Hoffmann Drilling Pty Ltd Superannuation Fund v Gold Coast City Council & Ors

Planning and Environment Court Appeal No 137 of 2020

Joint Expert Report on groundwater issues between the following:

- **Dr Trevor Johnson (TJ) of SLR Consulting and UQ, acting for Hoffmann Drilling on groundwater**
- **Tony McAlister (TM) of Water Technology acting for Gold Coast City Council on groundwater**
- **Dr Matthew Currell (MC) of RMIT acting for the Australian Rainforest Conservation Society on groundwater**
- **Wayne Moffitt (WM) of 28^{0}S Environmental acting for Hoffmann Drilling on ecology**
- **John Delaney (JD) of Cardno acting for Gold Coast City Council on ecology**
- **Dr Robert Kooyman (RK) of Macquarie University acting for the Australian Rainforest Conservation Society on ecology**

STATEMENT TO COURT

We, the undersigned, hereby acknowledge that we have been instructed on an expert's duty to assist the Court and that, that duty overrides any obligation we may have to any party to the proceedings or to any person who is liable for our fees or expenses.

We furthermore state that no instructions were given or accepted to adopt or reject any particular opinion in preparing this report.

BACKGROUND

On 24 April 2018, Michel Group acting on behalf of Graeme Hoffmann and Chuda Kaewmongkhon as trustee for the Hoffmann Drilling Pty Ltd Superannuation Fund [**Hoffmann**] made application to Gold Coast City Council [**Council**] for a Development Permit for Material Change of Use for Extractive Industry (Commercial groundwater extraction) on land located at 263 Repeater Station Road, Springbrook. The land is described more particularly as Lot 36 on SP 139816.

By Decision Notice dated 12 December 2019, Council refused the development application, citing inter alia a number of reasons for refusal relating to groundwater and ecological issues. Thynne Macartney Lawyers, acting on behalf of Hoffmann, lodged a Notice of Appeal with the Planning & Environment Court on 17 January 2020 (No 137 of 2020), seeking the refusal to be overturned.

Subsequently, the nominated groundwater and ecology experts met separately to prepare relevant Joint Experts Reports which were completed in October 2020.

On 27 May, Council lodged Revised Reasons for Refusal with the Court, as follows:

> ***Groundwater***
>
> ***a. Suitable geological characterisation, groundwater testing and modelling investigations have not been undertaken for the site and surrounding areas to demonstrate that the proposed use is acceptable;***

b. It has not been demonstrated that the proposed extraction will not cause unacceptable environmental impacts, including when considering the cumulative impacts of the proposed extraction with other groundwater extraction operations and climate change.

Ecology

a. It has not been demonstrated that the proposed development will not have unacceptable impacts on matters of National, State and Local environmental significance that are known to occur within the site and surrounding locality, including:

(i) impacts associated with the transportation of extracted groundwater upon the safe movement of native fauna and vegetation which will need to be cleared;

(ii) impacts associated with the reduction in the availability of groundwater resources.

b. The proposed development is not consistent with the purpose of the Planning Act 2016 in that it has not been demonstrated that it would result in the achievement of ecological sustainability.

On 27 May 2021, the Court issued an order requiring the above nominated experts in groundwater and ecology to meet and prepare a combined JER by 26 June 2021. The Joint Report is to

(a) Set out the opinions of the experts in relation to the issues in dispute relevant to their field of expertise;

(b) Identify any opinion that is jointly held;

(c) Identify each matter about which the experts agree (with reasons);

(d) Identify each matter about which the experts disagree (with reasons)

Further Information

(1) On 18 June, TJ provided an additional report dated 5 May 2021 to each of the experts relating to the results of the pump test and groundwater monitoring which had been carried out on the subject site and which were documented in a report titled “Hydraulic Testing of the Hobwee Basalt Aquifer at 263 Repeater Station Road, Springbrook, SE Queensland” that was considered in, and presented as Appendix 4 to, the Ecology JER dated 06/04/2021.

(2) A copy of the report dated 5 May 2021 provided to the other experts is presented as Annexure A, and a copy of the report titled “Hydraulic Testing of the Hobwee Basalt Aquifer at 263 Repeater Station Road, Springbrook, SE Queensland” is presented as Annexure B.

The following is provided by WM

(3) In Paragraph 80(a)-(i) of the Ecology JER, I provided my assessment of potential impacts of the water extraction on ecological values. This assessment was based on my understanding (at this time) of groundwater issues. Advice from TJ dated 5 May 2021 (**Annexure A**) has provided me with new information and an improved understanding of groundwater issues that I did not possess at the time of preparing the Ecology JER. The key points are on pages 5-6 of TJ’s advice and the concluding paragraph on Page 8 which states. “*I am comfortable that the pump tests alone are sufficient for me to state that there will be no measurable impact*

from the proposed aquifer extraction on either flows in the adjoining streams, or on GDE's on this site or elsewhere."

(4) TJ's assessment, identifying that there will be no change in groundwater availability for groundwater dependent ecosystems. This in turn leads WM to conclude that there will be no impact on flora and fauna associated with the subject spring or other springs beyond the cone of depression described by TJ. MC and TM dispute TJ's assessment, leading RK and JD to express concern that there is potential for impact on ecological values. I agree that there would be impacts to ecological values and MES if there are meaningful changes to groundwater output at the spring. In this regard, the groundwater evidence becomes a threshold issue for the ecological evidence.

(5) If the Court decides to approve the proposed development, there should be a requirement to closely monitor the gully for change, as conservation significant species do occur in this area. In addition to establishing a monitoring bore, natural features of the gully that are sensitive to changes in groundwater output should be carefully documented in a baseline report and then monitored for the life of the project. I propose as follows:

(a) I described the flora values of the gully in Paragraph 80(d)-(f) of the Ecology JER. As further described in Appendix 21 of that document, species such as rainforest spinach, and to a lesser extent, Pollia, Giant Lady Fern (Diplazium dilatatum), Japanese Lady Fern (Deparia petersenii subsp. congrua) and Giant Creek Fern (Pneumatopteris sogerensis) are indicators of persistent soil moisture (refer Plate 4 of the discussion);

(b) Within the gully, the extent of these groundwater dependent target species should be mapped to a high degree of detail and their current condition documented through at least ten 1m X 1m ($1m^2$) survey plots.[1] This baseline survey should be undertaken in the seasonally dry late Winter-early Spring. The timing of the baseline survey should be maintained for future monitoring events. The % contribution of each target species to the overall foliage cover of the groundcover layer within the plot should be recorded and photographed at each monitoring event.[2] Results should be averaged across all plots but results from individual plots should also be considered. Monitoring data must be provided to Council within 4 weeks of survey completion; and

(c) The development conditions need to identify hold point criteria. These could be subject to further negotiation, but I have provided the following as an example for discussion….. if surveys identify >20% target species foliage loss (averaged across plots) or > 50% target species foliage loss in any single plot, a hold point is established that requires extraction rates to be reduced until the cause of the decline is identified. Monthly monitoring would be then undertaken to monitor plant health. If declines continued, further reductions in the rate of extraction might be required. The annual late Winter-early Spring monitoring events are the most important. If declines are observed over four consecutive years without reasonable alternate explanation, consideration may be given to ceasing the approval.

(6) In Appendix 18 of the Ecology JER I identified a list of conservation significant fauna species. Those fauna species most sensitive to change will be amphibians reliant on the flow in the

[1] The plots will commence at the current seepage point and extend along the gully to the edge of the property.
[2] A high degree of precision will be required, and I propose that permanent monitoring plots be established. The corners of the plot should consist of a metal post over which a $1m^2$ monitoring frame can be placed. The monitoring frame should be further subdivided into into $100cm^2$ units to allow for a refined examination of plant cover. A photograph of the plot should be taken for year-on-year comparison. The camera should be located over the centre of the plot, and be perpendicular to, and 1.5m above, the ground. Monitoring reports should provide plot photos and plot data from previous monitoring events to allow for direct year-on-year comparisons.

gully and on maintenance of the soaks that sit beside the gully. The conservation significant species directly reliant on habitats at and immediately below the seepage point are:

(a) Tusked frog[3] - a species that depends on the slow moving (trickling) flow of the gully to provide breeding habitat. Site surveys by Planit Consulting failed to locate this species, but habitats appear to be suitable and Tusked frog is considered a likely occurrence. If the Court decides to approve the proposed development, a condition should be imposed requiring baseline monitoring to be undertaken to confirm occurrence, and then ongoing monitoring to confirm the species persistence. Monitoring is discussed further below

(b) Neither Masked Mountain frog nor Black-soled frog[4] were recorded by the Planit Consulting surveys, but both are considered likely occurrences in the small soaks that sit beside the gully. If they occur at the Site, these species will require maintenance of the soaks. If the Court decides to approve the proposed development, a condition should be imposed requiring baseline monitoring to be undertaken to confirm the occurrence of these species. Persistence of the groundwater dependent plants (described above) is a reliable indicator for persistence of the two locally significant frogs, but targeted survey should also be undertaken in Spring-early Summer (breeding season) to confirm their persistence. Monitoring is discussed further below.

