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The Hon Justice Rachel Pepper
Chair
Scientific Inquiry into Hydraulic Fracturing in the Northern Territory
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Email: fracking.inquiry@nt.gov.au

Dear Justice Pepper

On 2 August 2017 you requested additional information with respect to Geoscience Australia's submission to the *Scientific Inquiry into Hydraulic Fracturing of Unconventional Reservoirs in the Northern Territory*. The additional information related to future developments and groundwater studies.

Please find attached Geoscience Australia's response to the Information Request.

Yours sincerely

Dr Andrew Heap
A/g Chief
Resources Division

16 August 2017

Australian Government
Geoscience Australia

Geoscience Australia response to an Information Request from the

Scientific Inquiry into Hydraulic Fracturing in the Northern Territory

August 2017

1 Introduction

Geoscience Australia received an Information Request dated 2 August 2017 from the *Scientific Inquiry into Hydraulic Fracturing of Unconventional Reservoirs in the Northern Territory* (the Inquiry) related to its submission.

The Inquiry has requested responses relating to future development and groundwater studies, which are outlined below.

2 Future development

In its submission, GA mapped the various basins in the Northern Territory and provided the following statement with respect to the prospectivity of each basin:

"The Amadeus Basin was assessed to have high prospectivity with high confidence. The McArthur and Georgina basins were assessed to have moderate prospectivity with high confidence. The remaining Northern Territory basins were assessed to have lower prospectivity, lower confidence, or both."

Please comment on the likelihood and timeframe for development of each basin, as well as the limitations involved in making an assessment of this kind.

The Amadeus Basin is the only onshore basin in the Northern Territory with identified **reserves**[1] and existing petroleum production infrastructure. Any new petroleum discovery made in this basin has the potential to take advantage of pre-existing infrastructure to provide a quick path to commercialisation. As seen with discoveries in areas such as the Cooper Basin, any new gas discoveries could technically be brought on stream within 12 months (not taking into account any regulatory matters to be resolved).

In the Beetaloo Sub-basin (a sub-basin of the McArthur Basin) Origin Energy highlighted the potential of the basin with the company declaring a **contingent resource**[2] of 6.6 tcf in its media release of 15 February 2017[3]. The classification as a **contingent resource** clearly signifies that the company is not satisfied that the resource is currently commercial, and that more assessment of the resource is required prior to it being made a **reserve**, or that some other barriers to commercialisation need to be overcome. Given the current moratorium on hydraulic fracturing of onshore unconventional reservoirs in the Northern Territory, this is enough of a barrier to commercialisation to prevent the resource being declared a reserve, let alone other potential factors.

If the moratorium on hydraulic fracturing was removed, the resource identified by Origin Energy would still require additional work prior to being reclassified as a **reserve**. This work would include additional drilling and reservoir modelling to understand the extent and nature of the resource, and would require at least another 12 months' work, possibly more.

The decision to move to production in a basin without pre-existing infrastructure is a well-understood assessment process involving significant investment decisions and regulatory compliance hurdles. It is difficult to see production from the Beetaloo Sub-basin in less than three years.

[1] "Reserves represent that part of resources which are commercially recoverable and have been justified for development, while contingent and prospective resources are less certain because some significant commercial or technical hurdle must be overcome prior to there being confidence in the eventual production of the volumes." (http://www.spe.org/industry/docs/PRMS_guide_non_tech.pdf)

[2] "Contingent resources are less certain than reserves. These are resources that are potentially recoverable but not yet considered mature enough for commercial development due to technological or business hurdles." (http://www.spe.org/industry/docs/PRMS_guide_non_tech.pdf)

[3] https://www.originenergy.com.au/about/investors-media/media-centre/beetaloo-basin-drilling-results-indicate-material-gas-resource.html

Petroleum was first noted in the Georgina Basin in 1910 when petroliferous odours were recorded during the drilling of water bores. Over 70 wells (petroleum and stratigraphic) have been drilled in the basin but no resources have been identified. There remains a great deal of uncertainty about the ability of the rocks within the basin to generate and host significant volumes of hydrocarbons. In this respect the Georgina Basin lags behind the Beetaloo Sub-basin, so any discovery made today would almost certainly be more than three years from commercialisation, and potentially more than a decade.

