1 well which is being drilled now. We accessed this site via the Mt. Leseur National Park and remained within the boundary of the park at all times.

We have some matters that we would like to follow up with the DMP compliance branch or whoever is responsible for these matters.

1) **Spread of Dieback**

we are very concerned about the potential for activities to spread dieback in to the park as the well is located on higher ground and surface water flow would bring dieback directly into the park.

From our inspection it appeared that a number of the requirements of the EMP on surface water management and hygiene were not being met.

Given that rains are forecast for the end of the week in that area, we request that the DMP require drilling operations on the site to be halted until the following matters are investigated and dealt with. Can you urgently advise what measures will be made to investigate this situation and what compliance action will be taken by the DMP?

Inspection and wash down of all vehicles and equipment prior entering site is accordance with Drover-01 Bio-security procedure [HSE-PR-050].

We witnessed a number of vehicles coming and going from the site including a very dirty dusty semi-trailer and we saw no evidence that washdown was occurring.

- Drover-01 site graded to fall away from Lesueur National Park, surface water run off contained within site.

Could not verify this from the park boundary.

- Site infrastructure: Access Road, Hygiene Station, Camp and Well Site are graded to fall away from Lesueur National Park.

There does not appear to be grading on the access road away from the park and a section of the access road runs uphill away from the park boundary and would drain directly towards the park.

- 1.5m bund wall established along western boundary of the Well Site to

manage surface water run off away from National Park.

This is definitely not present. We were able to see the full height of dongas and site offices from the Eastern Boundary of the park. Clearly there is no 1.5M bund as required on the Western Edge of the drill site. We note that the public advice from the EPA on the project recommends that the entire site is bunded. **Can you advise why this is not picked up in the EMP?**

- Imported materials (proppant, road and well pad base) will be declared 'dieback free'.

Can you confirm, has DMP verified that this is being complied with, what evidence of such declaration have you received and can you provide the certification material?

2) Community consultation.

We were told by the drilling contractors that community consultation had occurred via meetings with residents of Green Head and Dongara. We understand meetings were held recently by AWE in Dongara to discuss other (conventional) wells (refer invitation attached). We understand from locals who attended this session that the AWE staff did not want to discuss the Drover well.

Can you confirm what community consultation is / was required by AWE for the Drover drilling site? What community consultation has been undertaken and what evidence does the DMP have to verify the claims that community consultation has been undertaken for Drover-1? Can you provide this information to us please?

3) Contamination clean up contingency plan

The EPA's public advice says:

The DMP has further advised that a contingency plan for the clean-up of contamination in the event of well leakage has yet to be submitted as part of the Environment Plan (EP). The DMP has requested that this be addressed in a revised version of the EP and will not provide approval until the DMP is satisfied that an adequate contingency plan is in place.

Presumably this document has been approved by the DMP however the summary EMP does not appear to include this document. Can you release it please? Was this provided to the EPA?

4) Inconsistencies between the EPA public advice and the summary EMP

As we look into this we have found examples where the prescriptions in the EMP do not match up to the recommendations made by the EPA in their public advice. Perhaps a number of EPA recommendations are picked up elsewhere.

Can you send us a comprehensive document or spreadsheet indicating where each of the EPA's recommendations are covered by the EMP or other regulatory instruments? If the final conditions differ from the EPA recommendations can you advise why?

Thanks for your prompt response on these issues.

Regards,

Piers.



Piers Verstegen
Director



[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

30 May 2014

Green Head and Leeman Residents

Dear Resident

AWE Limited - Project Update: Drover Exploration Well

I am writing to provide an update on AWE Limited's exploration well in the Shire of Coorow and to supplement the information we provided at our community information session held in Leeman last November. Feedback from the information session showed general community support for our commitment to providing project updates at key stages of the project such as this.

The Drover exploration site is located on cleared pastoral land 18 kilometres southeast of the Green Head township. It is part of AWE's exploration program assessing shale gas and tight gas potential in the Perth Basin. We expect the drilling rig to arrive shortly and drilling to begin by July 2014 rather than in April as originally scheduled. This phase of the project will use conventional drilling methods and will take four to six weeks to complete.

AWE aims for open and ongoing dialogue with people in Mid-West communities and beyond about our activities in the area. In particular, we are keen to keep you informed of the Drover exploration well progress and to ensure that any questions you may have are satisfactorily answered.

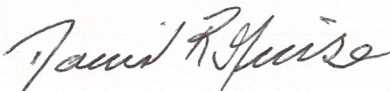
Information about the Drover Exploration Well program is available from our website at www.awexplore.com/irm/content/project_drover.html and information about the tight shale and gas sector is provided by the Department of Mines and Petroleum at www.dmp.wa.gov.au. The information is also available at the Shire of Coorow office in Leeman.