(c) A further species to consider is the GCCC locally significant Pouched frog. This species occupies moist leaf litter in areas that are often well-removed from streams. Pouched frog was not recorded from the site by the Planit Consulting surveys but is almost certain to occur in areas adjoining the subject gully and across the broader site and locality. Desiccation of the leaf litter layer would detrimentally affect this species, but this will be naturally mitigated by continued growth and development of the surrounding regrowth forest. This process could be enhanced by removing areas of lantana that are prohibiting regeneration. Supplementary planting could be considered, but facilitating natural regeneration is preferred. Notwithstanding, survey for Pouched frog should be undertaken in Spring-early Summer (breeding season) to confirm presence and persistence. Monitoring is discussed further below.

(7) If the groundwater dependent target plant species identified above persist, there is no reason to suspect that population of these conservation significant amphibians will be significantly affected. However, if the Court decides to approve the proposed development, the development conditions need to identify monitoring and hold point criteria for these amphibians. These could be subject to further negotiation, but I have provided the following as an example for discussion:

(a) Baseline survey for the identified conservation-significant amphibians should be undertaken before the commencement of the proposed development. Survey should involve a detailed traverse of the gully to record the location of individuals and to assess the robustness of the populations. An experienced observer with demonstrated expertise in the identified species will be required; and

(b) In subsequent monitoring years, at the end of each year's seasonal dry (~October) three *Song Meter* wildlife acoustic recorders are to be set at pre-determined positions along the gully. The Song Meters are intended to capture the first flush of activity (frog chorus) arising from early season storms. This method is sufficient to determine species

[3] Qld Vulnerable.
[4] Both GCCC – locally significant species.

persistence in the gully, but ground survey is also required to determine population robustness and continued occupancy of areas identified by the baseline survey

(8) If monitoring surveys fail to record each or all the target species over two consecutive monitoring periods, a hold point is established that requires extraction rates to be reduced until the cause of the decline is identified. If monitoring fails to record each or all of the target species over four consecutive years, consideration may be given to ceasing the approval.

(9) Several further conservation significant amphibians are known from the locality, including Fleay's barred frog, Giant-barred frog and Cascade tree frog. None are expected to occur in the gully directly below the extraction point, but all could occur in areas downstream (and off site). Given issues with access to private land, it is more difficult to establish monitoring for these species. However, as I have discussed in Paragraph 80(h) of the Ecology JER, I also believe that there is much lower potential for impact with progression downstream from the Site (i.e., due to the beneficial impact of contributing catchments).

(10) Other conservation-significant species are also likely to use the gully below the extraction point as part of a much broader range (Sooty Owl, Marbled Frogmouth, Rufous Fantail, Black-faced Monarch, Albert's Lyrebird, Spectacled Monarch). However, these species have broader ecological niches than the identified amphibians and use both wet (gullies) and dry (ridges) rainforest habitat. They are unlikely to be sensitive to small changes in vegetation composition and would not be particularly useful indicators of vegetation / habitat change.

(11) In Paragraphs 106-108 of the Ecology JER, I set out my position regarding the potential for vehicle strike arising from increased truck movements on the road network. On 22 July 2021, I arranged to ride in the articulated vehicle carting water from the nearby "Come-by Chance" water extraction site down the mountain to the bottling plant and return. While I understand that the vehicle to be used in the Hoffman operation will be smaller, the exercise provided further insight into the potential for vehicle strike on fauna and reinforced my earlier thoughts on there being limited potential for impact over and above that which would arise from existing use of the road by lighter vehicles.

POINTS OF AGREEMENT

(12) All relevant Points of Agreement remain unchanged from those included in the first JERs completed separately by the groundwater and ecology experts – **WM** except for issues that I have described further in this JER. There are no additional Points of Agreement.

POINTS OF DISAGREEMENT

(13) Previous Points of Disagreement contained within the first groundwater and ecology JERs remain unchanged.

(14) TJ says that the groundwater level monitoring which was undertaken on the subject site in February 2021 demonstrates that the proposed water extraction will have no measurable adverse impact on groundwater levels outside the boundary of the subject site. He also states that the monitoring shows that there will be no significant change in groundwater conditions at those locations on the site where groundwater exists close to the ground surface and sustains Groundwater Dependent Ecosystems (GDEs). He states that from a hydrological point of view, the proposed commercial extraction of water from the subject site will have no impact on these GDEs. The reasons for this are outlined in detail in TJ's report of 5 May 2021 which is attached to this JER.

(15) TJ says that the level of investigation completed in association with the groundwater level monitoring, as well as the information provided in previous assessments as outlined in the first groundwater JER, show that Council's allegation that:

> ***Suitable geological characterisation, groundwater testing and modelling investigations have not been undertaken for the site and surrounding areas to demonstrate that the proposed use is acceptable***

is unsupportable. Further groundwater investigation, monitoring and modelling would have no effect on the conclusion that commercial water extraction from the subject site does not lower groundwater levels more than 100 m from the extraction point.

(16) Further, if it is accepted that the monitoring adequately demonstrates this outcome (ie that extraction has no impact on groundwater levels external to the subject site), Council's second allegation, namely that

> ***It has not been demonstrated that the proposed extraction will not cause unacceptable environmental impacts, including when considering the cumulative impacts of the proposed extraction with other groundwater extraction operations and climate change***

is also unsupportable.

(17) TM says that monitoring and modelling work which has been conducted to date in regard to this matter is insufficient and inadequate to ensure that there will be no adverse impacts on adjacent sensitive receptors associated with the proposed groundwater extraction project. This opinion is based on a combination of the following issues:

(a) Pump test data provided for another site (133 Repeater Station Road), which is located some distance 'down slope' from the subject site, is not directly transferable to consideration in regard to the current matter due to the significantly larger area which may be influencing groundwater behaviour at this location;

(b) Pump test data provided for the subject site is either of too short a duration, or, for the one record which is of a somewhat longer duration, shows that the hydrogeology of the site is highly complex and that significant impacts could in fact occur;

(c) No pump test data are provided for a sufficiently long period of time under drier conditions of the year, wherein off-site impacts are far more likely to be observed;

(d) No cumulative impact assessments have been conducted to evaluate what, if any, additional impacts the current project may have in association with other pumping operations in the region; and

(e) The only 'modelling' which has been conducted uses an inappropriate, largely surface water based, simulation platform that:

(i) Is calibrated to streamflow data collected at a location several kilometres downstream of the site: and

(ii) Is then applied in regard to evaluations at the subject site using an inappropriate contributing area.

(18) MC agrees with the points outlined by TM above. In addition:

(a) MC disagrees that there will be 'no significant effect' on GDEs at the nominated elevation, or measurable change in water table beyond 100 m from the extraction bores. MC believes there is certain to be some level of impact on GDEs – in particular, reduced flow from springs which emanate from the basalt aquifer targeted for

extraction, down-gradient from the proposed water extraction site. The extent of this impact is currently poorly quantified, due to a lack of appropriate data and modelling investigations, and the most recent technical work on which TJ bases his conclusion does not address this, for the following reasons:

(b) The pumping test conducted is unable to determine or account for the capture[5] of water that currently supports groundwater dependent ecosystems at the site, and any other down-gradient surface water features which may be influenced by reduced discharge from the aquifer to the surface. The capture of such water cannot (as asserted by TJ on p. 6 of his report) solely be determined based on an analysis of water table heights in an aquifer during pumping.

(c) The extent of groundwater dependence of springs on the property which support downstream waterways, or their tolerance for reduced flows as a result of groundwater extraction (including the capture of discharge by pumping wells) remains uncharacterised. It is noted that the study prepared by QUT for Gold Coast City Council in 2020[6] indicates these springs likely emanate from the same aquifer targeted by the extraction bores, and as such some proportion of extracted groundwater would come at the expense of flow from these springs. This may have detrimental effects on any ecosystems dependent on spring flow, particularly during dry periods (and this has not been analysed or accounted for).

(d) The pumping test appears to have been interrupted by a significant rainfall event which made the identification of drawdown effects beyond the initial three days difficult to impossible.

(e) Bore construction details and lithology logs were lacking from the pumping test report. This means it is unclear how representative the monitoring bore water levels are of the aquifer drawdown caused by the pumping wells - i.e., it is unclear whether the monitoring and pumping bores are tapping the same depth and lithology within the aquifer. As TJ noted in his report, the aquifer is fractured and likely to be heterogeneous, and as such the geology needs to be carefully characterised to determine if monitoring bores are screening a horizon which is connected with the zone being pumped.

(f) The description and visual depiction of a drawdown cone in TJ's report may not be appropriate for the site, as the aquifer in question is a fractured rock aquifer, and is thus likely to exhibit heterogeneity and/or anisotropy (i.e., not simple, radial patterns of drawdown in response to groundwater extraction).

(g) Monitoring rates of flow (volume over time) from the springs within the gullies on the property, and other potentially impacted spring-fed streams on Fig. 1 of the groundwater JER (including Cave Creek), is essential baseline data and should be monitored for a sufficient period to determine variability under current conditions (accounting for seasonal changes). If the proposed extraction were to be approved, these flows should continue to be monitored in addition to groundwater level monitoring proposed by WM (in Paragraph 5).