All other basins in the Northern Territory would be in a similar situation to the Georgina Basin.

3 Groundwater Studies

GA submitted that groundwater studies are being undertaken:

a) in the Southern Stuart Corridor between Alice Springs and Tennant Creek; and

b) in the Northern Stuart Corridor around Daly Waters.

Please advise when these studies will be completed. Please also advise whether the studies will estimate the aquifer volumes, quality and recharge rates.

As part of Geoscience Australia's Exploring for the Future Programme (www.ga.gov.au/about/projects/priority-projects/exploring-for-the-future), regional groundwater studies are being undertaken in the South Stuart Corridor and the Northern Stuart Corridor project areas. Both projects include the collection of targeted new baseline pre-competitive geoscience information, including geophysical surveys, hydrogeological mapping and groundwater chemistry analysis, to provide regional-scale estimates of aquifer volumes and groundwater quality (including salinity).

Within the Southern Stuart Corridor project area, there are a number of separate sedimentary basins. There is a reasonable understanding of the groundwater systems (and recharge rates/processes) in the Ti Tree Basin (which corresponds to one of the National Collaborative Research Infrastructure Strategy (NCRIS) Groundwater Infrastructure sites, managed by the National Centre for Groundwater Research and Training), but very limited data for the Rocky Hill, West Davenport, and Tennant Creek areas. There is reasonable data and understanding of the groundwater system north of Daly Waters, but very sparse data south of Daly Waters.

The new investigations will help identify potential recharge areas, in all of the project areas, while also establishing baseline monitoring sites to better understand groundwater aquifers and processes, including relative rates of recharge. However, due to the sparsity of temporal groundwater monitoring data and the regional scale of these projects, improvements to our estimation of long-term recharge rates will be limited. Both the Northern and Southern Stuart Corridor projects will be completed by June 2020.

The Department of Environment and Natural Resources and has advised the Inquiry that the Tindall Limestone Aquifer has a recharge rate ranging from 100,000 ML/y to 330,000 ML/y. Please comment on these estimates.

The recharge rates quoted above are derived from a Northern Territory Department of Environment and Natural Resources (DENR) report (Bruwer and Tickell, 2015). The recharge rate estimates are applicable only for the North Mataranka to Daly Waters District. The recharge rates in the latter area are based on a combination of groundwater investigations including drilling, hydrochemistry and pump tests, aquifer mapping using airborne geophysics, temporal bore monitoring data, water balance estimates, and a numerical groundwater model. The DENR recharge rate estimates appear to utilise standard groundwater modelling techniques and assumptions. The range of recharge estimates reflects the variable data density, uncertainties in the understanding of the hydrogeology, and uncertainties about the distribution of localised rainfall.

Recharge rates are very difficult to measure directly as they require detailed temporal information on rainfall and the controls of near surface geology properties (permeability/porosity) on water

filtration. As these input parameters are highly variable within basins and change through time, they are difficult to estimate, especially in areas that have sparse data coverage.

The Tindall Limestone is an extensive stratigraphic unit that has a variety of internal rock types and is estimated to be up to 200 m in thickness. The unit is characterised by major highly heterogeneous fracture and cavern networks that provide the high porosity and inter-connected migration pathways for well-developed groundwater systems. As such, recharge rates will be highly irregular, due to both rainfall variability across this climate zone and a paucity of hydrogeological data (including groundwater levels, quantity and quality of water, pump rates, yields, and draw down rates) at all scales.

Outside the North Mataranka to Daly Waters District, available data for the Tindall Limestone is very sparse, and recharge estimates from modelling studies are likely to carry greater uncertainties. Furthermore, there are only a few studies of the recharge in the variable soils/regolith/geology overlying the Tindall Limestone, and limited data on the potential role of faults and fractures on controlling both secondary porosity development and recharge. Although previous studies provide some local-scale estimates on recharge rates for the Tindall Limestone, is it difficult to extrapolate these estimates to provide an accurate estimate on recharge rates for the entire unit.

Reference

Bruwer, Q. and Tickell, S. J., (2015). Daly Basin Groundwater Resource Assessment - North Mataranka to Daly Waters, Department of Land Resource Management, Water Resources Report Number 20/2015D. ISBN 978-1-74350-003-3.