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8721 AND STATE OF WESTERN AUSTRALIA & ORS
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Sia Lagos

Registrar

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No. WAD 37 of 2022

Federal Court of Australia

District Registry: Western Australia

Division: General

**YINDJIBARNDI NGURRA ABORIGINAL
CORPORATION RNTBC (ICN 8721)**

Applicant

STATE OF WESTERN AUSTRALIA & ORS

Respondents

**Joint Report
Conference of Experts
Conference 2 – 19 March 2024**

Dr H Guan and Dr R Evans

Introduction

1. Pursuant to the orders of Justice Burley dated 10 January 2024, Registrar McGregor convened an experts' conference commencing on 19 March 2024 in the Adelaide Registry of the Federal Court of Australia.

2. The conference was attended by: Dr Huade Guan, expert for the Applicant and Dr Richard Evans, expert for the Respondents.

3. Prior to the conference, the parties provided a series of propositions to the Court. These propositions are set out in this report. These propositions were provided to the experts prior to the conference.

4. Prior to the conference, each expert was provided with the Expert Evidence Practice Note (GPN-EXPT) and at the conference, each expert was reminded of their role as an expert witness, including their duty to the Court.

5. At the conference, each expert was reminded of the purpose of the conference, namely to produce a joint report which briefly identifies what matters are agreed and where there is disagreement and why. The experts were encouraged to reach agreement on a subject, where it is possible to do so consistently with their knowledge and opinions on that subject.

6. The experts were reminded that sometimes apparent differences between experts are resolved by discussion and turn out to be an artefact of the process of drafting. Sometimes discussion enables disagreements to be clarified and the scope of the dispute to be narrowed or eliminated.

7. Experts were encouraged to approach the discussion with an open mind, with a view to assisting the Court. However, the experts were made aware they should not feel pressured to agree to any matter that is not consistent with their knowledge and opinions on that subject.

8. The Experts were reminded they are required to comply with the following guidelines when preparing this joint expert report:

- (a) In the period from the commencement of the expert meeting to the signing of the joint report, the experts must not communicate with the parties, their lawyers or counsel regarding the case except with the consent of the other party or as set out in sub-paragraphs (b) and (c) below.
- (b) If any expert requires guidance in relation to a matter of procedure during this period, then the expert should send their enquiry by email to Registrar McGregor at Laurelea.McGregor@fedcourt.gov.au copying her assistant, Shannon.hayes@fedcourt.gov.au, and the other expert or experts.
- (c) An expert may communicate with the lawyers for a party for the purpose of getting assistance with logistical arrangements such as travel or teleconferencing but may not, in the course of that communication, discuss or disclose any substantive issue the subject of the meeting (or any aspect of it) with those legal representatives.
- (d) The experts are asked to discuss and decide between themselves how a final report is to be prepared. By way of example only, following discussion of a particular topic or topics, each expert might initially prepare their own draft response and exchange them before further discussion, or the experts may divide

up responsibility for preparing a first draft response on each topic that reflects the outcome of the discussion on that topic, with the report then to be collated, reviewed, amended as required and approved by each expert before it is finalised.

- (e) All draft versions of the report and draft materials exchanged are to remain confidential to the experts and must not be given or shown to the parties' lawyers or counsel in any jurisdiction either during or after the conclusion of the expert meeting.
- (f) The experts should also re-read and comply with Federal Court Practice Note GPN-EXPT (Annexure A; Annexure B). A copy of the Expert Evidence Practice Note can also be accessed at:

<http://www.fedcourt.gov.au/law-and-practice/practice-documents/practice-notes/gpn-expt>

9. The Experts were expected to have read the reports of, and considered the views of, the other expert ahead of the conference. The experts confirm this work was completed in preparation for the conference.

8. At the conclusion of the discussion, the experts were asked to confirm the substance of their discussion and the opinions expressed as set out in this report.

9. Each expert expressed the opinions set out in this report. The experts were asked to indicate this by signing the declaration at the end of the report.

10. Drs Guade and Evans agreed that it would be desirable to know if a paleochannel exists between the eastern arm and middle arm of Weelumurra Creek, as shown in Figure's 14 and 18 of Dr Guan's report.

CONFERENCE 2
Dr Guan and Dr Evans

The experts are to identify points of agreement and disagreement by including references to the paragraphs of Dr Guan’s and Dr Evans’ reports set out below.