(19) JD says that:

[5] Reduction of discharge of groundwater to the surface in response to pumping, as defined and explained in Alley et al., 1999 *Sustainability of Ground-Water Resources.* US Geological Survey Circular 1186.
[6] Reading, L. & Stanley, J. 2020. Springbrook Groundwater Investigation Pilot Project Final Report – July, 2020.

(a) if the position advanced by TJ, the Appellant's ground water expert, that *"… there will be no significant change in groundwater conditions at those locations on the site where groundwater exists close to the ground surface and sustains Groundwater Dependent Ecosystems (GDEs)"* is sound and free of any substantial uncertainty, then logically it could be concluded that the proposed development is not likely to have unacceptable ecological impacts on MES that are reliant on the local groundwater resource;

(b) however, there remains substantial disagreement between the groundwater experts concerning the reliability of the position advanced by TJ with both MC (the Co-Respondent's groundwater expert) and TM (the Respondent's groundwater expert) raising issues of concern regarding the adequacy of the groundwater investigations that have been undertaken on behalf of the Appellant and the reliability of the inferences that can be drawn from same;

(c) given the disagreement that exists between the groundwater experts regarding the potential impacts of the proposed development on the local groundwater resource, and the known presence on the Site and within the broader locality of a diversity of MES that are reliant on the local groundwater resource, it is my assessment that there is a material risk that the proposed development will have substantive adverse impacts to groundwater dependent MES that occur within and adjacent to the Site;

(d) the additional commentary presented by WM in paragraphs (5) to (10) reinforces my concerns regarding:

(i) the likelihood of adverse impacts on a diversity of groundwater dependent MES;

(ii) the technical and logistical challenges of monitoring and detecting adverse impacts of groundwater extraction on groundwater dependent ecosystems before they actually occur; and

(iii) uncertainty as to whether a commercially viable groundwater extraction could occur at this site in a manner that is consistent with the protection of groundwater dependent MES that occur within the site boundaries and surrounding landscape;

(e) specifically, I note in respect of the commentary presented by WM in paragraphs (5) to (10) that:

(i) I agree with WM that baseline assessments of the abiotic and biotic components of the groundwater ecosystems are required, but am of the opinion that such assessments should be undertaken prior to the commencement of any commercial groundwater extraction so that:

i. a properly informed assessment of impacts can be made; and

ii. an operational impact monitoring and management program could be developed;

(ii) the baseline assessments, and any subsequent ongoing monitoring program, should include consideration of potential off-site impacts which will present logistical issues associated with the ability to enter land supporting potentially impacted groundwater dependent ecosystems that is not under the control of the Appellant;

(iii) the baseline and ongoing monitoring should consider, in addition to the species nominated by WM, a broader suite of indicators including stream flow, water quality, aquatic invertebrates, and additional flora species selected from all forest strata

that potentially draw from the available groundwater resources which are not confined to water that is discharged from the on-site springs;

(iv) the baseline assessments, and any ongoing monitoring, should consider not only immediate vicinity of the two spring-fed waterways that occur on the subject land but also the surrounding areas that are likely to draw from the groundwater flowing towards these springs and waterways;

(v) the use of "species persistence" as an indicator of acceptable impacts would not be sufficient and would need to be supplemented by more nuanced indicators that can detect declines in species abundance, health and population viability that are potentially linked to the commercial groundwater extraction operations; and

(vi) if nominated performance indicators show that the commercial groundwater extraction is having an adverse impact on MES, the groundwater extraction should initially cease and then only recommence when specific (yet to be determined) criteria are satisfied.

(f) consistent with the precautionary principle and the achievement of ecological sustainability, it is my considered opinion that the proposed development should not be approved until such time as there is greater scientific certainty regarding:

a. the nature of the groundwater resource that is proposed to be extracted and how it interacts with the various MES that occur within and adjacent to the site;

b. the likely spatial and temporal impacts of the development on the local groundwater resource and associated potential for significant adverse impacts on the various MES that occur within and adjacent to the site; and

c. the ability to effectively regulate, via conditions, any groundwater extraction such that unavoidable impacts to groundwater dependent MES are maintained at acceptable and sustainable levels.

(20) JD says that the additional commentary provided by WM in paragraph (11) does not alter my opinions regarding the adverse ecological impacts that would be associated with the off-site transportation of groundwater, as expressed in paragraphs 23), 96), 102 and 103) of the Ecology JER dated 06/04/2021.

(21) RK agrees with the points outlined by MC and TM above and accepts their positions on the additional materials provided. RK has read the additional comments provided by TJ and WM in response and finds nothing therein that would alter his opinion as provided in the Ecology JER (dated 06 April 2021) in relation to the likely and possible impacts of the proposal on ecological matters.

(22) TJ says, in response to the points raised by MC above, that there can be no adverse impact on either springs or GDEs if these features lie outside of the cone of depression formed in the groundwater surface when pumping occur. TJ says that the definition of the cone of depression is that there is no change to groundwater levels or conditions outside of the boundary of the cone. The only question which needs to be considered is whether the nominated features (springs and GDEs) lie outside of that zone of influence. TJ says that the information derived from the pump tests is adequate for him to conclude that this is the case.

(23) WM recognises the biodiversity values of the landscape in which the Site is located, and that the Site itself supports conservation significant species (as identified by WM's investigations). TJ's groundwater assessment leads him to conclude that the proposed extraction would

cause no adverse impact on springs or GDE's. This in turn leads WM to conclude that there will be no impact on flora and fauna associated with the subject spring or other springs beyond the cone of depression described by TJ. MC and TM dispute TJ's assessment, leading RK and JD to express concern that there is potential for impact on ecological values. I agree that there would be impacts to ecological values and MES if there are meaningful changes to groundwater output at the spring. In this regard, the groundwater evidence becomes a threshold issue for the ecological evidence.

(24) If the Court is willing to approve the proposed development, I suggest that development conditions be imposed requiring ongoing monitoring for the life of the project. I consider the vegetation parameters to be monitored reliable indicators of enduring environmental value in the gully fed by the spring and have proposed limited tolerance to change before rates of extraction must be reduced or the operation cease. I also propose monitoring of conservation significant amphibians likely to occur in the gully.

Trevor Johnson
BE, MEngSc, PhD, CPEng, FIEAust, RPEQ, GAICD

Tony McAlister
BE, MEngSc, CPEng, FIE Aust. RPEQ, GAICD

Matthew Currell
PhD

Wayne Moffitt

John Delaney
BSc

Robert Kooyman

03 August 2021

ANNEXURE A

HOFFMANN DRILLING SUPERANNUATION FUNDSPRINGBROOOK WATER EXTRACTION PROPOSAL SUMMARY OF GROUNDWATER IMPACTS

5 May 2021

620.13782-L01-v0.1.docx

Thynne Macartney
Level 32, Riverside Centre
123 Eagle Street
BRISBANE QLD 4000

Attention: Ms Danielle Sibenaler

Dear Danielle

HOFFMANN DRILLING SUPERANNUATION FUND
SPRINGBROOOK WATER EXTRACTION PROPOSAL
SUMMARY OF GROUNDWATER IMPACTS

I refer to our recent discussions in relation to this matter. In accordance with your instructions, I have prepared the following brief report to summarise the result of the analysis and site investigation work completed to date on behalf of Hoffmann. In particular, I have focussed on the results of pump tests undertaken on site in February 2021.

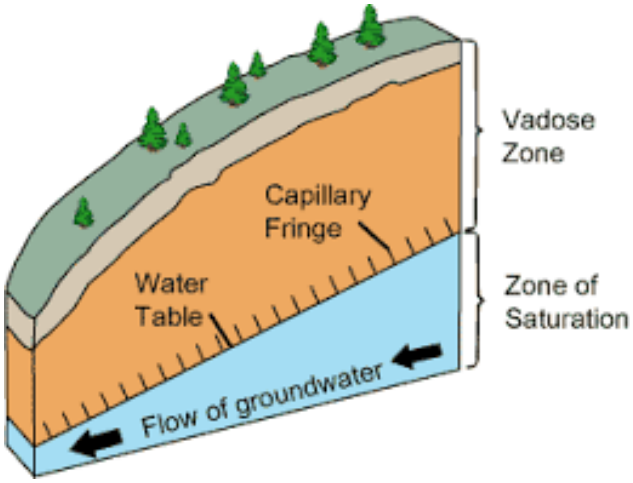
In accordance with the requirements of Rule 33 of the Planning and Environment Court Rules 2018 and Rule 428 of the Uniform Civil Procedures Rules 1999, I declare that

- I have not been given, or accepted, any instructions to reject or adopt any particular opinion in preparing this report.
- The factual matters stated in this report are true to the best of my knowledge.
- I have made all inquiries which I believe to be appropriate,
- The opinions stated in the report are genuinely held by me
- No matters of significance which I regard as relevant have, in my knowledge, been withheld from the court.
- I have been instructed on an expert's duty to the Court, understand that duty, and have discharged it in the preparation of this report.

