

8 November 2024

Director Petroleum Operations
Department of Lands, Planning and Environment
PO Box 3675
Darwin NT 0801

ATTENTION: Ms Sally Strohmayr

Dear Ms Strohmayr

Re: Annual Interpretative Groundwater Quality Report - Well Drilling, Hydraulic Fracture Stimulation and Well Testing Environment Management Plan Exploration Permit 136 SWP4-3

Ministerial condition 6(iii) of the conditions of approval for the *SWP4-3: Well Drilling, Hydraulic Fracture Stimulation and Well Testing Environment Management Plan Exploration Permit 136* (the EMP) requires *In support of clause B.4.17.2 of the Code, the interest holder must...provide to an interpretative report of groundwater quality based on the groundwater monitoring required to be conducted at the well site(s) in accordance with Table 6 of the code. The interpretative report must be provided annually within 3 months of the anniversary of the approval date of the EMP and include:*

- *identification of any change to groundwater quality or level attributable to conduct of the regulated activity at the well site(s) and discussion of the significance and cause of any such observed change;*
- *interpretation of any statistical outliers observed from baseline measured values for each of the analytes;*
- *discussion of any trends observed;*
- *a summary of the results including descriptive statistics;*
- *description of the layout of the groundwater monitoring bores and wells, indicative groundwater flow directions and levels in accordance with the Preliminary Guideline Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin.*

The Code is in reference to the Code of Practice: Onshore petroleum activities in the Northern Territory (DENR, 2019). It is referred to as the “Code” throughout this report.

This letter constitutes the annual interpretative groundwater quality report for the Maverick 1 well site for 2024.

Site layout and groundwater flow direction

Figure 1 presents the layout of the Maverick 1 wellsite, showing the locations of the Maverick T463 A1-1 (known as, and hereafter referred to as Maverick 1) exploration well and the control monitoring bore (CMB – RN042730/BET-MB028).

The Maverick 1 exploration well was drilled and cased between 17 September (spud) and 22 October 2022 (rig release). It has been suspended since. The well has not undergone hydraulic stimulation.

The indicative groundwater flow direction, based on the SREBA (DEPAWS, 2022), is from the southwest to the northeast in the vicinity of the Maverick 1 well site.

The CMB was completed in July 2022 and is 80 m to the south-southeast of Maverick 1. It is up hydraulic gradient based on the regional groundwater flow direction (Figure 1, after DEPAWS, 2022). The CMB is fully penetrating of the Gum Ridge Formation aquifer. The Anthony Lagoon Formation aquifer is not present at the Maverick 1 wellsite.

Water supply for the drilling of Maverick 1 was sourced from the CMB.

There have been no further regulated sub-surface activities at the Maverick 1 well site.



Figure 1 Site layout and indicative groundwater flow direction

Water level trends

The standing water level in the CMB at the time of its installation was measured with an electronic water level meter at 115.0 m below ground level (mbgl).

An airline was installed with the pump for ongoing manual water level measurements as the headworks were not suitable for a standard electronic water level meter. An automatic water level logger has not been installed in the CMB.

Airline pressures were routinely measured at monitoring events. In April 2024 a larger compressor was used to measure the airline pressure than what had previously been used. It was found that the maximum pressure (representing the height of the water column above the airline orifice) was 560 kPa, compared with previous airline measurements of ~260 kPa. This exercise suggests there is likely to be a small hole in the airline rendering the previous airline pressure measurements erroneous.

On 2 September 2024 a slimline electronic water level meter was used to measure the standing water level (115.03 mbgl).

Based on the available water level data there has been no significant change to the water level in the Gum Ridge Formation at Maverick 1 due to the regulated activities.

Water quality trends

Groundwater from the CMB has been sampled for the suite of analytes listed in Table 6 of Section B.4.17 of the Code. Water quality monitoring of the CMB commenced on 9 July 2022 and nine samples complying with Table 6 of the Code were collected prior to the commencement of drilling on 17 September 2022. Monitoring activities continued through the drilling activities and seven samples have been collected since drilling commenced.

Summary statistics of the analytical results are provided in Table 1 for the CMB. Where an analyte concentration was reported as less than the effective quantification limit (EQL), it was assumed to be equal to the EQL for the calculation of the statistic.

