



Our ref: 1646_DPIE_MEDM_Review211203

17 December 2021

Ann Hagerthy

Senior Compliance Officer

Department of Planning, Industry and Environment

PO Box 3145

SINGLETON NSW 2330

Submission via NSW Major Projects Portal

Dear Ann

RE: Review and Update of the Maximum Extraction Depth Map for the Mackas Sand Project (PA 08_0142)

Following completion of the 2021 Mackas Sand Project Independent Environmental Audit (IEA) on 30 July 2021 and in accordance with Schedule 3 Condition 3 of PA 08_0142, a revision and any subsequent update of the Maximum Extraction Depth Map (MEDM) was required to be undertaken. Mackas Sand Pty Limited (Mackas Sand) engaged Umwelt (Australia) Pty Limited (Umwelt) to undertake the revision of the MEDM for the Mackas Sand Project (the Project).

Following the review of the MEDM, Umwelt provided Mackas Sand the following recommendation:

“...that the Maximum Extraction Depth Map not be updated until additional monitoring data is collected to improve the hydrogeological understanding of the site, particularly the response of groundwater levels to rainfall events”.

As recommended by Umwelt, Mackas Sand did not update the MEDM for the Project in the revised Mackas Sand Soil and Water Management Plan (Umwelt, 2021) which was submitted to the Department of Planning, Industry and Environment (DPIE) on the 30 November 2021.

Furthermore, to improve the hydrogeological understanding of the Project site, Mackas Sand will undertake the recommendations that have been provided by Umwelt in their review of the MEDM (see the ‘Mackas Sand Quarry Groundwater Review’ letter which has been attached to this letter). These recommendations include a review of the integrity of the groundwater bores on site and the installation of groundwater loggers to measure groundwater level at hourly intervals for a period of 6 months, with this data to be utilised in a review of the MEDM to be undertaken in 2022.

If you require any further details or have any questions in relation to the above, please do not hesitate to contact me on 0408 490 911.

Regards,

A handwritten signature in black ink, appearing to read "R McKenzie", is written over a light blue horizontal line.

Robert McKenzie

Director Mackas Sand Pty Limited

26 November 2021

Robert Mackenzie
Director
Mackas Sand & Soil Supplies Pty Ltd

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Dear Robert

RE: Mackas Sand Quarry Groundwater Review

Umwelt has been engaged to conduct a data analysis review of the observed groundwater monitoring data in association with the site groundwater model and the associated Maximum Extraction Depth Map at the Mackas Sand Quarry (Site), NSW. The site operates under Development Consent (PA 08_0142), issued in 2009 and most recently updated in 2016 for Modification 2.

The allowable depth of sand extraction is dependent on predictions of maximum groundwater levels as outlined in Condition 7 of Schedule 2 of the development consent, which states the following:

“The proponent shall not undertake any sand extraction:

- (a) Within 0.7 m of the maximum predicted groundwater level on Lot 220; and*
- (b) Within 1.0 m of the maximum predicted groundwater level on Lot 218, unless the core testing program demonstrates that extraction to within 0.7 m of the maximum predicted groundwater level can be undertaken without disturbing acid sulphate soils.”*

Maximum predicted groundwater levels and maximum extraction depth maps were developed from a numerical groundwater model undertaken by Umwelt (2011).

Condition 3 of Schedule 3 of the development consents, states the following:

“Within 3 months of the completion of the Independent Environmental Audit (see condition 5 of schedule 5), the Proponent shall review and update as required the Maximum Extraction Depth Map for the project to the satisfaction of the Secretary”

It is understood that the Independent Environmental Audit was completed in July 2021. Furthermore, predicted groundwater levels were recently simulated for the period January 1997 to December 2019 by GHD (2020) using the existing site model developed by Umwelt (2011). The GHD (2020) results state a close match between their modelled and observed groundwater levels for the simulated period, with the modelled maximum (GHD 2020) showing a general match to the modelled maximum by Umwelt (2011).

The purpose of this report is to present the observed groundwater levels measured during 2020 and 2021 (up to Quarter 3 2021) for the six site monitoring bores compared to historical trends and the maximum predicted groundwater levels estimated by Umwelt (2011).

1.0 Review

1.1 Bore Network and Construction Details

Monitoring bores at Mackas Sand include two bores located on the northern edge of the Lot 218 extraction area (SP5 and SP6) and 4 bores located around the perimeter of Lot 220 (SP1 to SP4). Due to sand encroachment, monitoring point SP6 was replaced by BL158 in 2011, which is located about 100 m away from SP6. Groundwater monitoring locations are detailed in the Mackas Sand Soil and Water Management Plan (2014). Groundwater levels at these monitoring points have been monitored since July 2008. From March 2010 onwards, groundwater levels have typically been measured quarterly.