I state that I am a civil engineer with over 43 years of relevant experience in the fields of urban development, hydraulics, water quality and engineering infrastructure. I hold the degrees of Bachelor of Engineering (Honours), Master of Engineering Science and Doctor of Philosophy, all in civil engineering from the University of Queensland. I am a Fellow of the Institution of Engineers Australia as well as a Registered Professional Engineer Queensland (RPEQ 4744) and an Adjunct Associate Professor in the School of Civil Engineering at the University of Queensland. From 1996 to 2015, I was a Director of the international consulting engineering company Cardno Ltd. I am currently employed as a Technical Director with SLR Consulting.

SLR Consulting, under my direction, prepared a report on this matter in June 2020 titled Water Balance Assessment. That report specifically did not seek to carry out a detailed groundwater assessment, since substantial work in that regard had already been completed for Hoffmann by Douglas Partners. The water balance report was intended only to demonstrate that, on a total water cycle basis, the amount of water proposed to be extracted from the aquifer was a minor component of both the rain which fell on the local catchment area, as well as the infiltration seeping to the water table. I am satisfied that the results show clearly that the planned extraction would have no measurable effect on the overall volume of water available for existing ecological and environmental requirements within the nominated catchment area.

Council and the Co-respondents to the appeal have claimed that there will be deleterious effects on existing vegetation as a consequence of the operation of the extraction proposal. I note in that regard that the majority of plants in the catchment area are not relying on the existing aquifer for their sustenance. The aquifer has been determined to be normally at a level of around 830 m AHD. Vegetation above this level will be drawing moisture from what is known as the vadose zone. This is the soil profile which exists between the ground surface and the water table. The vadose zone contains soil water which is seeping from the surface to deep drainage, some of which will eventually reach the aquifer and replenish it. There is also likely to be some capillary action which will draw water upwards from the aquifer into the vadose zone, as shown in the following sketch. However, this effect is expected to be minor, and is in any case occurring deep in the soil profile. In general, water moisture in the vadose zone will be unaffected by extraction from the groundwater.



However, it has been established that there are groundwater dependent ecosystems (GDEs) present on this site, and in the catchment generally. These GDEs are likely located on and around the locations of springs and surface seepage flows which are aquifer-fed, since these are the locations where the aquifer is close enough to the natural surface to allow such vegetation to access the aquifer itself. It is my understanding that Wayne Moffitt, the ecologist nominated by Hoffmann for this matter, has identified several species on site which he considered are contained in GDEs. By definition, these GDEs can only exist at, or below, the level of the water table, ie the upper level of the aquifer. Above the water table level, plants will be drawing moisture from the vadose zone, and not from the aquifer.

In the Ecology Joint Experts Report, Mr Moffitt has expressed a number of concerns in respect of the potential impact of groundwater extraction on the level of the water table, and the subsequent potential impact on existing GDEs on site. In this regard, he has stated that "further clarity could be provided by the groundwater experts". In the Ecology JER, Mr Moffitt also made reference to further groundwater work, specifically on-site pump testing, completed by Iain Hair of Douglas Partners in February 2021. It seems from his comments that Mr Moffitt has drawn conclusions and made inferences from that pump testing which may not actually be correct.

The key purpose of this current report is then to review the pump testing report, so as provide Mr Moffitt with the guidance that he has sought.

In February 2021. Mr Hair attended the site with the applicant, and installed electronic piezo-metric water level monitors in a number of existing bores on that land. The location of the various bores is shown on the following extract from the Hair report (which is attached hereto in toto for completeness).

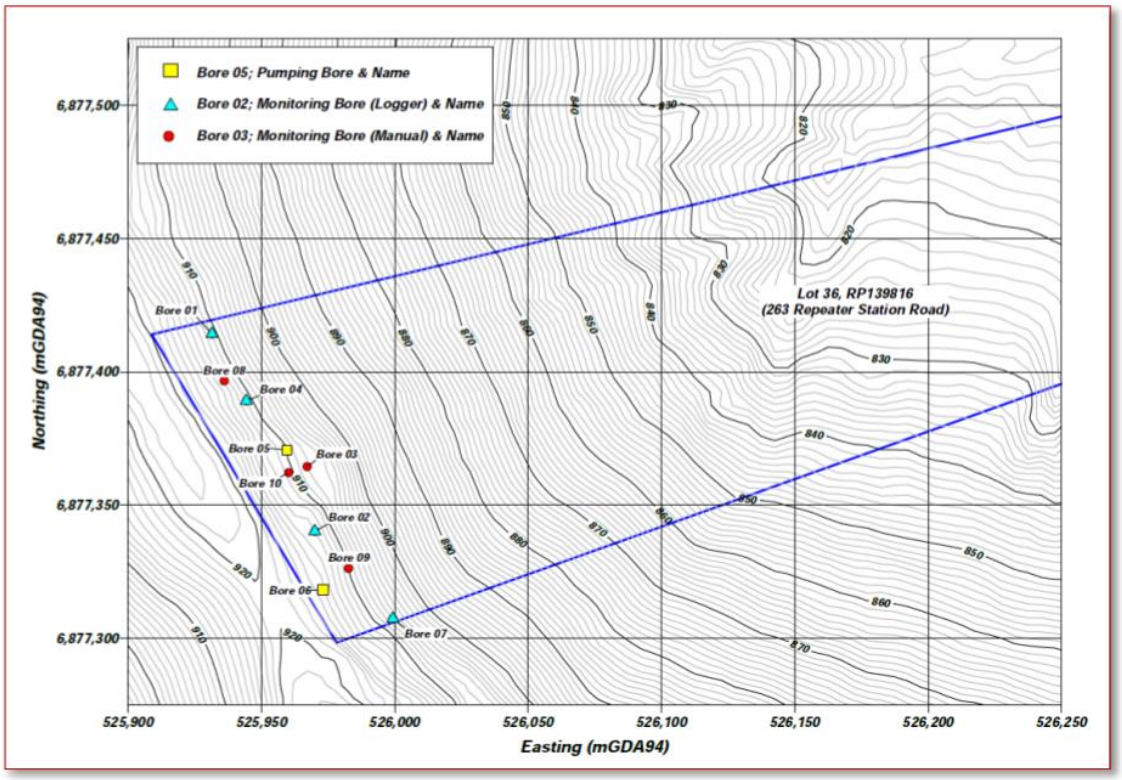
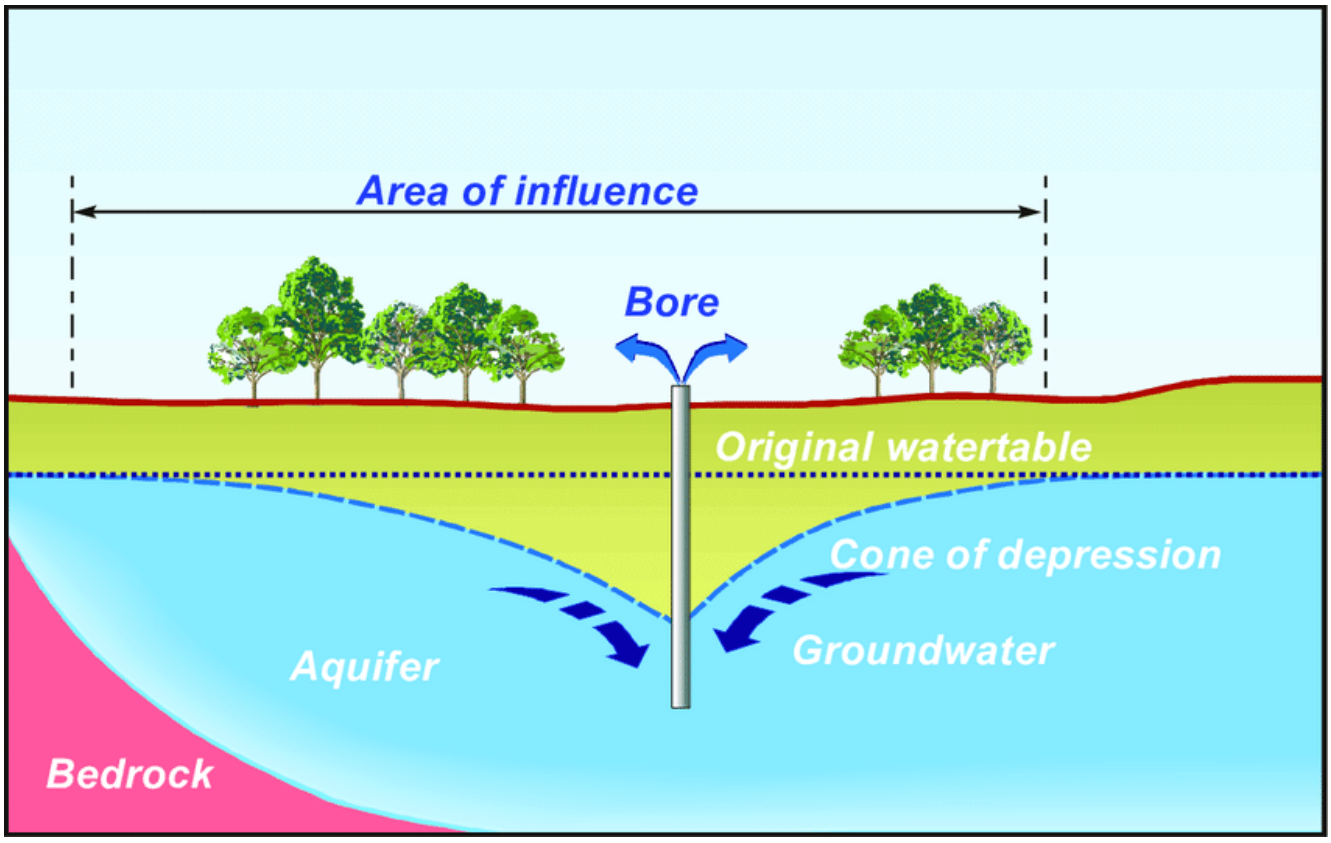


Figure 1: Locations of Production (Pumping) and Monitoring Bores at 263 Repeater Road

The pump test then took place, whereby a continuous extraction rate of 0.5 L/s was taken from the aquifer. Bores 5 and 6 were pumped continuously for a period of 168 hours. In effect, however, only the first 72 hours of the test is considered applicable, since extensive rain fell in the catchment after that time and caused increases in the water table level in a number of the bores.