To identify whether there has been any change in water quality due to the regulated activities, a statistical assessment was made using a Student T-Test to test whether there was a significant difference in the results from prior to the start of drilling and after the start of drilling. An F-Test was used to determine whether the homoscedastic (statistically similar variance) or heteroscedastic (statistically different variance) formula for the T-Test was used. Where a concentration was reported as less than the limit of reporting, the limit of reporting was assumed as the sample concentration. The statistical significance was assessed to a 95% confidence. The results of the analysis are provided in

Table 2.

The analytes where the P-value was less than 0.05 (95% confidence that there is a significant difference between the CMB and IMB data) are listed below with timeseries graphs for these analytes provided in Attachment A. Discussion of the data trends is provided in Table 3

There are few statistically significant differences in groundwater chemistry of the CMB from prior to drilling of the Maverick 1 well compared with after the drilling of the well. The analytes which show statistically significant differences in their concentrations, as discussed above, are most likely due to natural variability within the aquifer and intra-laboratory variability in laboratory methods. Most of the analytes reported lower concentrations post drilling.

There has been no significant change to the water quality in the Gum Ridge Formation at the Maverick 1 wellsite due to the regulated activities.

Tamboran will continue to monitor the groundwater at the Maverick 1 wellsite in accordance with Ministerial conditions of approval of the EMP.

If you require any further information, please do not hesitate to email me.

Kind Regards



Alana Court
Senior Approvals Manager



References

DENR (2018) Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin. Department of Environment and Natural Resources, November 2018.

DENR (2019) Code of Practice: Onshore Petroleum Activities in the Northern Territory. May 2019.

DEPAWS (2022) Regional Report: Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin. DEPWS Technical Report 41/2022. Department of Environment, Parks and Water Security, Northern Territory Government. Berrimah, Northern Territory.

Table 1 Maverick 1 Gum Ridge Formation CMB (RN042730/BET-MB028) Statistical Summary

Analyte	Output Unit	EQL	Count	Min	Max	Average	P10	P50	P90
pH (Field)	pH Units	0.1	12	6.32	7.09	6.81	6.70	6.80	7.07
Electrical Conductivity (Field)	µS/cm	1	11	1117	1446	1248	1166	1217	1366
pH (Lab)	pH Units	0.01	14	7.29	8.02	7.61	7.33	7.67	7.89
Electrical Conductivity (Lab)	µS/cm	1	14	1190	1320	1264	1229	1270	1294
Total Dissolved Solids	mg/L	10	14	712	872	784	748	781	834
Suspended Solids	mg/L	5	14	1	<EQL	3	1	1	<EQL
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	14	368	437	411	379	420	425
Alkalinity (Carbonate as CaCO3)	mg/L	1	14	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Alkalinity (Hydroxide) as CaCO3	mg/L	1	14	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Alkalinity (Total) as CaCO3	mg/L	1	14	368	437	411	379	420	425
Chloride	mg/L	1	14	103	140	119	111	119	124
Sulphate as SO4	mg/L	1	14	115	154	142	132	144	150
Sodium	mg/L	1	14	67	80	76	72	76	79
Potassium	mg/L	1	14	9	16	11	10	11	11
Calcium	mg/L	1	14	101	136	123	116	124	131
Magnesium	mg/L	1	14	46	54	51	49	52	54
Fluoride	mg/L	0.1	14	0.5	0.7	0.6	0.6	0.6	0.7
Nitrate (as N)	mg/L	0.01	14	<EQL	0.06	0.04	0.02	0.05	0.06
Nitrite (as N)	mg/L	0.01	14	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Gross alpha activity	Bq/L	0.05	13	<EQL	0.26	0.19	0.16	0.19	0.22
Gross beta activity (excluding activity of K-40)	Bq/L	0.1	13	<EQL	0.16	0.11	<EQL	<EQL	0.14
Methane	mg/L	0.01	14	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Ethane	µg/L	10	14	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Propane	mg/L	0.01	14	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Arsenic	mg/L	0.001	15	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Barium	mg/L	0.001	15	0.050	0.079	0.056	0.051	0.055	0.061
Boron	mg/L	0.05	15	0.11	0.19	0.16	0.13	0.16	0.19
Cadmium	mg/L	0.0001	15	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Chromium (III+VI)	mg/L	0.001	15	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Copper	mg/L	0.001	15	<EQL	0	0	<EQL	<EQL	0
Iron	mg/L	0.05	15	<EQL	0.16	0.06	<EQL	<EQL	0.09
Lead	mg/L	0.001	15	<EQL	0	0	<EQL	<EQL	<EQL
Lithium	mg/L	0.001	15	0.042	0.060	0.053	0.050	0.052	0.058
Manganese	mg/L	0.001	15	<EQL	0.052	0.006	<EQL	0.002	0.007
Mercury	mg/L	0.0001	15	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Selenium	mg/L	0.01	15	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Silicon as Si	mg/L	0.1	14	26.8	30.4	28.6	27.2	28.5	30.0
Silver	mg/L	0.001	15	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Strontium	mg/L	0.001	15	0.627	0.787	0.709	0.648	0.717	0.765
Zinc	mg/L	0.005	15	<EQL	0.020	0.007	<EQL	<EQL	0.014
TRH C6 - C10 Fraction (Sum)	µg/L	20	14	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
TRH C10 - C40 Fraction (Sum)	µg/L	100	14	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Sum of BTEX	µg/L	1	14	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL
Total Reportable PAH	µg/L	0.5	14	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL

