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No. WAD37 of 2022

Federal Court of Australia
District Registry: Western Australia
Division: General

Yindjibarndi Ngurra Aboriginal Corporation RNTBC (ICN 8721)
Applicant

State of Western Australia and others
Respondents

APPLICANT'S EXPERT HYDROLOGIST'S SHORT RESPONSE TO THE FMG RESPONDENTS' EXPERT HYDROGEOLOGIST'S REPORT

(Filed pursuant to item 10 of the timetable attached to the orders made 9 February 2024)

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Dr Huade Guan: Responsive Comments to Dr Evans' Report

1. The main arguments in Dr Evans' report, which address the conclusions of my report are:
   a) there was a decreasing rainfall trend in the SHM and the surrounding area from 2013 to 2023;
   b) there was a wetting period from 1996 to 2006 in the area. It is believed this wetting period "would have produced artificially high groundwater levels over much of the region. The onset of a drier phase shows a downward adjustment in groundwater levels in response";
   c) based on this, Dr Evans concludes NDVI degradation in recent years is due to a combination of short-term rainfall condition and long-term groundwater readjustment; and
   d) dewatering at the SHM would not impact groundwater levels beyond the immediate vicinity of the SHM, because there is a long lag between the recharge zone and the discharge zone.
2. Dr Evans also questions the appropriateness of using the Bureau of Meteorology (**BoM**) GDE Atlas:
   e) "In Dr Guan's report, it is implied that the potential GDEs are likely GDEs, however, Dr Guan has not demonstrated and proven that this is actually the case".

Conclusion (a): there was a decreasing rainfall trend in the SHM and surrounding area from 2013-2023

3. The rainfall trend in Dr Evans' report is based on the cumulative deviation from the mean (**CDFM**), which is inappropriate to examine rainfall trends because CDFM curves vary depending on which mean annual rainfall is chosen (Figure 1). The CDFM curves graphed in Appendix D2 in Dr Evans' report, which is cited multiple times in that report, compares rainfall at "Solomon Area" against the mean annual rainfall of other locations near the SHM. This is conceptually wrong. The CDFMs in Appendix D2, which show a decreasing trend in SHM and an increasing trend at locations further away, are misleading.

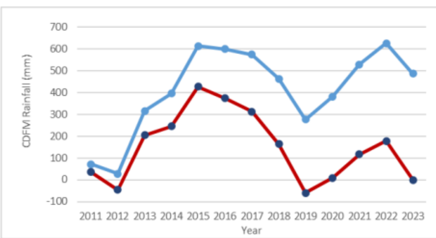

Figure 1 The CDFM curves of Mount Florance based on the long-term mean annual rainfall (Blue) and on the short-term mean (Red). Data provided in Rainfall Data and Analysis_V1 (a support document in Evans' report.

4. Even if a CDFM is properly produced, it is not suitable for analysing vegetation cover change. This is because vegetation in arid and semiarid areas quickly responds to interannual rainfall variability. A recent study on the whole Australian continent shows that rapid vegetation growth in a big wet year diminishes within two years (Ma and Huete et al. 2016). In my own research on vegetation interannual variability (e.g. Long and Guan et al. 2019), I do not use rainfall CDFM at all.
5. Another issue in the rainfall trend analysis is what rainfall datum are used. In my report, all rainfall datum comes from BoM. Dr Evans received rainfall data from Jordin Barclay, an employee of FMG, which included a mix of sources (BoM and FMG) and included the use of incomplete data sets in the preparation of figures for Dr Evans' consideration. In my report, four BoM stations (Coolawanyah, Mount Florance, Hamersley, and Wittenoom) are examined and shown in Figure 8. Two additional stations on either side of SHM in the northeast-southwest direction (Yalleen and Newman Aero; Figure 12 in my report), without any data gaps until 2023, show no rainfall trends in recent years. This confirms what is also shown by rainfall measurements at the Coolawanyah weather station, close to the SHM; no significant rainfall trend exists after 2015 (Figure 8 of my report). They are re-plotted in Figure 2 below.

6. In short, the rainfall trend described in Dr Evans' report is based on problematic CDFM charts. Such a trend is not observed from the BoM data of Coolawanyah, Yalleen and Newman Aero.

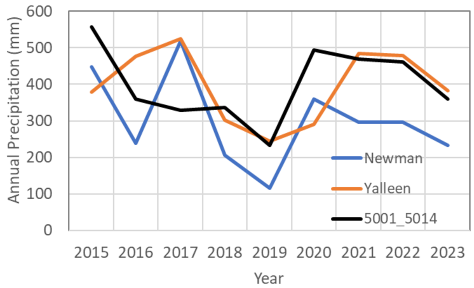

Figure 2 Annual rainfall at three locations surrounding the SHM area with complete data for 2015-2023 (7176: Newman Aero, 5029: Yalleen, 5001: Coolawanyah, 5014: Mount Florance).

7. In addition, even if the rainfall trend existed, it cannot explain the patterns presented in Figures 11, 13, 14, and 15 of my report. Those figures show increasing NDVI trends and decreasing NDVI trends. Were the NDVI change related to a decreasing rainfall trend, we would see decreasing NDVI trends everywhere.

Conclusion (b): there was a wetting period from 1996-2006 resulting in artificially high groundwater levels, followed by a groundwater re-adjustment.