In this context, the pump test is intended only to determine the extent of the cone of depression which forms in the aquifer when extraction occurs. This behaviour is illustrated on the following sketch:



There is a maximum drawdown in the water table level at the pump site which reflects the rate of pumping. As the distance from the bore increases, the gradient of this drawdown decreases since the extraction is now occurring from a much larger area (and volume). Eventually, at some finite distance from the bore, the water table level is virtually indistinguishable from the pre-pumping level. At this location, the cone is so large that the volume being extracted has no measurable effect on the water table level.

By monitoring the depression in the water table at points distant from the bore, one hopes to be able to determine the area of influence, and the distance at which any impact on water table level is effectively negligible.

In an ideal outcome, the area of influence would be confined to the site itself, such that there was no adverse impact on water table level external to the boundaries, and there would be no impact on adjoining anthropogenic use of water from the same overall aquifer. That outcome was achieved on this site, as shown in the plot on the next page. At the monitoring bores on the northern (bore 01) and southern (bore 07) boundaries, the impact of pumping over the three days was, at most, less than 0.5 m. For all practical intents and purposes, the extraction of 0.5 L/s from the unconfined aquifer on this site has no impact on other nearby properties.

There is obviously a further compliance requirement in this case, which is that the extraction should not significantly affect the level of the water table in the vicinity of any GDEs.

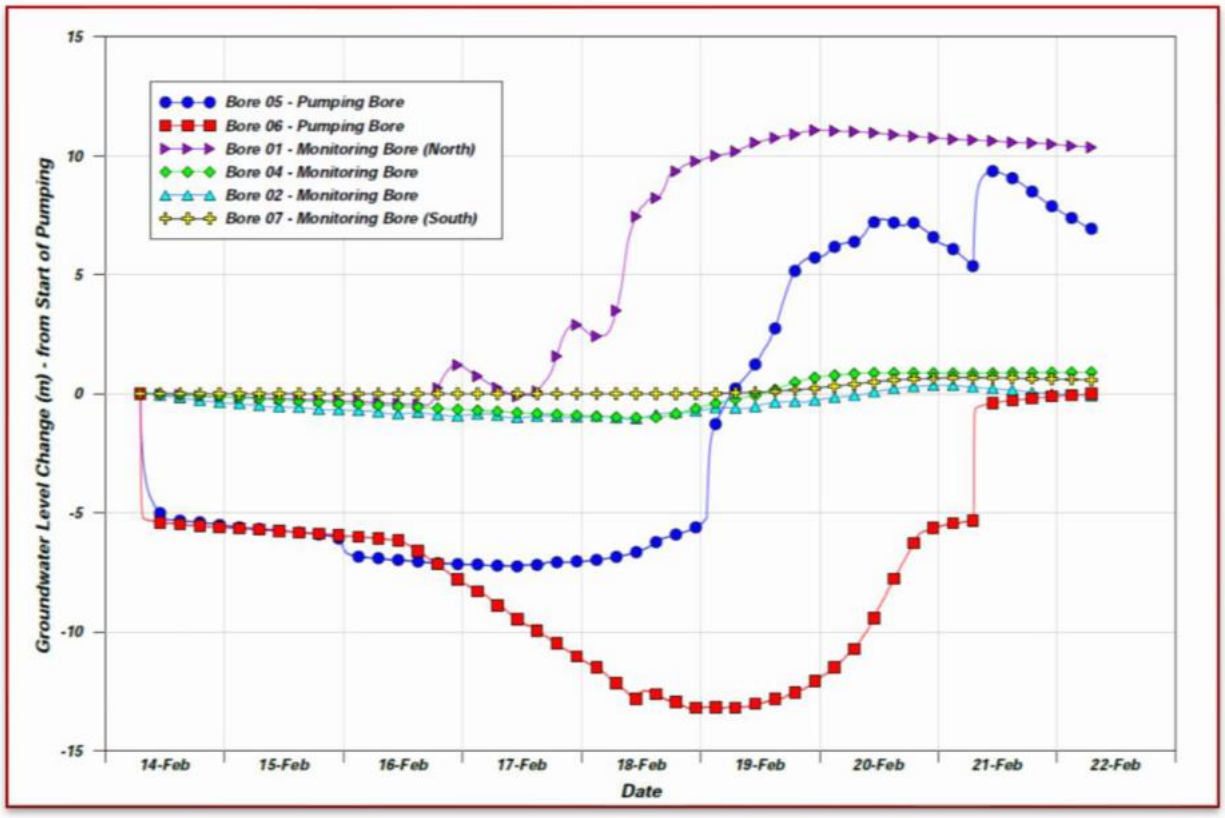


Figure 2: Groundwater Levels recorded in Production (Pumping) and Monitoring Bores over the Period 14 to 22 February (inclusive).

In that regard, the results require some interpretation. Based on the contour map of the site (Figure 1 above), the 830 m AHD contour level is about 170 m east of the line of bores at its closest location. In comparison, bore 07 is about 28 m from pumping bore 06, while bore 01 is about 52 m from pumping bore 05. Consequently, the bore water level plots indicate that the area of influence extends no more than 52 m from the pumping bores. Areas outside of the area of influence will remain unaffected by pumping at a rate of 0.5 L/s.

Therefore, I expect that there will be no change at a location more than 170 m from the pumping bores. There is an existing spring and wet seep at the 830 m AHD contour location which was inspected by Mr Moffitt and me in late 2020. Site inspections undertaken by others during the pumping test did not disclose any apparent change in conditions at this location.

Based on these findings, I can reasonably conclude that the proposed extraction will have no significant effect on the availability of water to the GDEs present in the catchment at around the 830 m AHD level. While there is likely to be a significant reduction in the water table level in the vicinity of the pumping bores (up to 15 m based on the pump test), there will be no measurable change at points more than 100 m away in any direction.

Mr Moffitt has asked whether the results are likely to be different during the drier part of the year. In my opinion, the water table level is likely to fall somewhat in the low-rainfall months as a result of climatic conditions, although the location and extent of the GDE vegetation shown to me Mr Moffitt indicates that this natural variation is small. I do not expect that there will be a major change in hydraulic behaviour as a result of this lowering.

I expect that groundwater extraction in winter will therefore continue to have no measurable impact on water table levels outside of the nominated 100 m area of influence, which the GDE areas are outside of by some distance.

I note that there is no monitoring bore located in the vicinity of the 830 m AHD contour on the subject land. Ideally, a bore can be established at a point somewhat higher than the nominated GDE location, so that any changes in the water table level at this location can be monitored in real time. However, I note that access to this area by a drilling rig is likely to be quite difficult, and a bore located in flatter country somewhat below the seepage location may be the best outcome achievable.