Topics	Dr Guan Report Paragraph	Dr Evans Report Paragraph
A. Hydrogeology of the Solomon Hub Mine		
1. The key conceptual hydrogeological features of the Solomon Hub Mine, including the permeability or otherwise of the formations beneath the Solomon Hub Mine.	[17]	[25]-[31]
<p>Dr Guan</p> <ul style="list-style-type: none"> With reference to the CSIRO report, 2015, the relevant key feature is the paleochannel aquifer and adjacent fractured rock aquifers in the Wittenoom Formation at some locations. Both paleochannel and the Wittenoom Formation extend into the Lower Fortescue Valley, as described in para 17 of my report. <p>Dr Evans</p> <ul style="list-style-type: none"> Many reports indicate that the high permeability paleochannels are underlain and adjacent to low permeability formations, as described in paras 25 to 31. Hence, I believe that the hydraulic connections between the paleochannels and the other formations is low. 		
2. The extent, if any, to which the conceptual hydrogeological features which control groundwater flow in the region indicate: (a) whether any impacts to groundwater levels from dewatering activity in the Solomon Hub Mine could occur within the compensation claim area, beyond the immediate vicinity of the dewatering activity (via regional flow paths or otherwise); and	[3], [17], [39], [40]	[4], [20], [27], [31], [32], [38], [53], [83]
<p>Dr Guan:</p> <ul style="list-style-type: none"> Through the permeable paleochannel aquifer, theoretically dewatering in the SHM can impact the groundwater in the paleochannel as long as the SHM is not completely isolated from the surrounding paleochannel aquifers. It is unlikely that a grout barrier can completely disconnect the SHM from the paleochannel aquifer(s). In the Kangeenarina Creek catchment the mining alteration of the catchment and dewatering can impact mountain front recharge in the alluvial fan area, with possible mechanisms described in para 17 of my report. <p>Dr Evans:</p> <ul style="list-style-type: none"> The conceptual hydrogeological model indicates that virtually all groundwater flow occurs in the paleochannels. In this regard the impacts of dewatering would be felt almost exclusively in the paleochannels. The adjacent and underlying formations (except where 		

the Wittenoom Formation is weathered and fractured) are low permeability and hence any impacts through these units will be small and take a long time. The impacts in the paleochannels could be transmitted along the paleochannels and this is why the supplementation schemes have been introduced to limit any impacts to within the mine disturbance envelope.

(b) assuming that the permeability of the formations beneath the Solomon Hub Mine is such that those formations could act as an aquifer, the timeframe within which impacts of dewatering from Solomon Hub Mine could be detected outside the immediate vicinity of the dewatering activity.		[33]-[34], [83]
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Dr Guan:

- Generally, I agree with Dr Evans’s following comment on the permeability-dependent groundwater response to a disturbance.

Dr Evans:

- The answer depends on the permeability of the aquifer. If very permeable, then the effects could be felt in months to about a year. If moderate permeability then the effects could take several years to a decade. Note that there are other factors other than permeability which can influence the rate of transmission of impacts.

B. Rainfall Data and Trends

3. The appropriate data set for determining rainfall at the Solomon Hub Mine.		[47], [81]
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Dr Guan:

- The appropriate data set is the publicly available data set without data gaps.

Dr Evans:

- The appropriate data set uses all available data and use standard professional judgement to interpret gaps.

4. The appropriate method of interpreting and presenting the results obtained from any data set in relation to rainfall at the Solomon Hub Mine.		[40], [42], [43]
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Dr Guan:

- This is dependent on the objectives. We can use actual rainfall time series rainfall for investigating vegetation responses, or CDFM for investigating groundwater recharge response. Long term rainfall mean should be used to construct a CDFM for investigating possible groundwater recharge change. Given the rapid vegetation cover response to water availability, interannual variation of vegetation cover (if not groundwater- or inflow-dependent), can be used to infer rainfall interannual variability.

Dr Evans:

- Generally, agree with Dr Guan’s response concerning use of rainfall data for investigating short term vegetation responses. However, trends in rainfall are influenced by many other factors, including elevation differences.
- CDFM is most appropriate for considering groundwater responses. Both short term and

long term means can be used depending on the objective. I have adopted short term means (i.e. since mining started) for the CDFM analysis as I consider that this is the most appropriate time frame to assess rainfall trends.

5. The trends, if any, which may be discerned from relevant data about rainfall at or near the Solomon Hub Mine, having regard to:
 (a) only publicly available data; or alternatively
 (b) all data available to the experts.

[30]

[5], [41], [42], [45], [48], [82]

Dr Guan:

- Based on the publicly available data set (3 stations) no clear trend is observed for the period from 2015-2023, but there is a dry year in 2019 recorded in all three stations.
- Based on the NDVI trends from 2019 to 2023, as shown in Figure 11 of my report, most of the vegetation cover in the area surrounding the SHM is getting better. This is consistent with the fact that 2019 was a dry year.

