Our Water Future
Discussion Paper
June 2015

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SUMMARY

APPEA welcomes the release of the *Our Water Future Discussion Paper* and the commencement of a structured, consultative process about water policy and regulation in the Northern Territory (NT).

The prospects for the further development of the onshore oil and gas industry in the NT has focused some attention on the protection of groundwater, and the water use requirements during exploration and development. The 2014 report of the NT Inquiry into Hydraulic Fracturing, by Dr Alan Hawke, has provided a solid foundation for a discussion of the issues and the operational and regulatory approaches required to ensure water is managed responsibly.

The Hawke report estimated that if current shale gas exploration is successful and yields a scale of activity similar to that now occurring in the Cooper Basin (one of Australia's oldest and most productive gas hubs) water usage could increase to 1.5-2.4 gigalitres a year. That would be equivalent to 1-2 per cent of current water use in the NT. Water recycling and the use of non-potable water from deeper aquifers not suitable for human or stock consumption or horticulture would mean less use of potable water by industry and less competition with other water uses. Water requirements for current exploration activities remain one-off and very small compared to licences allocated for horticulture or other purposes.

In addition, after an extensive independent review of scientific literature from around the world, the Hawke Inquiry concluded that under a robust regulatory regime, the environmental risks for groundwater associated with hydraulic fracturing can be managed effectively.

Water usage by the petroleum industry in the NT is currently regulated under petroleum legislation in a broadly equivalent way to that which would apply under the water legislation (from which these activities are exempt). APPEA sees importance in maintaining a single regulatory process for the industry during a period of significant reform. It would support removal of the exemption from the provisions of the Water Act as recommended by Hawke provided administrative arrangements allow for a one-stop-shop model for operators.

The oil and gas industry would also welcome the opportunity to work with the Departments of Mines and Energy and Land Resources Management to further develop information sharing systems so that data about water resources and water usage can be easily included in a centralised database easily accessed by industry and the community.

As noted above, and in the discussion paper, the Hawke report is a very comprehensive and authoritative document in relation to water usage and water management by the oil and gas industry and more broadly in the NT. It will be important that the review of water policies and regulation commenced through the release of this discussion paper remains well coordinated with its the recommendations and findings.

ABOUT APPEA

APPEA is the peak national body representing Australia's oil and gas exploration and production industry. The organisation has more than 85 full member companies exploring for and producing Australia's oil and gas resources. These companies currently account for around 98 per cent of Australia's total oil and gas production and the vast majority of exploration. APPEA also represents over 230 associate member companies providing a wide range of goods and services to the industry.

Almost one quarter of APPEA's full member companies have petroleum interests in the offshore and onshore areas of the NT. Twelve of these have offshore interests, seven are operating onshore while four have a mix of offshore and onshore interests. APPEA members account for most of the exploration activity currently occurring within granted onshore exploration permits.

ONSHORE OIL AND GAS IN THE NT

The NT has been producing oil and gas for more than 30 years and most of the electricity used by households and industry in the Top End (including Darwin, Pine Creek and Katherine) and Alice Springs is generated from gas.

Oil and gas has been produced from the Mereenie and Palm Valley fields near Alice Springs since the early 1980s. For many years these fields supplied Top End electricity generators until the commissioning of the Blacktip project in waters offshore from Wadeye in 2009.

Over the past two years two other projects in the Amadeus Basin have been developed - the Dingo gas field (supplying gas for power generation in Alice Springs) and the Surprise oil project.

These projects would not have been possible without an active exploration industry dating back to the 1960s.

Further exploration and development of the NT's onshore oil and gas resources, including those contained in shale and tight formations, would improve the NT's long-term energy security and provide a reliable source of energy and gas feedstock for new industrial development. The potential supply of gas to other markets in the eastern states or overseas would help reduce the growth in Australian and global greenhouse gas emissions and help to improve air quality and living standards in trading partners to our North. Experience elsewhere has shown that increased oil and gas development can create new employment and business opportunities for regional areas and Indigenous communities and greater royalty receipts for the NT Government.

The onshore gas industry could therefore become a major new source of economic growth for the NT. Exploration is currently seeking to prove up gas reserves from conventional underground reservoirs as well as from deeper shale rocks. The NT is believed to contain large shale gas resources although much more work is needed to ascertain the size of these resources and extent to which they can be economically recovered. The main areas of interest are the McArthur Basin and Beetaloo Sub-basin lying between Katherine and Elliott, the Amadeus Basin (west of Alice Springs) and the Georgina Basin (north east of Alice Springs).