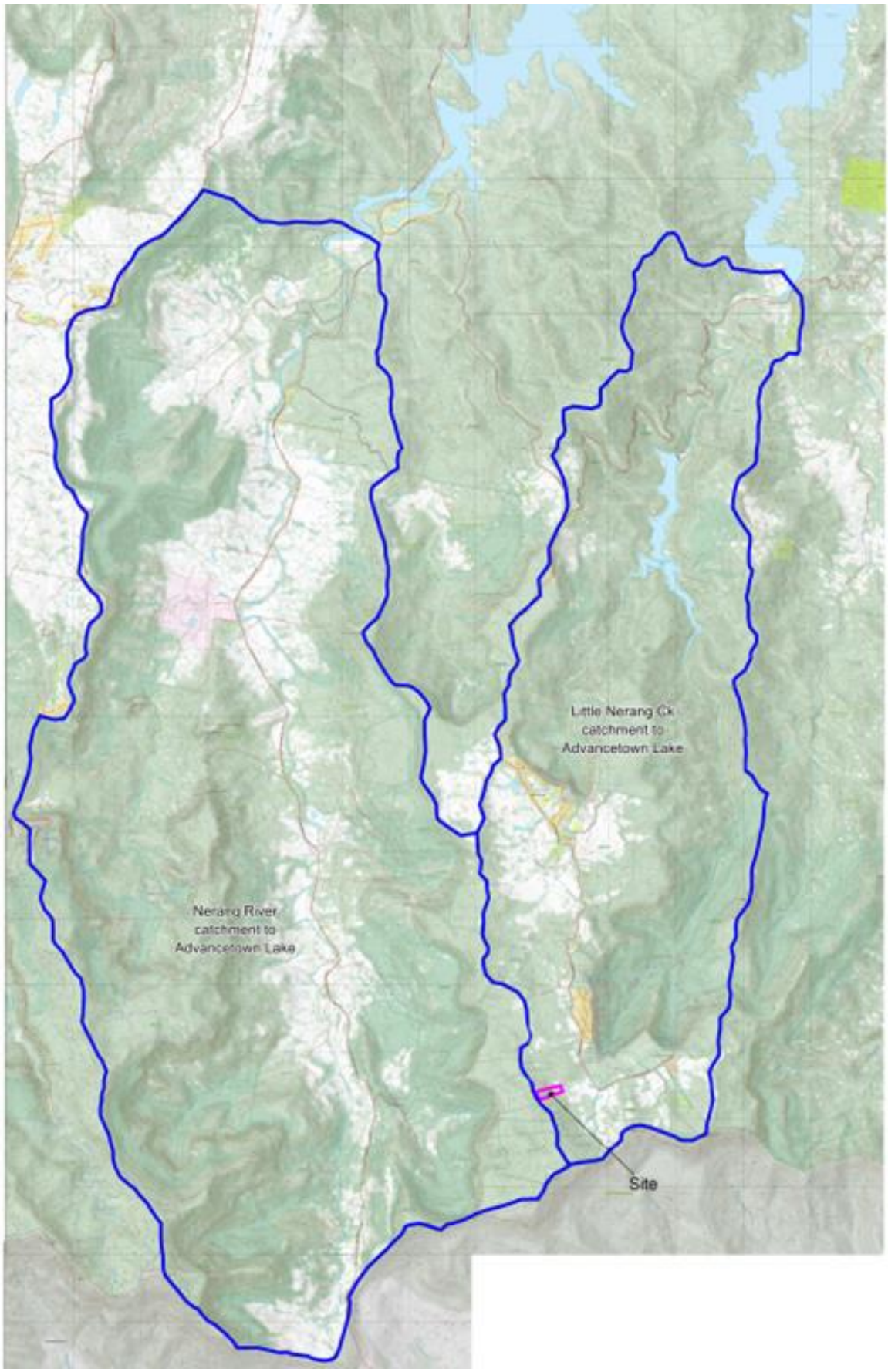
The water table level monitoring results shown in Figure 2 indicate that the aquifer under the subject site is not uniform and contiguous. Based as it is on fractured rock, it would be expected that there would be a degree of compartmentalisation, heterogeneity and fracture flow in respect of connectivity. The experts for Council and the Co-Respondents make much of this issue in stating that the proposed aquifer extraction should not proceed unless a much more extensive groundwater investigation, in terms of breadth of issues as well as duration, is undertaken. I do not agree with this position for the following reasons.

In reality, the only groundwater issue of concern here is whether the proposed aquifer extraction will have an adverse impact on water table levels in the catchment, and thereby on either surface water flows in nearby watercourses or on vegetation which is reliant on groundwater. In that respect, the parameters of the Springbrook aquifer are irrelevant. The only issue which matters is whether the extraction will lower the water table level to an unacceptable degree. I don't need to know the intricacies of the aquifer to reach a conclusion in this regard. I only need to carry out the pumping test.

The extent of the Nerang River and Little Nerang Creek catchments in comparison to the Hoffmann site is shown on the plan on the following page.

The base flows in these two streams are supplied by groundwater from the adjacent higher areas over their entire lengths. The pump tests indicate that extraction of 0.5 L/s from the Springbrook aquifer will have no effect on the water table level beyond the boundary of the Hoffmann site. Hence the only possible impact of the extraction on surface water discharges occurs within the boundary of the site. The above map shows that the site is only a minute fraction of the total catchment area of the two streams. Common sense dictates that the effect of this extraction on base flows in the Nerang River and Little Nerang Creek will be immeasurably small. This will be the case even if the cumulative impact of all extractors is considered.

The first part of the test is therefore complied with without any requirement to undertake more extensive groundwater investigations.


Little Nerang Ck
catchment to
Advancetown Lake
Nerang River
catchment to
Advancetown Lake
Site

The second part of the test is whether extraction will affect ecology in the catchment area. Again, the results from the pump testing are instructive and illuminating. These tests show that there will be no effect on water table levels at a distance of more than 100 m from the pumping bores. Provided that the nominated GDEs are outside of this area of influence (as I understand they are), there will be no measurable effect on the water table level.

The water table level will of course continue to fluctuate in accordance with the natural cycle, ie, it will generally be higher in summer than in winter, and it will respond quickly to rainfall. This behaviour in relation to rainfall is apparent in the pump test results which show significant increases in water level in bores 01, 05 and 06 immediately following rainfall. It is of interest, but of no concern to this matter, that bores 02, 04 and 07 did not show the same response. This variation in behaviour in bores located in close proximity does indicate that variable conditions and compartmentalisation clearly exist in the Springbrook aquifer at this location. The aquifer, at least in this area, is likely to be made up of a number of smaller cells which are interconnected at some level by the faults and fissures in the bedrock.

This may be of academic merit. However, it is inconsequential to the matter now before the Court. The only information which is needed from the pump test is the determination that the planned extraction from the aquifer will have no impact on water table levels at distances more than 100 m from the pumping bores.

I am comfortable that the pump tests alone are sufficient for me to state that there will be no measurable impact from the proposed aquifer extraction on either flows in the adjoining streams, or on GDEs on this site or elsewhere.

Yours sincerely

DR TREVOR JOHNSON
Technical Director

ANNEXURE B

HYDRAULIC TESTING OF THE HOBWEE BASALT AQUIFER AT 263 REPEATER STATION ROAD, SPRINGBROOK, SE QUEENSLAND

Hydraulic Testing of the Hobwee Basalt Aquifer at 263 Repeater Station Road, Springbrook, SE Queensland

Introduction

A springwater bottled water source is proposed for the Hobwee Basalt Aquifer at 263 Repeater Station Road, Springbrook. The property is owned by Mr Graeme Hoffmann of Hoffmann Drilling Pty Ltd. A total of 10 bores have been drilled on the property; two are production (pumping) bores, a third is a backup production bore, and the remaining seven (7) bores are utilised as groundwater monitoring bores. The layout of bores drilled on the property is shown on Figure 1.

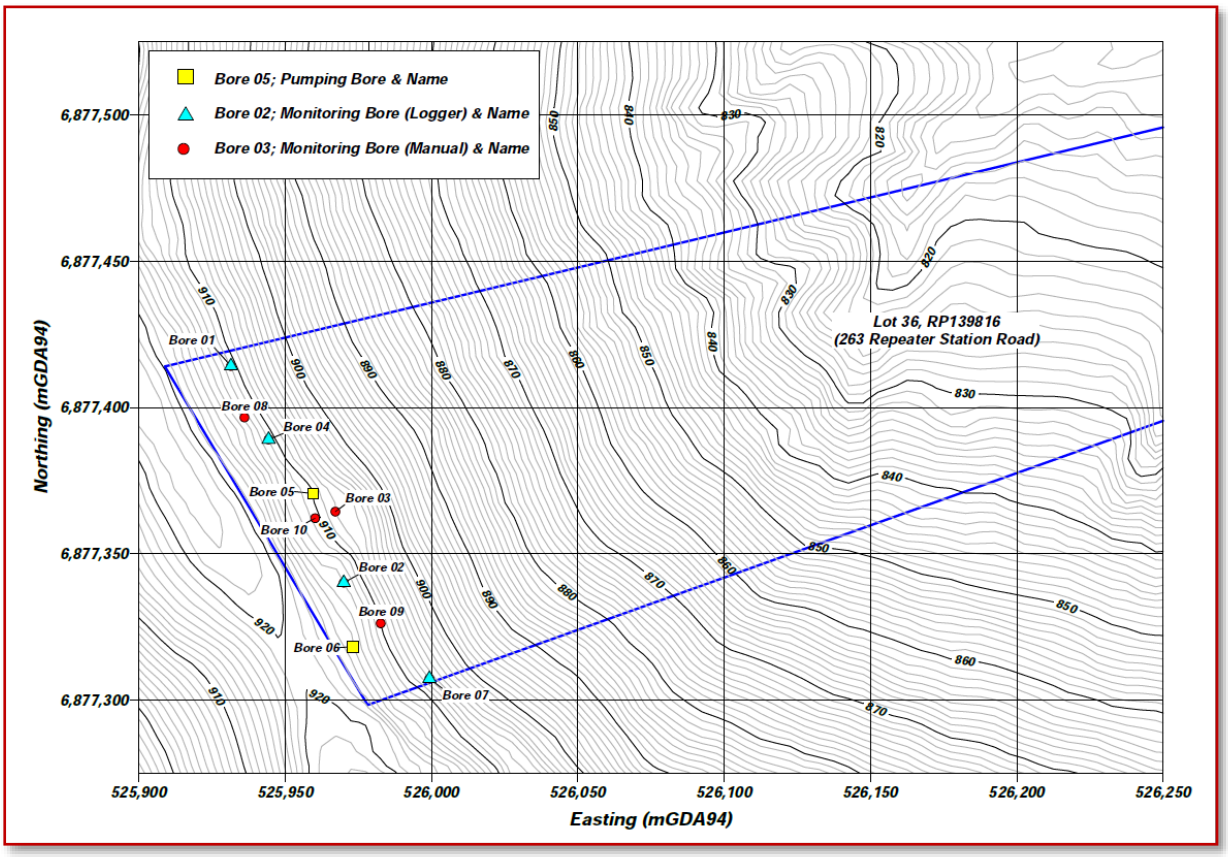


Figure 1: Locations of Production (Pumping) and Monitoring Bores at 263 Repeater Road

Test Pumping & Methodology

Bores 05 and 06 were pumped concurrently from 0700 hrs on 14 February to 0700 hrs on 21 February, a total of 168 hours pumping. The combined discharge rate was 0.5 L/s. Following cessation of pumping, recovery of groundwater levels was recorded for a period of 26 hours.