1.2 Review of 2020 and 2021 Observed Groundwater Levels and Rainfall

Rainfall data from the Bureau of Meteorology at Station 61078 at Williamstown RAAF Base has been downloaded for the period Jan-1900 to Nov-2021. Based on this data a Cumulative Rainfall Deviation (CRD) has been computed to show long-term rainfall trends within this period. An upwards trend in the CRD represents a period of above-average rainfall, and a downwards trend a period of below-average rainfall.

Figure 1 shows the CRD for the period March 2010 to September 2021 together with observed groundwater levels at the six monitoring bores. The CRD marks a period of below-average rainfall between 2016 and the first quarter of 2020. From the second quarter of 2020 to the first quarter of 2021, a period of higher-than-average rainfall occurred. Rainfall for Williamstown RAFF Base during 2020 was the twelfth wettest on record since records began in 1942, and rainfall so far during 2021 (up to October) is the fifth highest on record.

Except for SP4, observed groundwater levels at the site show a good correlation with rainfall, e.g. a sharp rise in the CRD at the start of 2021 shows increasing groundwater levels. SP4 shows a weaker correlation to rainfall, which is likely caused by its proximity to a drain (Umwelt, 2011). The quarterly measurement frequency of groundwater levels provides a data resolution suitable for understanding broader potential impacts to groundwater, however the quarterly frequency may result in correlation between rainfall events and groundwater levels to not be able to be replicated in groundwater modelling outputs.

Over the monitoring period March 2010 to September 2021, the maximum water levels were recorded from January 2020 for all bores, except SP4. This observation corresponds with the observed rainfall trends, with the area experiencing above average rainfall since 2020.

It is noted that SP1 shows an observed head of 0.83 mAHD measured on 17 March 2021. This measurement is very low given the historical trends of rainfall and groundwater levels at this and other monitoring sites, and therefore this measurement could be erroneous.