Petroleum activities in the NT are current subject to significant reforms arising from the Hawke report which is ensuring robust and best practice operational and regulatory approaches. As noted previously, it will be important that the review of water policies and regulation commenced through the release of this discussion paper remains well coordinated with the Hawke Inquiry recommendations and findings.

Attachment 1 at the end of this submission illustrates the location of key petroleum basins and petroleum wells drilled in the NT to date.

WATER PROTECTION AND USAGE

Water Protection

The oil and gas sector is committed to ensuring that its impacts on the environment are minimised. To ensure the adequate protection of groundwater it is common practice that operators use a number of risk mitigation measures, including robust well construction, safe handling and use of chemicals and extensive environmental monitoring.

The Hawke report provides a comprehensive summary of well construction processes and the international research around well integrity at Section 5.2, while sections 5.4 and 5.5 focus on the use and management of chemicals used in hydraulic fracturing and flowback water.

Petroleum companies construct wells to the highest standards to ensure that oil and gas is kept within the well and water is kept out. These wells are also maintained throughout their operational life to ensure that they remain safe and efficient.

Ensuring that well integrity is maintained throughout the life of operations is critical to safety and the protection of the environment and to achieve this, similar to performing a service on a car, wells are routinely inspected and subjected to maintenance. The industry is also committed to monitoring and fixing any wells that are not functioning to the standards required.

The common conclusion reached by many studies is that oil and gas wells have very low leakage rates (for example, one estimate of 0.005% to 0.01%[1] for wells currently in service, with lower frequencies in more recent developments) and that with good practice and strong regulation, monitoring should ensure that leaks are quickly detected and remedied.

The United States Environmental Protection Agency (EPA) recently released the most comprehensive review of hydraulic fracturing impacts on groundwater ever undertaken.[2] The EPA found that there are pathways (or mechanisms) which can impact ground water, however the report notes that the authors "did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources in the United States."

The CSIRO has identified one of the key risks of shale gas developments to be spills of fluids at surface or leaks of produced water, two areas which the industry focusses on for risk mitigation.[3] The chemicals used in hydraulic fracturing are found in many food products and common household items. They include guar gum used in ice cream, table salt, disinfectants, detergents and corrosion and scale inhibitors – all of which are used in very low concentrations. Many of these chemicals break down during the fracturing process or are held within the rock strata. For

[1] G. E. King & D. E. King, 'Environmental Risk Arising From Well-Construction Failure – Differences Between Barrier and Well Failure and Estimates of Failure Frequency Across Common Well Types, Locations, and Well Age', Society of Petroleum Engineers, http://shale.palwv.org/wp-content/uploads/2014/02/SPE-166142-PA-P2-copy.pdf, P. 2 [Accessed 2/2/2014]. P. 18.
[2] US EPA 'Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources'.
[3] http://www.csiro.au/news/transcripts/YouTubeTranscripts/2014/Oct/Unearthing-shale-gas.html

example, acid is spent within a short distance of the entry point and does not return as acid to the surface; biocides are spent and degrade; surfactants and corrosion inhibitors absorb on rock or steel surfaces.[4]

Chemical handling management systems are required in many industrial processes, including mining and petroleum activities, and controls are applied through well-developed regulation and guidelines.

The Hawke Inquiry found that:

> *"chemicals used during hydraulic fracturing generally pose a low environmental risk, providing that leading practice is applied to minimising surface spills and managing flowback water after fracturing".*[5]

Water Use

For the past 50 years petroleum exploration in the NT has been a relatively small user of water and this will continue to be the case for the foreseeable future.

Industry operating practices and principles commonly identify the minimisation of water use and protection of water quality as priorities which are fundamental to our operations.

Hydraulic fracturing has been used in the NT's oil and gas industry since the 1970s and in other Australian jurisdictions since the 1960s. Since that time around 1500 wells in South Australia, Western Australia and the NT have been hydraulically fractured with no adverse effects on water aquifers[6] . This includes the fracture of more than 30 wells in the Amadeus Basin in the NT.

Water usage will increase as exploration activity increases. Water is required during drilling of a well (typically 1 ML) and during hydraulic fracturing. Section 5.3 of the Hawke report includes a detailed discussion of water usage during hydraulic fracturing in Australia and overseas. The report states that a commonly quoted average requirement is 15 ML per hydraulically fractured well with usage varying between 5 and 24 ML per well depending on the length of the well, type of well (vertical only or vertical/horizontal), number of fracture stages and local conditions.