<EQL = less than the EQL

EQL = effective quantification limit

Table 2 Maverick 1 Statistical Assessment

Analyte	Output Unit	EQL	Pre-drill		During and post drill		Statistics	
			Number of samples	Average Concentration	Number of samples	Average Concentration	F.Test Statistic	T.Test - P-value
pH (Field)	pH_Units	0.1	7	6.81	6	6.92	0.03	0.3
Electrical Conductivity (Field)	µS/cm	1	7	1235	5	1286	0.29	0.2
pH (Lab)	pH_Units	0.01	9	7.69	7	7.38	0.81	0.01
Electrical Conductivity (Lab)	µS/cm	1	9	1267	7	1257	0.16	0.271
Total Dissolved Solids	mg/L	10	9	783	7	779	0.47	0.4
Suspended Solids	mg/L	5	9	2	7	4	0.73	0.004
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	9	408	7	418	0.20	0.2
Alkalinity (Carbonate as CaCO3)	mg/L	1	9	<EQL	7	<EQL	-	-
Alkalinity (Hydroxide) as CaCO3	mg/L	1	9	<EQL	7	<EQL	-	-
Alkalinity (Total) as CaCO3	mg/L	1	9	408	7	418	0.20	0.2
Chloride	mg/L	1	9	117	7	119	0.24	0.36
Sulphate as SO4	mg/L	1	9	145	7	133	0.00	0.025
Sodium	mg/L	1	9	77	7	73	0.02	0.02
Potassium	mg/L	1	9	11	7	10	0.07	0.046
Calcium	mg/L	1	9	126	7	119	0.05	0.1
Magnesium	mg/L	1	9	52	7	50	0.07	0.01
Fluoride	mg/L	0.1	9	0.6	7	0.7	0.01	0.1
Nitrate (as N)	mg/L	0.01	9	0.04	7	0.05	0.06	0.01
Nitrite (as N)	mg/L	0.01	9	<EQL	7	<EQL	-	-
Gross alpha activity	Bq/L	0.05	10	0.20	5	0.17	0.03	0.2
Gross beta activity (excluding activity of K-40)	Bq/L	0.1	10	0.11	5	0.10	0.08	0.3
Methane	mg/L	0.01	9	<EQL	7	0.010	-	0.14
Ethane	µg/L	10	9	<EQL	7	<EQL	-	-
Propane	mg/L	0.01	9	<EQL	7	<EQL	-	-
Arsenic	mg/L	0.001	10	<EQL	7	<EQL	-	-
Barium	mg/L	0.001	10	0.057	7	0.055	0.20	0.2
Boron	mg/L	0.05	10	0.16	7	0.16	0.37	0.45
Cadmium	mg/L	0.0001	10	<EQL	7	<EQL	-	-
Chromium (III+VI)	mg/L	0.001	10	<EQL	7	<EQL	-	-
Copper	mg/L	0.001	10	0.0011	7	0.0016	0.00	0.2
Iron	mg/L	0.05	10	0.07	7	<EQL	0.00	0.1
Lead	mg/L	0.001	10	<EQL	7	0.0011	0.00	0.2
Lithium	mg/L	0.001	10	0.054	7	0.050	0.42	0.1
Manganese	mg/L	0.001	10	0.002	7	0.009	0.00	0.2
Mercury	mg/L	0.0001	10	<EQL	7	<EQL	-	-
Selenium	mg/L	0.01	10	<EQL	7	<EQL	-	-
Silicon as Si	mg/L	0.1	9	29	7	29	0.27	0.475
Silver	mg/L	0.001	10	<EQL	7	<EQL	-	-
Strontium	mg/L	0.001	10	0.732	7	0.661	0.39	0.002
Zinc	mg/L	0.005	10	0.007	7	0.010	0.11	0.07
TRH C6 - C10 Fraction (Sum)	µg/L	20	9	<EQL	7	<EQL	-	-
TRH C10 - C40 Fraction (Sum)	µg/L	100	9	<EQL	7	<EQL	-	-
Sum of BTEX	µg/L	1	9	<EQL	7	<EQL	-	-
Total Reportable PAH	µg/L	0.5	9	<EQL	7	<EQL	-	-