Groundwater levels were recorded using Solinst Levelogger 5 loggers installed in both pimping bores and in monitoring bores:

- Bore 01 – on the northern boundary of 263 Repeater Station Road;
- Bore 04;

- Bore 02; and
- Bore 07 - on the southern boundary of 263 Repeater Station Road.

Logging of groundwater levels in these 4 monitoring bores provided an even coverage of data across the property. Loggers were set to record at 1 minute intervals. Groundwater level data recorded during the test pumping program are plotted as metres below (drawdown), or above the starting water level for each bore in Figure 2.

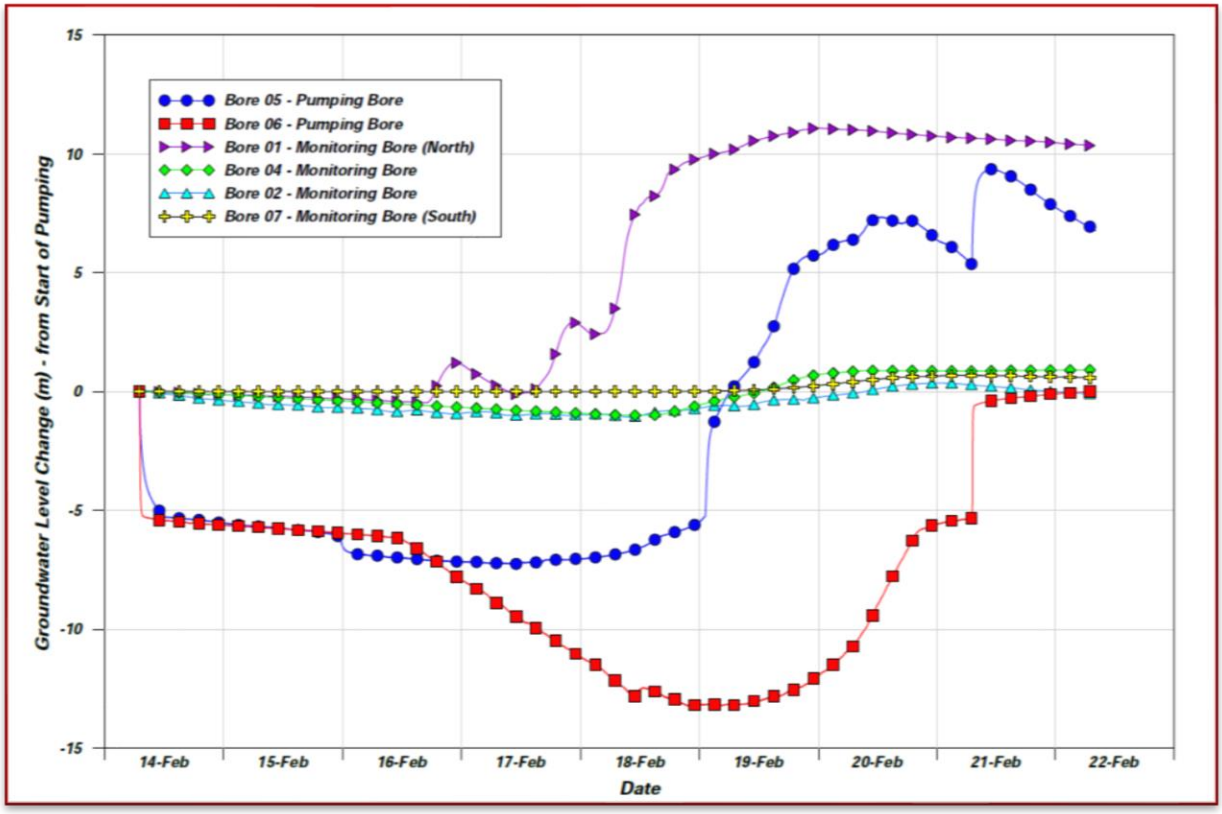


Figure 2: Groundwater Levels recorded in Production (Pumping) and Monitoring Bores over the Period 14 to 22 February (inclusive).

Results

Pumping Bores

Groundwater levels were recorded in both pumping bores (Bore 05 and Bore 06). Results in terms of metres drawdown with respect to levels at the commencement of pumping are shown in Figure 3. Both bores were pumped at ~0.25 L/s for a total discharge of 0.5 L/s.

Figure 3 shows that the maximum drawdown recorded in Bore 05 was ~7.3 m, which occurred approximately 3 days after pumping began. Thereafter, pumped water levels in Bore 05 were affected by rainfall recharge. While still pumping, groundwater levels rose ~14.4 m indicating good aquifer recharge in the vicinity of this bore. At the end of pumping, groundwater levels in this bore were still ~5.3 m above the level at start of pumping.

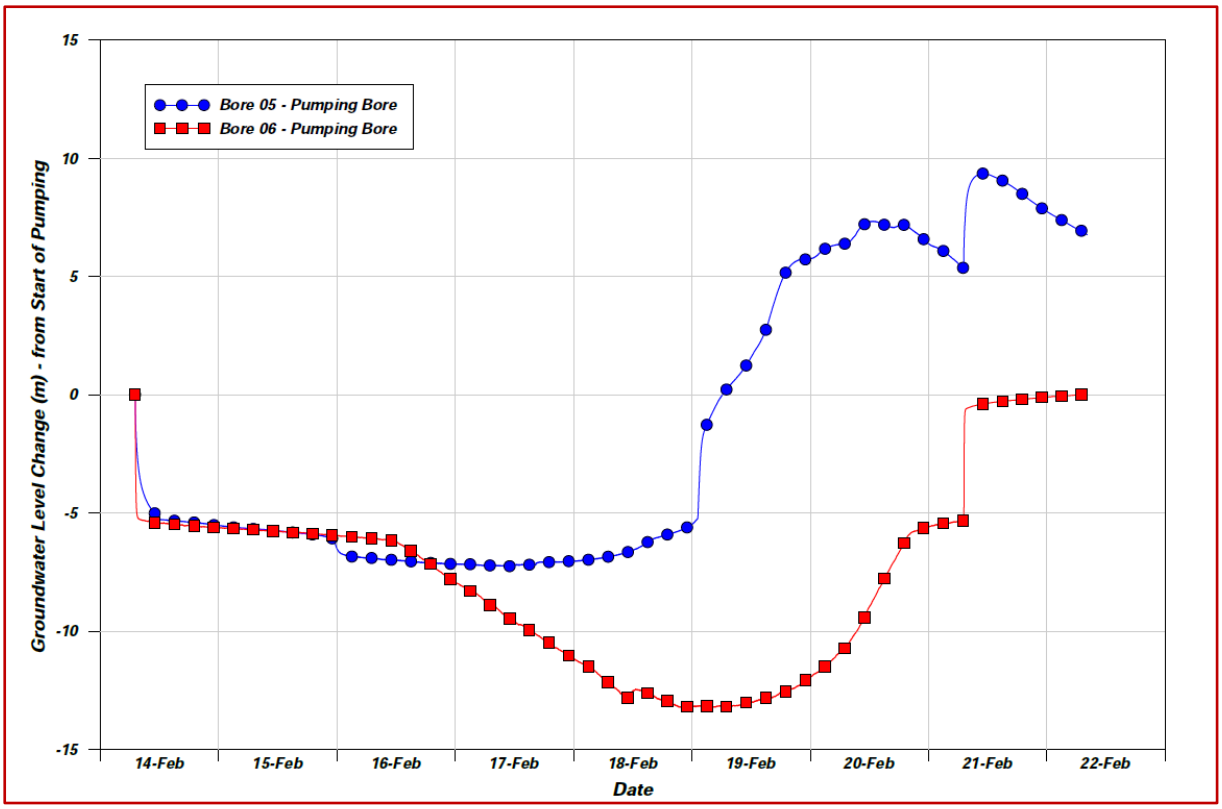


Figure 3: Groundwater Levels recorded in Production (Pumping) Bores over the Period 14 to 22 February (inclusive).

Figure 3 shows that the maximum drawdown recorded in Bore 06 was ~13.2 m, which occurred almost 5 days after pumping began. Thereafter, pumped water levels in Bore 06 were affected by rainfall recharge. While still pumping, groundwater levels rose ~-5.4 m indicating reasonable recharge in the vicinity of this bore. At the end of pumping, groundwater levels in this bore were at -5.4 m (drawdown) with respect to the level at start of pumping.