Alternatively, please feel free to contact us if you would like to discuss this or any other AWE project in the Mid-West. Our contact details are:

- [REDACTED]
- [REDACTED]

If you prefer not to receive future updates, please let us know and your address will be removed from the distribution list.

Yours sincerely

[REDACTED]
Regional Manager - WA

Attachment M

Motions passed unanimously at August 2014 Coorow Shire Council meeting, Leeman, Western Australia (Excerpt)

OFFICER RECOMMENDATION

That Council:-

1. publicly supports the request from Green Head and Leeman residents for the fracking at Drover-1 to be put on hold pending a thorough independent investigation of the risks to the Mount Peron aquifer and bore field
2. does not support any further gas fracking within the Shire of Coorow (including exploration fracking) without full environmental impact assessment by the EPA, including assessment of impacts to surface and groundwater resources
3. does not support any further gas fracking within the Shire of Coorow (including exploration fracking) without;
 - a. Health impact assessment (as called for by the Department of Health); and
 - b. Assessment of cumulative impacts on agricultural land (as called for by the WA Farmers Federation (WAFF))

RESOLUTION:

2014/

Moved: Cr

Seconded: Cr

**CARRIED /
Simple Majority**

Honourable Dr Kim D Hames MLA
Deputy Premier; Minister for Health

Honourable Mia J. Davies MLA
Minister for Water

cc.
Mr Shane Love MLA
Member for Moore

30 July 2014

Dear Ministers

URGENT

Request for intervention to protect town water supply from contamination risk due to imminent gas fracking

We the undersigned residents of Green Head and Leeman communities are deeply concerned about the potential for gas fracking activity at the Drover1 fracking site to cause irreversible contamination of the water supplies that provide drinking water to our communities.

We understand that fracking will begin at the site within weeks.

We are writing to seek your urgent intervention in this matter to require fracking activities to be suspended pending a full public assessment of these risks before fracking occurs.

From our investigations to date (including examination of documents released via Freedom of Information) we have identified a number of extremely concerning matters that must be addressed as an absolute matter of priority so that the drinking water can be adequately protected.

- The Drover-1 fracking well is in close proximity to the Mt Peron Bore-field and Priority1 Drinking Water Source Area which supplies the towns of Leeman and Green Head. The fracking well is located within the catchment and recharge area for the bore-field and the prevailing surface and groundwater flows are towards the bore field from the fracking site.
- The groundwater monitoring is only designed to detect spills or pollution incidents at the surface and will not detect contamination arising well casing failure within the aquifer or contamination migrating from the fracking zone. Groundwater monitoring results will not be publicly reported and details of contamination events will not be made publicly available until 5 years after they occur. Our community could be exposed to pollution during that period without even knowing it.
- The fracking activity is exempt from the normal pollution control licensing regime that is applied to other industrial activities under Part V of the *Environmental Protection Act*.
- The proposal has not undergone environmental or health impact assessment. The Department of Water have relied on a superficial desktop groundwater study paid for by the gas company, and have not conducted any detailed assessment of risks to the water resource.
- There is a vertical separation distance between the base of the aquifers and the Fracking zone of only 700 metres. The fracking zone is at 1600m depth. The connected Lesueur Aquifer and Woodada Formation (minor aquifer) extend to 900m depth.
- The potentially highly fractured Kockatea Shale separates the base of the aquifer from the fracking zone. The proponents groundwater study notes that "*The hydraulic properties along faults in the area are difficult to assess without specific investigations which have not been undertaken ... Faults that cut the strata are potential conduits for vertical movement of fluids.*"
- Department of Water documents note that: "*Methane leakage arising from a poorly constructed well or well failure is hard to assess. Regulators must be reliant upon the information provided to them by the operators. It is suspected that adverse findings would not be reported as these may have negative effects on the ongoing viability of the project.*"
- The Drover-1 well is being drilled at or very near to the site of an abandoned conventional gas well drilled in the 1990's (Gairdner-1). The presence of this abandoned, corroding well very near to the Drover-1 well presents a significant potential contamination pathway for high-pressure fluids and gas to migrate into groundwater. This risk was not assessed and there is no mention of the presence of the abandoned well in any documentation.

Given the above, we do not believe that the Department of Water, Environmental Protection Authority or Department of Health have adequately fulfilled their duty of care to our community. Similarly we do not have confidence that the regulations administered by the Department of Mines and Petroleum will protect our drinking water from contamination arising from the fracking operations.

The most recent comprehensive study of well failure and leakage rates in onshore gas development in the Journal of Marine and Petroleum Geology has found 'well barrier or integrity failure' rates of up to 75%. The report documents failure in 6.7% of wells in the Marcellus Shale in Pennsylvania between 2005 and 2013.