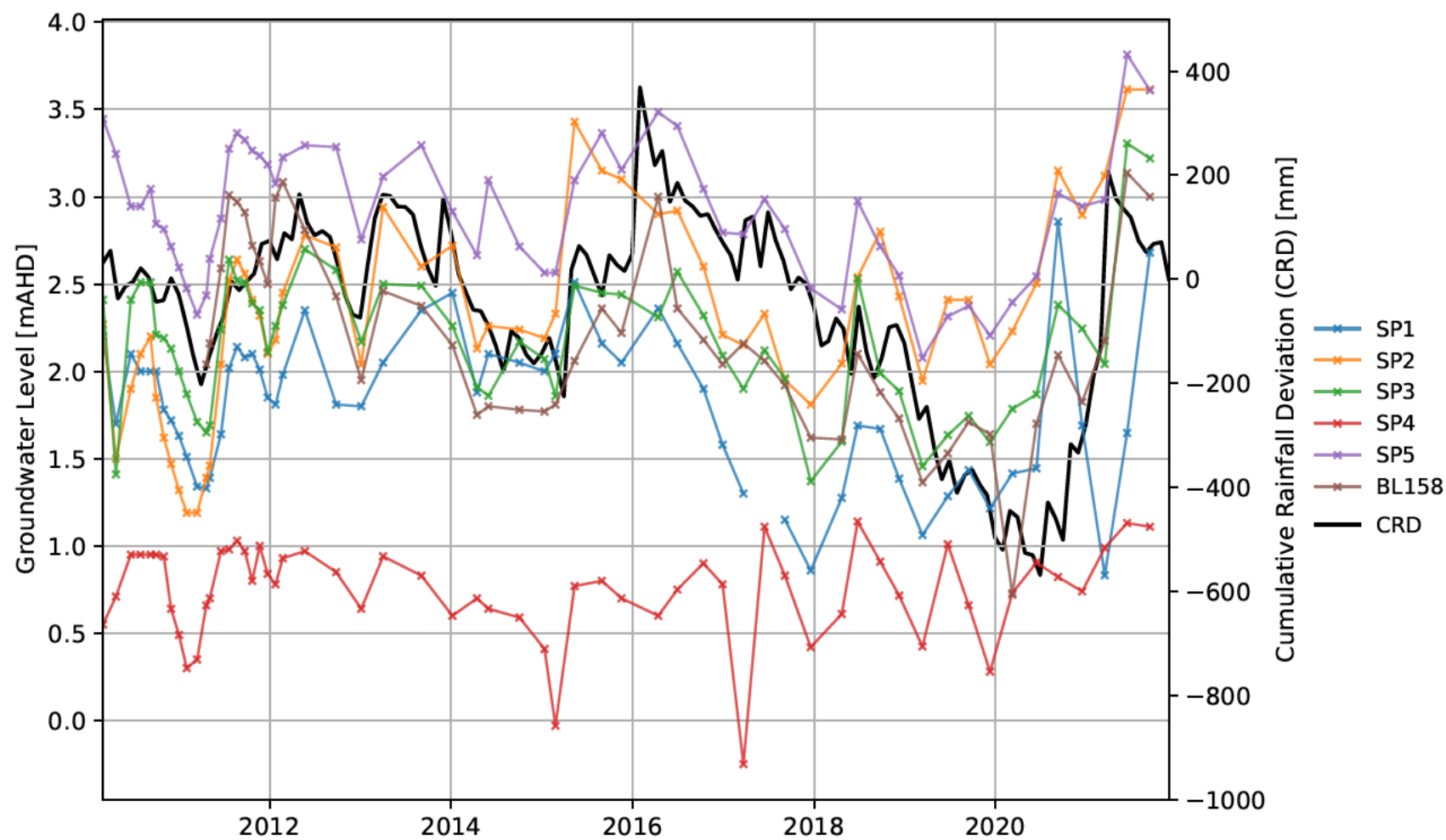


Figure 1 Observed Groundwater Levels and Cumulative Rainfall Deviation

1.3 Comparison with GHD (2020) Model and Umwelt (2011) Maximum Groundwater Levels

Figure 2 compares the most recent groundwater level monitoring data with modelled groundwater levels developed by GHD (2020) and maximum estimated groundwater levels developed by Umwelt (2011). Key observations are summarised as follows:

- Maximum observed groundwater levels exceed the maximum predicted groundwater levels modelled by Umwelt (2011) for bores SP2, SP3 and SP5 during the period 2020 and 2021. It is noted that SP5 did not exceed this limit prior to this period.
- The exceeded groundwater levels for bores SP2, SP3 and SP5 correspond to above average rainfall years during 2020 and 2021.
- Quarterly monitoring frequency may not always capture short-term temporal changes in groundwater level i.e. peaks in water level which typically occur after rainfall events may not be captured by the quarterly monitoring.
- Modelled groundwater levels by GHD (2020) only extend to December 2019, which does not capture the recent period of high rainfall.
- The GHD (2020) model does not replicate the maximum observed groundwater levels at SP2, SP3, SP5 and BL158.