It is also important to bear in mind that water requirements for the development of a well are a one off event and not repeated annually. Once a well is completed and producing there are no further water requirements unless after a period of years it needs to be re-fractured to re-stimulate gas flow.

While water use at a local level may be significant and require careful management, Hawke points out that:

> *"the projected water requirements for fracturing are small relative to total water availability at NT or regional scales."*[7]

Over the next 7-10 years Hawke estimates that water requirements for drilling and hydraulic fracturing could average 150-240 ML a year (assuming an average of 10 long horizontal wells a year). In the longer term, if exploration is successful and yields a scale of activity similar to that

[4] P. 113 Of the Hawke Report
[5] P. 117
[6] See for example, "*DMP sets the record straight for shale and tight gas*", http://www.dmp.wa.gov.au/7105_17715.aspx
[7] P. 106

now occurring in the Cooper Basin (up to 100 wells a year), water usage for fracturing could increase to 1.5-2.4 GL a year. This is unlikely to occur quickly as it has taken 50 years or more for the Cooper Basin gas fields to grow to these levels.

Around 10 vertical wells were hydraulically fractured in 2014. This was a significant increase over previous years and mostly attributable to one exploration program in the Georgina Basin and the appraisal program on the Mereenie field. However, those programs have been completed so the number of wells being fractured this year is expected to be substantially lower.

Hawke's estimates also do not take account of the water savings that are achievable from the recovery and reuse of up to 70 per cent of the water used in each fracturing stage. Nor do they consider the ability to use non-potable water in many fracturing operations. These factors significantly reduce the extent to which oil and gas exploration competes with other industry and communities for potable water.

Even without considering these factors, Hawke concludes that water usage by the oil and gas industry would be small compared to other industry sectors and individual licence holders:

> *"The projection of 1.5-2.4 GL/ year of total ground water extraction for fracturing activity for the entire NT falls within the range of maximum water entitlements recently granted to individual properties or enterprises in the Daly/Roper water Control District".* [8]

In May 2015 the Government allocated almost 34 GL to 71 licence holders in the Katherine region (an average of 0.5 GL per licence holder). In 2013 one licence holder received an allocation of 5.8 GL a year for ten years. In 2011-12 the agriculture, mining and manufacturing sectors in the NT consumed 102 GL of water.

The following sections provide specific comments on the strategic policy priorities, vision, guiding principles, goals and objectives outlined in the discussion paper.

[8] ibid

STRATEGIC POLICY PRIORITIES

Table 1: APPEA Comments on Strategic Policy Priorities

Priority	Topic	APPEA Comments
1	Competing demands for water	APPEA supports the use of a science-based approach to water allocation planning. Security of water supplies for the development of the petroleum and other sectors is critical. Tailoring sources and water quality to specific needs could help reduce competition for the same resources. As noted above, the petroleum industry can, in some instances, make use of water that is not potable or suitable for stock use (due to high salinity or the presence of other chemicals). Research is also being undertaken into waterless fracturing using gels and carbon dioxide or nitrogen foams.
2	Water stewardship	APPEA supports the longer term action of working with key sectors, including petroleum, to improve water conservation, efficiency and productivity. To some extent this is already occurring through measures referred to above, including the recycling of flowback water from hydraulic fracturing, and use of non-potable water.
3	Build strategic water knowledge, research and innovation	Further research into the NT's groundwater resources is essential if the NT is to attract new industries and take a leading role in the development of Australia's north. The vertical drilling of wells by the onshore petroleum industries yields important information about the size and quality of previously known and unknown aquifers. Further collaboration as envisaged by the sixth near term action (page 14), could yield significant benefits through, for example, improvements to the processes for sharing information about resources and the results of aquifer monitoring programs.
4	Assessment and monitoring of water resources	APPEA supports the near term action for periodic reporting of water use by the petroleum sector. This is already occurring to a degree with some water use in petroleum activities being reported to the DME. There is benefit in industry working with government agencies to review and improve current data collection methods so that information about the industry's water usage can be included in a centralised database which can be readily accessed by the community and industry.
5	Resilient water supplies and sanitation	The oil and gas industry recognises the fundamental importance of ensuring that urban centres and remote communities have access to safe, secure and sufficient supplies of drinking water. Above and below ground sources used to supply drinking water must be carefully managed so as to maintain high standards of water quality. APPEA supports the protection of water resources based on a risk management approach, including one which takes into account the opportunity for impacts on environmental factors to be mitigated. As pointed out by the Hawke report the risk to aquifers from petroleum exploration activities is very low and there have been no confirmed cases in the NT (or anywhere else in the world) of adverse impacts on aquifers due to hydraulic fracturing. The industry in Australia and around the world has been successfully drilling through water aquifers (including the Great Artesian Basin in the Cooper Basin and the Mereenie aquifer supplying Alice Springs) for many decades. The technology and drilling practices to enable this to occur, without affecting water aquifers, has been continuously refined throughout that period.