8. The CDFM might be useful to infer possible groundwater recharge change. However, the CDFM curves in Figure 6-1 of Dr Evans' report, on which Dr Evans' argument is based, shows a wet year in 1996, a wet period in 1998 and 1999, and then a wet year in 2005. A few dry years occurred in between. There was not a continuous wet period from 1996 to 2006, as is stated in Dr Evans' report. Based on this conclusion, Dr Evans further concludes that the groundwater table has slowly decreased in the region after 2006. This was a likely situation, not a fact. If there is a groundwater table "re-adjustment" as Dr Evans suggests, it should have been reflected in the groundwater table monitoring bores. However, of three groundwater bores which have datum prior to the start of mining at SHM, two boreholes (Quarrina Bore and Warp 16) show no trend within a few years after 2006.
9. However, following the start of mining at the SHM in 2012, many groundwater bores in the vicinity of SHM show decreasing water level at rates around 0.2 m/yr. This is a significant rate; within 10 years, the groundwater table can decrease by one meter.

Conclusion (c): recent NDVI degradation is due to short-term rainfall condition and long-term groundwater readjustment

10. Thus, Dr Evans' conclusion that the NDVI degradation in recent years is due to a combination of short-term rainfall condition and long-term groundwater readjustment is not supported.

Conclusion (d): dewatering would not impact groundwater levels beyond the immediate vicinity of SHM, because there is a long lag between the recharge zone and discharge zone.

11. Dr Evans comments on the time frame between the recharge zone and discharge to address my suggested connection of the degraded vegetation in the alluvial fan downstream of Kangeenarina Creek to dewatering at SHM (Figure 17 in my report). If we are talking about actual water molecule movement over a long distance between the recharge zone and the discharge zone, I tend to agree with Dr Evans in that it may take years, decades or even longer. However, if the groundwater in the alluvial fan connects with the groundwater beneath SHM by fractured-rock aquifer(s) or other aquifers where groundwater is pressurized, any groundwater change in SHM can propagate rapidly to the alluvial fan, via a so-called pressure-wave mechanism (Wenninger et al. 2004). We can experience

the water flow rate from the hose can immediately reduce if we turn down the tap.

12. Another mechanism, which may connect the degraded vegetation in the alluvial fan to the hydrological condition in the SHM, is via the mountain front recharge from surface water. This mechanism is described in Figure 3 of Wilson and Guan (2004). The SHM has reduced the catchment area of Kangeenarina Creek. This change has very likely reduced streamflow during heavy storms, and thus may have reduced groundwater recharge to the alluvium fan aquifer.

Conclusion (e): Dr Guan has not demonstrated the existence of GDEs

13. I agree that the moderate potential terrestrial GDE map, provided by BoM, shows where terrestrial GDEs are likely occurring. It does not prove the existence of GDEs. However, all typical GDE vegetation species from a survey in the area (Ecologia 2014) fall in or at the margin of the mapped moderate potential GDEs (blue triangles in Figure 7 of my report). This suggests the reliability of the moderate GDE map. In my report, the map is adopted to narrow the area so that vegetation trends can be analysed for those areas where groundwater change because of dewatering at the SHM may have occurred.
14. In this focused area, vegetation degradation has been identified (Figure 16 of my report). Looking at the groundwater table data in Dr Evans' report, we can see the connection of the vegetation and groundwater changes in the alluvial fan of Kangeenarina Creek. In this area, groundwater table has fallen at the rate of about 0.25 m/yr (Figure 7-1 in Dr Evans' report). In the same area, vegetation has degraded, particularly in 2022 and 2023 (Figure 17 in my report). This co-incidence of results from two independent sources of data, suggests the vegetation degradation in the alluvial fan is highly likely caused by the groundwater change.
15. In fact, narrowing the investigation area based on this moderate GDE map can sometimes leave out some real groundwater GDEs. For example, in Figure 18 of my report, the NDVI trend at and the surrounding vegetation quadrat #347 is not shown. This quadrat contains *E. Victrix*, which is considered a likely GDE species (Ecologia 2014). The NDVI of this vegetation quadrat has decreased significantly (Table 1 in my report; Figure 3 below).

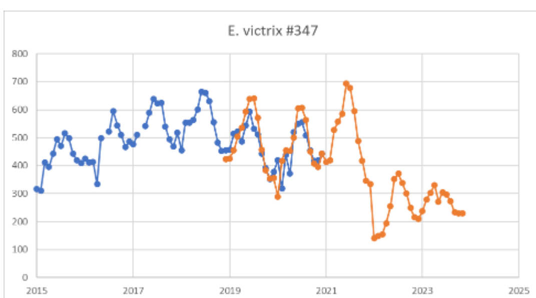

Figure 3 Monthly Landsat (blue) and Sentinel-2 (orange) NDVI (×1000) time series for a selected *E. Victrix* quadrat (#347 in Ecologia 2014) in the SHM area, showing an abrupt degradation of vegetation cover in 2022 and 2023. The location is marked in Figure 18 of my report.

References

1. Ecologia (2014). Solomon Hub Flora and Vegetation Assessment
2. Long, X., Guan, H., Sinclair, R., Batelaan, O., Facelli, J.M., Andrew, R., et al. (2019). Response of vegetation cover to climate variability in protected and grazed arid rangelands of South Australia. *Journal of Arid Environments*, 161: 64-71.
3. Ma and Huete, et al. (2016). Drought rapidly diminishes the large net CO2 uptake in 2011 over semi-arid Australia. Scientific Report, 6:37747.
4. Wenninger et al. (2004). Experimental evidence of fast groundwater responses in a hillslope/floodplain area in the Black Fore4st Mountains, Germany. Hydrological Processes, 18: 3305-3322.
5. Wilson, J.L., and H. Guan (2004). Mountain-block hydrology and mountain-front recharge. Detailed in Guan's report.

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