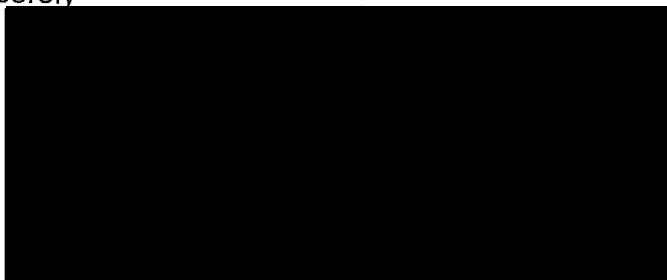
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In summary, we believe that there is a very high likelihood that surface and groundwater Contamination from gas fracking at the Drover-1 Well site will contaminate the Leeman and Green Head town water supplies with methane and other toxic chemicals that may be released with the gas or injected during fracking operations.

We seek your immediate intervention to ensure that the health of our communities is not compromised by pollution resulting from gas fracking in our drinking water catchment. We request that you use any powers you have which would enable you to intervene to stop fracking operations until a full detailed public assessment of the risks has been undertaken. We request that you do so as a matter of the highest urgency.

Please advise us what action you will take to address this urgent request.

Yours Sincerely



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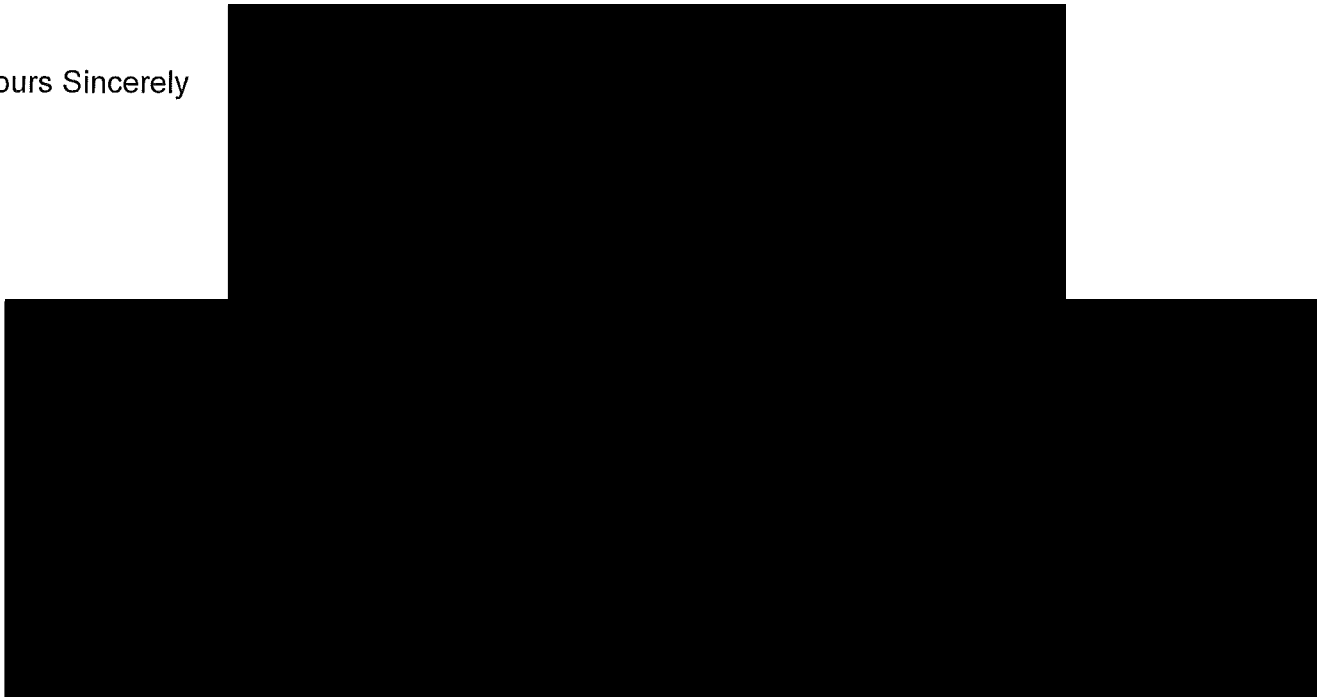
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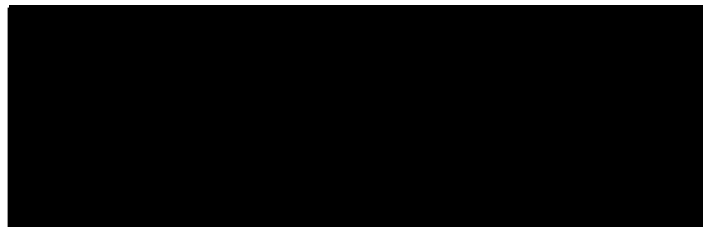
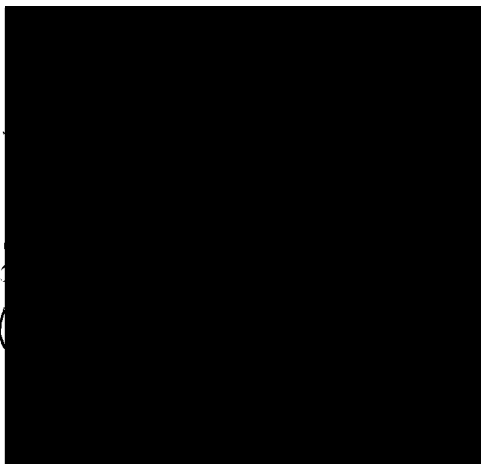
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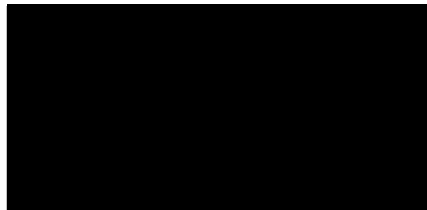
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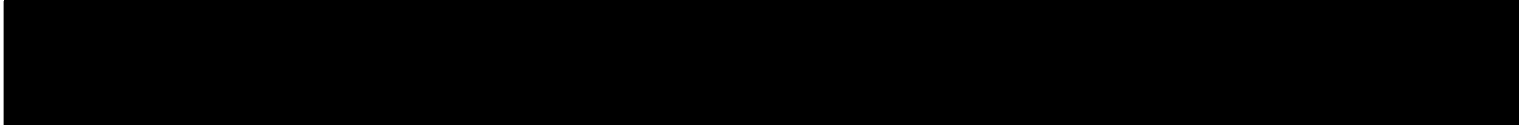
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Honourable Dr Kim D Hames MLA
Minister for Health