VISION, GUIDING PRINCIPLES, GOALS AND OBJECTIVES

APPEA supports the Vision, Guiding Principles, Goals and Objectives outlined in the discussion paper as providing a solid framework for water policy development and regulation. They are clear, concise and comprehensive and give due recognition to the differing interests and demands on the NT's water resources.

The Vision states this very succinctly:

> *"sustainably managing our water resources to meet the competing demands of a healthy environment, a growing population and a prosperous economy."*

The paper is focussed on water that is potable and has a beneficial use. We note in this regard that the onshore gas industry has the ability to use non-potable water, for example in hydraulic fracturing operations. The potentially greater resource base and lower competition for non-potable water compared to potable water resources should also remain in focus in developing the proposed framework. The Pangaea Resources case study to the right is a good example of this.

Case Study – Pangaea Resources

Pangaea Resources, an operator in the Roper Basin, has been working closely with pastoralists and regulatory agencies in the use and management of local water resources. Before embarking on its seismic and drilling operations, Pangaea and the pastoralists on its permits negotiated voluntary land access and compensation agreements which included the use of potable water from water bores for camp use and drilling mud-mix. Standards for water bore monitoring, analysis and reporting associated with the drilling and assessment phase of the operations were agreed with the Departments of Mines and Energy and Land Resources Management (Water Directorate). The conversion of decommissioned wells into water bores for future use by pastoralists is also being considered.

During the drilling of two wells, Pangaea encountered a potentially large volume, brackish aquifer system located 50-350 meters below the potable aquifers in the region. This system is not present everywhere, but generated significant flow rates and could potentially yield large volumes of producible water. This potential alternative source of water for future drilling and fracture stimulation operations is separated from the potable aquifer system by a layer of impermeable basalt found across Pangaea's tenements.

APPEA makes the following specific comments in relation to the ten guiding principles:

Principle 2 – Sustainable management of water resources for the benefit of Territorians

Principle 2 recognises the importance of ensuring that water resources are managed on a sustainable basis. Table 1 refers to provisions in the *Water Act* and industry-specific legislation for mining and petroleum activities. At present, water consumption by the mining and petroleum industries is exempt from the *Water Act* as it is managed through the relevant mining and petroleum legislation administered by the Department of Mines and Energy (DME). DME's requirements are more extensive than those applying under the *Water Act*.

However, APPEA supports the removal of the exemption in consultation with industry. This will need to be accompanied by the development of an administrative process that meets the requirements of the *Water Act* and *Petroleum Act*, while avoiding regulatory duplication.

This would be consistent with the Hawke report findings (page 110) that:

- water allocation to gas extraction activities is probably best done under the *Water Act*, and where possible within the context of regional water allocation plans; and
- administrative arrangements should allow for a one-stop-shop model for operators should the *Water Act* apply to petroleum activities.

Principle 3 – Economic growth

The acknowledgement of water as a resource that is fundamental to economic growth is also welcomed. Oil and gas exploration and development activity are high value adding activities in terms of benefits received per ML of water usage. Expenditure on onshore petroleum exploration from 2009-10 to 2013-14 totalled $281 million including almost $140 million in 2013-14. Work value programs over the next five years (2014-15 to 2018-19) are expected to total $389 million[9]. The construction and operation of shale gas projects would deliver large, long term economic benefits to the NT, including the creation of new employment and business opportunities, infrastructure development, royalties paid to the NT Government and benefits for pastoralists and Indigenous communities.