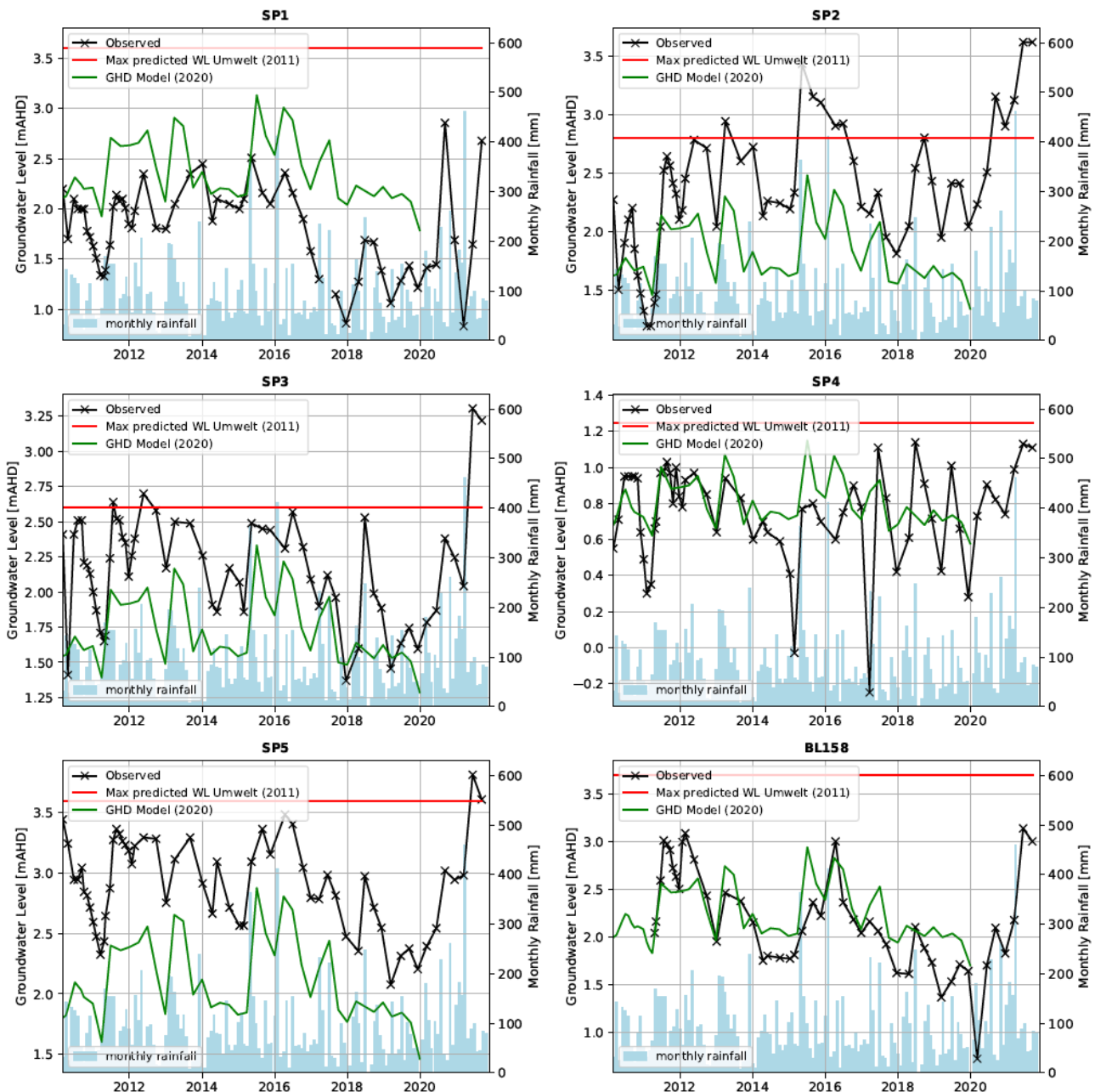


Figure 2 Observed and Modelled Groundwater Levels

1.4 Review of Maximum Extraction Depth

Conditions 7a and 7b of Major Project Approval 08_0142 specifies that the base of the quarry during operations must be no lower than 0.7 m above the maximum predicted groundwater level for Lot 220. The base of the quarry during operations at Lot 218 must not extend lower than 1 m above the maximum predicted groundwater level, or to within 0.7 m of the maximum if testing demonstrates acid sulphate soils will not be disturbed.

For 4 bores (SP2, SP3, SP5 and BL158) the maximum observed water levels are higher than the maximum predicted groundwater level by GHD (2020). Three bores (SP2, SP3 and SP5) also have observed groundwater levels which exceed the estimated maximum levels predicted by Umwelt (2011). These observed levels are yet to trigger action as required by the Trigger Action Response Plan as detailed in the Soil and Water Management Plan.

2.0 Conclusions and Recommendations

Recently observed groundwater levels measured at quarterly intervals during 2020 and 2021 show a new observed maximum groundwater level at four monitoring locations. The maximum groundwater level in three of these bores is higher than the maximum predicted groundwater levels reported by Umwelt (2011).

These new observed maximum groundwater levels are not captured by the GHD model (2020), as the simulation period for that model does not extend beyond December 2019.

The maximum predicted groundwater levels by GHD (2020) up to December 2019 do not represent the observed maximum groundwater levels for four site monitoring locations. It is therefore recommended that the groundwater model be updated and recalibrated to refine the match between observed and model predicted groundwater levels.

We recommend that the Maximum Extraction Depth Map not be updated until additional monitoring data is collected to improve the hydrogeological understanding of the site, particularly the response of groundwater levels to rainfall events. We recommend the following approach going forward:

- Undertake a physical review of the Mackas Sand groundwater monitoring bores to assess the integrity of the bores e.g. potential for leakage of surface water within the bore annulus.
- For a minimum six-month period, increase the frequency of groundwater level monitoring by way of installation of groundwater level loggers in at least three monitoring bores to monitor groundwater levels at hourly intervals. This will give a greater resolution of groundwater data that can be used to better understand how groundwater levels respond after rainfall events.
- After six months of additional data collection, undertake a further review of the data. Pending data review and bore integrity status, update the existing groundwater model and Maximum Extraction Depth Map.

We trust this information meets with your current requirements. Please do not hesitate to contact the undersigned on 1300 793 267 should you require clarification or further information.

Sincerely

A handwritten signature in dark ink, appearing to read 'C. Vincent'.

Craig Vincent
Principal Hydrogeologist

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M | 0488 209 673

4.0 References

Bureau of Meteorology, 2021.

GHD, 2020. Mackas Sand Groundwater Model Update.

Umwelt, 2011. Determination of Maximum Predicted Groundwater Level and Maximum Extraction Level at Lot 218 and 280, Salt Ash.