Honourable Mia J. Davies MLA
Minister for Water

13th Floor, Dumas House
[REDACTED]

CC Mr Shane Love MLA

July 2014

Dear Ministers

URGENT Request for intervention to protect town water supply from contamination risk due to imminent gas fracking

We the undersigned residents of Green Head and Leeman communities are deeply concerned about the potential for gas fracking activity at the Drover1 fracking site to cause irreversible contamination of the water supplies that provide drinking water to our communities.

We understand that fracking will begin at the site within weeks.

We are writing to seek your urgent intervention in this matter to require fracking activities to be suspended pending a full public assessment of these risks **before fracking occurs.**

From our own investigations to date we have identified that:

- The Drover-1 fracking well is in close proximity to the Mt Peron Bore-field and Priority1 Drinking Water Source Area which supplies the towns of Leeman and Green Head. Prevailing Surface and groundwater flows are towards the bore field from the fracking site.
- There is a very high risk of surface and groundwater contamination from well failure or leakage in the groundwater zone as well as chemical and wastewater storage and management in the surface. There is also a risk of contamination from the fracking zone (1600m depth) to the aquifer (to 600m depth), including via the Beagle fault.
- The results of groundwater monitoring around the fracking well (if this is done) will not be publicly reported and details of contamination events will not be made publicly available until 5 years after they occur. Our community could be exposed to pollution during that period without even knowing it.

- The fracking activity is exempt from the normal pollution control regulations that apply to other industrial activities under Part V of the Environmental Protection Act.
- The proposal has not undergone environmental or health impact assessment. The Department of Water have relied on a superficial desktop groundwater study paid for by the gas company, and have not conducted any detailed assessment of risks to the water resource.

In summary, we believe that there is a very high likelihood that surface and groundwater contamination from gas fracking at the Drover-1 Well site will contaminate the Leeman and Green Head town water supplies with methane and other toxic chemicals that are may be released with the gas or injected during fracking operations.

We believe the risks have not been adequately examined or assessed by the Department of Water or other regulators and we seek your immediate intervention to ensure that the health of our communities is not compromised by pollution resulting from gas fracking in our drinking water catchment.

We are aware that powers exist under the *Country Areas Water Supply Act 1947* and the *Health Act 1911* which would enable you to intervene to stop fracking operations and we request that you do so as a matter of the highest urgency.

Clearly this situation deserves a full detailed public assessment of the risks associated with this fracking activity and we ask that you use your powers to require such an assessment before fracking proceeds at the Drover-1 well.

Please advise us what action you will take to address this urgent request.

Yours Sincerely,