Dr Evans:

- Using all data available there is some variability in rainfall trends, but the Solomon data shows a clear dryer trend from about 2014 to 2023. Some data shows significant spatial variability, and hence, the ability to extrapolate is difficult. For example, topography can locally significantly influence rainfall.

C. Normalised Difference Vegetation Index (NDVI) Analysis

6. The location of any groundwater-dependent ecosystems (GDEs) in the compensation application area.

[21], [29]

[55]-[56]

Dr Guan:

- There are GDEs in the region. GDEs are more likely within the BOM-mapped moderate potential GDE area, e.g. as shown in Fig 7 in my report. Almost all 13 vegetation quadrats with typical GDE species identified in Ecologia (2014) are in the moderate potential GDE area. Most of these sites are in the compensation application area.

Dr Evans:

Generally, I agree with Dr Guan, however the confidence in them being actually GDEs over this large area is unknown because this has not been assessed in detail.

7. Whether Dr Guan’s NDVI analysis of moderate potential GDEs, combined with the analysis of vegetation quadrats of typical groundwater dependent species, in the compensation application area is appropriate to identify alterations in the levels of groundwater dependent vegetation in those areas.

[24], [30]

[59], [63], [64], [66]

Dr Guan:

- Yes

1	Dr Evans:		
2	<ul style="list-style-type: none"> Assuming the question is: Does NDVI tell us about vegetation health? Yes, but noting there are many factors influencing vegetation health. NDVI as an analysis method has a level of accuracy as discussed in my report. Also, the analysis method would be improved if it was carried out over a longer time period. 		
3	4	5	6
7	8.	The trends, if any, as to levels of vegetation cover which may be discerned or inferred from Dr Guan's NDVI analysis in the compensation application area.	[33], [35], [38], [41] [62], [66]-[70], [84]
9	Dr Guan:		
10	<ul style="list-style-type: none"> Six sites show a significant negative trends of vegetation cover in 2015-2023. One site shows a positive trend in the same period, as shown in Table 1. In the compensation application area both positive and negative NDVI trends are evident, as shown in Figs 13, 14 and 15. The most obvious negative NDVI trend is in the alluvial fan downstream of the Kangeenarina Creek where NDVI has decreased gradually since 2015 (Figure 17), and in the three riparian zones of Weelumurra Creek, where NDVI decreased abruptly in 2022 and 2023 (Figure 18). 		
11	Dr Evans:		
12	<ul style="list-style-type: none"> In figs 17 and 18 the positive trends are not shown. The significant negative trends in NDVI in these and other figures is clear, however the cause of these trends is believed to be due to climate or other processes. For example, the western arm of Weelumurra creek is many km from SHM and it is very difficult to conceptualise that the impact from SHM could extend this distance in the relatively short time. 		
13	D. Vegetation Cover Trends		
14	9.	Whether there have been changes to vegetation cover in the compensation application area.	[30], [34], [36]- [37] [7], [62]
15	Dr Guan:		
16	<ul style="list-style-type: none"> Yes. From 2019 to 2023, in the Kangeenarina Creek catchment vegetation shows a decreasing trend in the alluvial fan and in some sections of the creek. In the section immediately next to the SHM the vegetation cover condition appears to have increased. In the Weelumurra Creek catchment, decreasing trend occurred in the riparian zones, near the SHM. In the vegetation quadrats with typical vegetation species, six of them show significant vegetation decreasing trends in 2015-2023. 		
17	Dr Evans:		
18	<ul style="list-style-type: none"> NDVI analysis and field work by Ecoscape shows no significant changes in vegetation health from 2001 to 2022. However Dr Guan's NDVI analysis shows a decrease in vegetation health in more recent times. I consider that the different interpretations are due to slightly different methodologies, different locations and/or slightly different time frames. Nonetheless it is considered possible that at some locations there is a decrease in vegetation health. 		
19	10.	To the extent that there may have been declines in levels of vegetation cover in the compensation application area, the cause(s) or likely cause(s)	[17], [39]-[40], [42], [44] [7], [62], [65], [69]-[70], [84]
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of such declines.		
Dr Guan:		
<ul style="list-style-type: none"> For the alluvial fan of the Kangeenarina Creek the vegetation decrease is very likely due to reduced groundwater table as shown in Dr Evans report Figure 7.1 where a decline of about 0.25 m/yr is shown. This decline is very likely related to a change in mountain front recharge via surface and/or subsurface paths due to catchment alteration and dewatering in SHM.. In the Weelumurra Creek, the timing of vegetation change is a couple of years after the increase of groundwater extraction in the Queens Valley. This vegetation decrease is considered to be likely due to a change of paleochannel aquifer underlying the creek. It is likely that the groundwater table decrease in the paleochannel aquifer has decreased for the last 2 years. 		
Dr Evans:		
<ul style="list-style-type: none"> The extent of the change of the vegetation cover is not clear however some decrease in vegetation health seems quite likely. It is believed that this is likely to be climate related process. It is not possible to comment on Dr Guan’s proposal on mountain front recharge as I am not aware of any analysis of this mechanism having been undertaken; for example, a transient water balance would be necessary. As discussed in my report, the groundwater level induced vegetation response is possible as clearly the levels have decreased in recent years. The cause of this decrease is believed to be due to rainfall changes. Mining induced groundwater level change in the paleochannels is possible but it is believed that the supplementation schemes address this. Groundwater level change through the basement rocks is not considered feasible due to their low permeability and other hydrogeological features. 		
E. Groundwater Trends		
11. The extent, if any, to which groundwater levels in the Solomon Hub Mine appear to have declined, both:		[6], [51], [82]
(a) in the immediate vicinity of dewatering activity; and		
(b) outside that immediate vicinity.		
Dr Guan:		
<ul style="list-style-type: none"> No comment. 		
Dr Evans:		
<ul style="list-style-type: none"> Within the SHM there is a significant decrease in groundwater levels, as expected, due to the dewatering. Outside of the mine disturbance envelope the rate of decline is typically from 0 to approx. 0.3 m/yr 		
12. To the extent that there have been declines in groundwater levels outside the immediate vicinity of the Solomon Hub Mine, the likely causes of such declines.	[46]	[49], [51]-[53], [82]-[83]
Dr Guan:		
<ul style="list-style-type: none"> Based on NDVI analysis and observed groundwater level the decline in the alluvial fan of 		