<EQL = less than the EQL

EQL = effective quantification limit

Table 3 Analytes for which there is a significant difference between pre-drilling and post-drilling concentrations

Analyte	Post-drill average less than pre-drill average	Discussion of trend*
pH (Lab)	Yes	Prior to drilling, the pH oscillated between ~ pH 8 and pH 7.3, rising to pH 7.9 in December 2022. Since May 2023, the pH has gradually declined to pH 7.15.
Suspended Solids	No	The significance in difference in suspended solids (TSS) concentrations from prior to post drilling is an artefact of the EQL varying from 1 mg/L to 5 mg/L and the EQL being used for the calculation of the statistic. The majority of TSS results post drilling have been reported with a 5 mg/L EQL and 1 mg/L EQL prior to drilling.
Sulphate as SO ₄	Yes	While the sulphate concentration increased in the first sample post drilling compared with the pre-drilling samples (average 145 mg/L) the concentration has exhibited a long-term decline by roughly 20 mg/L, with the most recent sample reporting a concentration of 125 mg/L.
Sodium	Yes	The reported sodium concentration has a range of 67-80 mg/L. The pre-drilling concentration exhibited a steeply declining trend, but of small magnitude (80 mg/L to 75 mg/L). Since drilling, the concentration has oscillated, but has generally been less than 75 mg/L.
Potassium	Yes	Notwithstanding the concentration in the first sample of 16 mg/L, the pre-drill concentration remained at 10 or 11 mg/L. Post drilling, the concentration has fluctuated gently between 9 and 11 mg/L but shows no defined long-term trend.
Magnesium	Yes	The reported magnesium concentration has a range of 46-54 mg/L. The pre-drilling concentration oscillated between 50 and 54 mg/L. The first sample post drilling, the concentration was reported as 50 mg/L and while the concentration oscillated slightly, it exhibited a longer-term declining trend until April 2024, when it reportedly increased to 54 mg/L. It was subsequently reported at 50 mg/L.
Nitrate (as N)	No	The nitrate concentration increased from <EQL (0.01 mg/L) to 0.06 mg/L prior to drilling, decreasing to 0.04 mg/L in the last sample before drilling commenced. In the first sample after drilling, the reported concentration was 0.06 mg/L with a long term gradual declining concentration trend since, with the most recent sample reporting a concentration of 0.04 mg/L.
Strontium	Yes	The strontium concentrations in the first two samples collected from the CMB (~0.78 mg/L) were relatively elevated compared with subsequent samples, potentially due to the aftereffects of the drilling of the monitoring bore. Concentrations then dropped to ~0.68 mg/L before increasing to around 0.72 mg/L immediately prior to and during drilling of Maverick. The strontium concentration then exhibited a longer-term declining trend, reaching a minimum concentration of 0.627 mg/L in July 2023. It subsequently exhibited a rising trend through late 2023/early 2024, reaching a local maximum of 0.728 mg/L. The concentration then decreased to 0.584 mg/L in the September 2024 sample.

* references to drilling refer to the drilling of Maverick 1 as opposed to the drilling of the CMB, unless explicitly stated otherwise

Attachment A - Timeseries chemistry charts