Principles 9 and 10 – Drinking water and sanitation

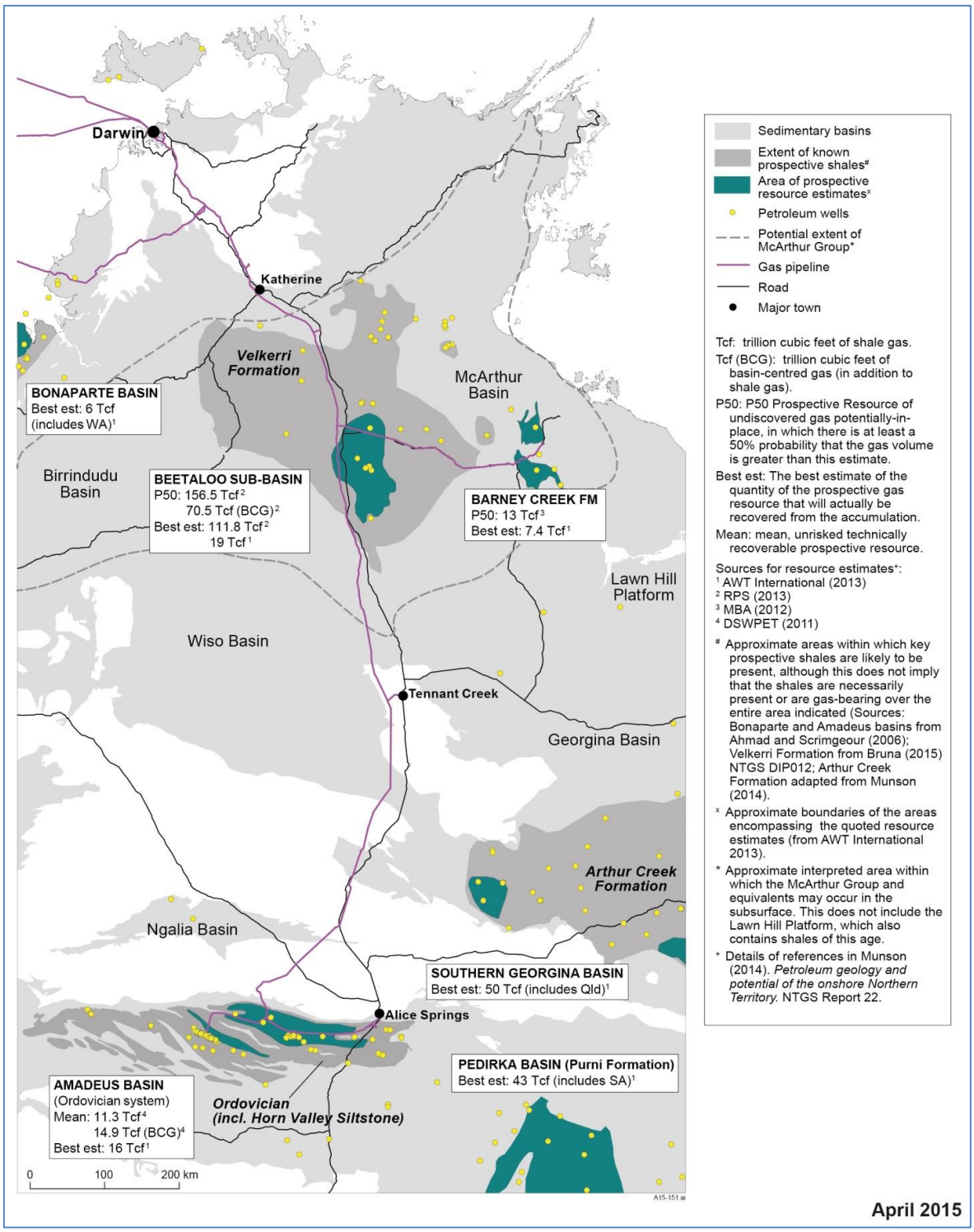
As noted above, the Hawke report (Section 5.2) provides a comprehensive summary of well construction processes and the international research around well integrity, while sections 5.4 and 5.5 focus on the use and management of chemicals used in hydraulic fracturing and flowback water.

Operators have in place standards relating to well design, well construction, well integrity management and well abandonment that adhere to practices published by organisations such as the American Petroleum Institute, who are recognised as world leaders in standards development for petroleum activities. These commonly meet or exceed expectations of the regulator and are subject to review and audit.

For a well to pollute, a leak must be able to extend from the innermost casing through to the external environment, with any barrier that interrupts this flow being an effective barrier.[10] The design, construction and completion of a well to the highest standards is therefore recognised as one of the most important ways of ensuring that the environment is protected throughout operations.

[9] See http://www.nt.gov.au/d/Minerals_Energy/Geoscience/Content/File/Docs/AGES2015/Presentations/AGES2015_Jackson.pdf
[10] G. E. King & D. E. King, 'Environmental Risk Arising From Well-Construction Failure – Differences Between Barrier and Well Failure and Estimates of Failure Frequency Across Common Well Types, Locations, and Well Age', Society of Petroleum Engineers (2013), http://shale.palwv.org/wp-content/uploads/2014/02/SPE-166142-PA-P2-copy.pdf, P. 2 [Accessed 2/2/2014].

Attachment 1: Shale Gas Resources and Potential



Source: NT Geological Survey