the Kangeenarina Creek is very likely related to a change in mountain front recharge via surface and /or subsurface path due to SHM. The mountain front recharge via surface runoff can respond to a change in the catchment in a short time (e.g., from days to months).

- The decline of groundwater underneath the Weelunurra Creek in the last 2 years inferred from NDVI analysis shown in Figure 18 is considered to be likely due to a change of paleochannel aquifer underlying the creek. The timing of this change is a couple of years after the change in water extraction in the Queens Valley.
- If there is a groundwater readjustment in the region following the wet period we would see a gradual groundwater level decline after the wet period. However, of the three bores with available data, two bores show no trend after 2006 and before mining.

Dr Evans:

- It is considered that the likely causes of the decline is due to a gradual and some what variable decline in rainfall superimposed on a hydrogeological adjustment in groundwater levels following the wetter period prior to the commencement of mining at SHM. (The decline of groundwater levels following wetter periods is a common process observed throughout the world.) The mining induced possible mechanism requires transmission of pressure over large distances in a relatively short time (from a groundwater processes perspective) and hence this is considered to be most unlikely.
- The possible decline in groundwater levels following the wetter period (1995 to 2006) cannot be demonstrated or disproven by only two observation bores over this large area. Many more bores would be required.

F. Dewatering in the Solomon Hub Mine

13. To the extent not covered, whether there is any evidence that the effects of dewatering in the Solomon Hub Mine extend beyond the immediate vicinity of the dewatering activity.

[77]-[80], [85]

Dr Guan:

- Hydrologically it is possible to have a small system (e.g., a farm dam) of a high water level next to a large system (e.g. a lake) of a low water level, if we can pump water from the large lake to the small farm dam. A supplementation scheme could appear to be successful if we only consider a localized small area. However, the effect of a large system with decreasing water level can still happen.

Dr Evans:

- On the basis of the data presented by FMG, the supplementation schemes seem to be effective. The decline in groundwater levels in Warp 16 prior to the introduction of the supplementation scheme could be due to several processes as mentioned in para 78.

Declarations of Experts

I, Richard Evans, in expressing the opinions attributed to me in this report have had regard to the basis material and the statements made at the conference of experts and have made all the inquiries which I believe are desirable and appropriate and that no matters of significance which I regard as relevant have, to my knowledge, been withheld.

Richard Evans

Signed:

Dated 20 March 2024

I, Dr Huade Guan, in expressing the opinions attributed to me in this report have had regard to the basis material and the statements made at the conference of experts and have made all the inquiries which I believe are desirable and appropriate and that no matters of significance which I regard as relevant have, to my knowledge, been withheld.

Signed: *Huade Guan*

Dated 20 March 2024