Recovery was swift in both bores with a recovery of ~5.0 m in Bore 05, and a recovery of ~4.4 m in Bore 06 within a few hours of pumping stop (Figure 3).

Monitoring Bores at Property Boundaries

Bore 01 and Bore 07 are located at the property boundaries of 263 Repeater Station Road. Bore 01 is located adjacent to the northern boundary, and Bore 07 is located adjacent to the southern boundary. Groundwater levels recorded in these bores during the test pumping program are shown in Figure 4.

The maximum drawdown recorded in Bore 01 was 0.47 m on 16 February at about 5:00 PM. Thereafter, groundwater levels rise due to rainfall recharge. Groundwater levels rose to >10 m higher than the pre pumping test level and remained at that level for the remainder of the test. The area near Bore 01 is obviously an area of high groundwater recharge.

Groundwater levels in Bore 07 did not decline at all during the test pumping. A slight rise occurred due to rainfall recharge. The groundwater level remained elevated by ~0.6 m at the end of the test pumping program.

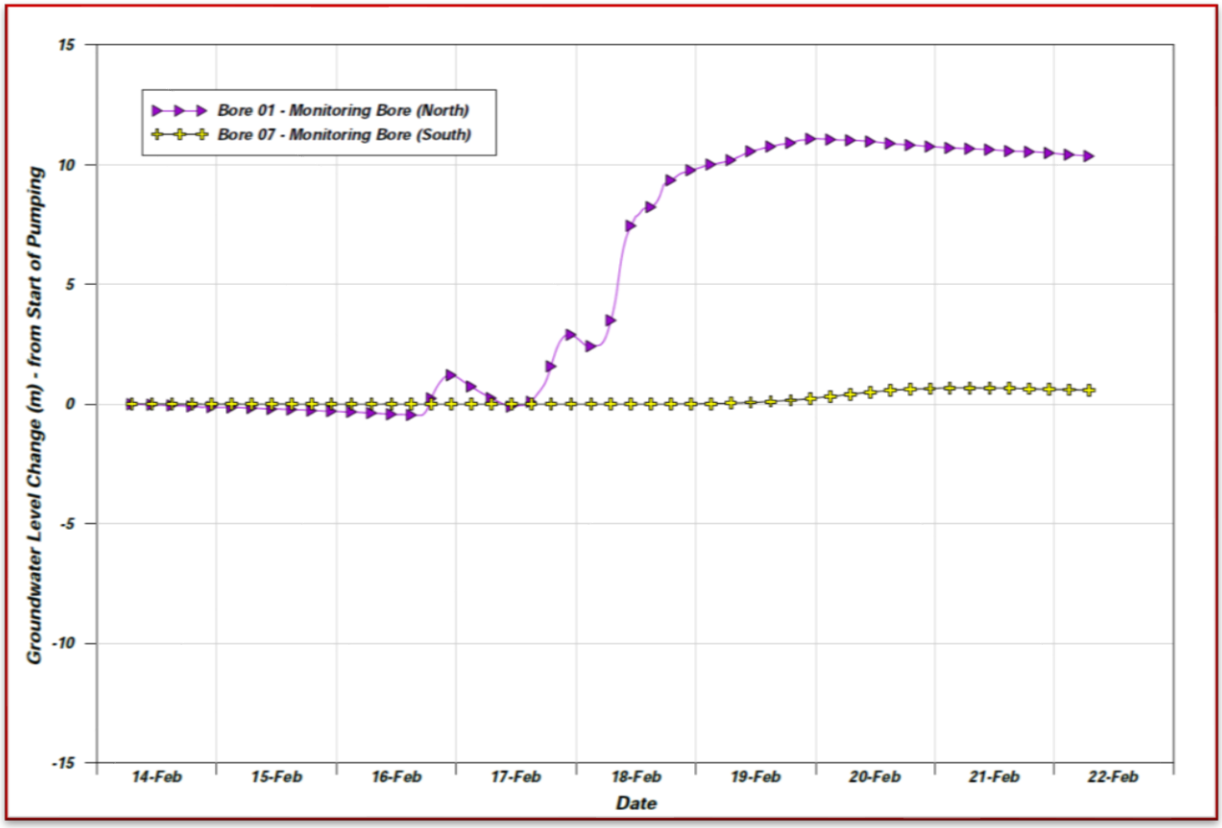


Figure 4: Groundwater Levels recorded in Monitoring Bores on the Property Boundaries over the Period 14 to 22 February (inclusive).

Other Monitoring Bores

Groundwater levels were also monitored in Bore 04 and Bore 02. Hydrographs (Figure 5) show groundwater levels recorded in these bores during the test pumping. A maximum drawdown of ~1.0 m was recorded in Bore 04, and a maximum drawdown of ~1.1 m was recorded in Bore 02. Steady rises from rainfall recharge were recorded in these bores post 18 February.

At the end of the test pumping program, groundwater levels in these bores were higher than at the start of pumping.

The hydrographs of these bores indicate that groundwater levels at 263 Repeater Station Road do not decline much apart from at the pumping bores (Bore 05 and Bore 06) themselves.

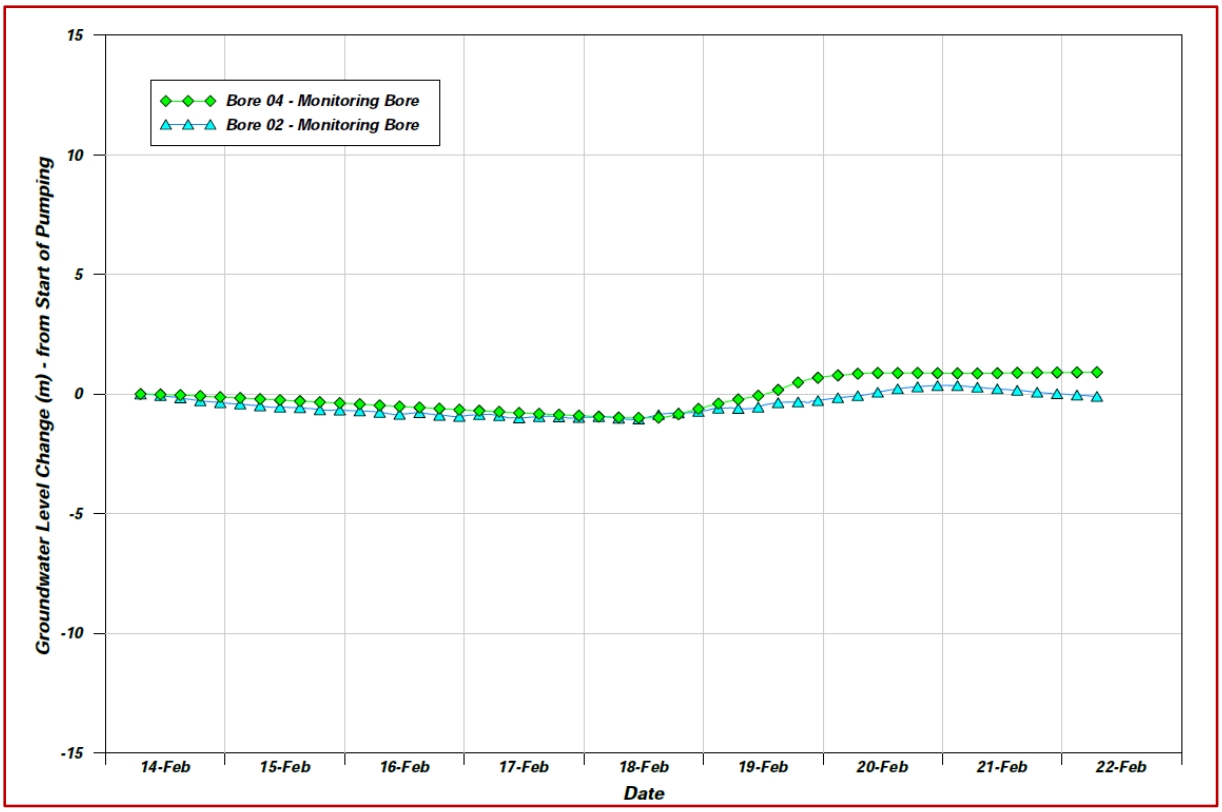


Figure 5: Groundwater Levels recorded in Monitoring Bores 02 and 04 over the Period 14 to 22 February (inclusive).

Conclusions

From a structured test pumping program at 263 Repeater Station Road over a seven (7) day period, the following conclusions can be drawn:

- The Hobwee Basalt Aquifer appears to be very "compartmentalised" with rainfall recharge being more prominent in some areas of the aquifer. Overall, the aquifer is readily recharged by rainfall events;

- Pumping at a rate of 0.5 L/s is sustainable in the long term with minimal or no impact on other groundwater users or the environment. Drawdown is quite limited outside the immediate area of the pumping bores; and

- The rate of seepage from springs on the property does not diminish during pumping from Bores 05 and 06 in the short term. Seepage from these springs is known to reduce (naturally) over prolonged periods, to being damp patches only.