Northland REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

Memo

Date: 13/06/2024

To: Stuart Savill

From: Hagen Robertson

Subject: Ruakākā Solar Farms – Review of Assessment of likely groundwater levels report

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This memo covers my comments on the report by BECA dated 7 March 2024, *Assessment of likely groundwater levels at Site 1 for Proposed Ruakākā Solar Farms.*

The report bases much of its analysis on the groundwater levels being above normal, based on being above the 60th%ile. Th 60th%ile value is used by NRC as broad indication of the groundwater conditions, to show when levels are above average, but does not provide much evidence for deeper analysis of the overall situation. For example, during the two site visits during late September and early October 2023 the report states that the groundwater level was above normal, however, as demonstrated in Table 1, the actual groundwater level was only 108% of the average for that period, essentially only slightly above average for that specific month. Relying on this definition is simplistic and does not provide a real picture of the groundwater situation.

Below I have provided statements from the BECA report in *italics* followed by my comments.

> *On the basis of historically high rainfall and groundwater levels, the wetland extents captured by Google Earth imagery on 24 March 2023 represent 'above normal' hydrological conditions with elevated rainfall and groundwater levels likely maintaining wetland water levels and extents beyond those typical.*

There has been very little analysis on the connection between the wetlands and groundwater at Site 1, however, due to the low relative level of the wetlands (3-4 m RL) and the very high groundwater levels (3.95 mMSL) recorded at the time of the satellite imagery, it is fair to suggest that at this time groundwater could have been maintaining the water levels in the wetlands beyond typical levels.

> *We understand that NRC also utilised MEL drone imagery flown September 2022, which we note is when seasonally high groundwater level typically occurs, as seen over most years (Figure 2). While the groundwater level measured in September 2022 is similar to past seasonal maxima and therefore representative of normal hydrological conditions, it coincides with the time of year when wetland extents can reasonably be expected to be at their greatest.*

The groundwater level at this time was 117% of average for the month but only slightly above the 90th%ile, which represents a value that is surpassed every 2-3 years.

It is likely that wetland mapping based on site visits undertaken and aerial or drone imagery captured during this time, particularly March 2023, may overestimate typical wetland extents.

Estimates based solely on imagery captured during March 2023 may overestimate the typical wetland extent, however, the wetland extent estimates were also based on aerial imagery from 2020, a drone survey in September 2022 and site walkovers in late September and early October 2023 when groundwater levels were close to average for the periods (see Table 1).

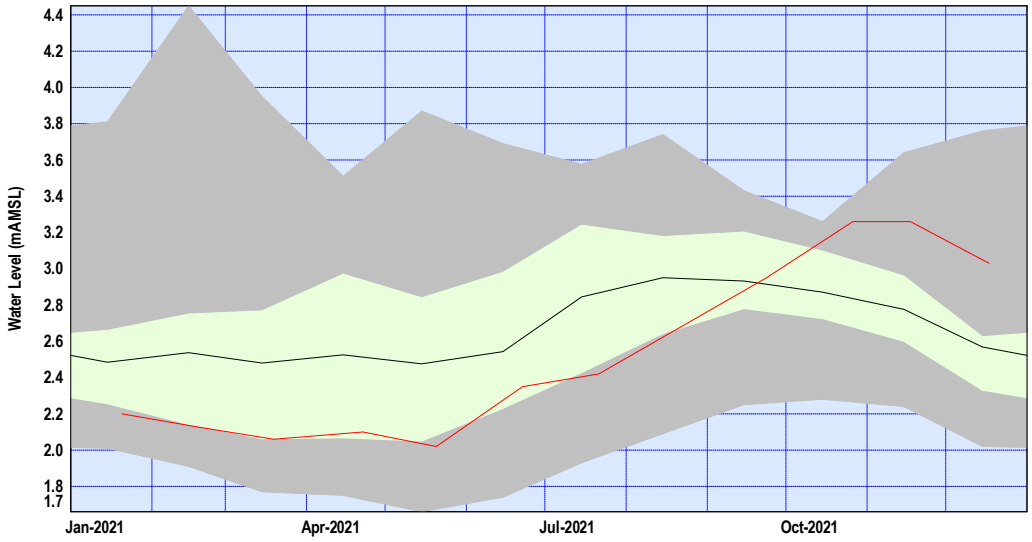
I have provided a table and three plots below to show the groundwater level during this period in more detail. The Table has the groundwater level measurement closest to the time of the site visits/image collection. The groundwater level measurements are compared to the average for the month and against the 90th %ile for the complete record. The 90th %ile is good proxy of the seasonal maxima as it is surpassed during the wettest period every 2-3 years.

Table 1. Groundwater level at Ruakākā GW at Peter Snell Rd (Race Course Main) at time of site visits

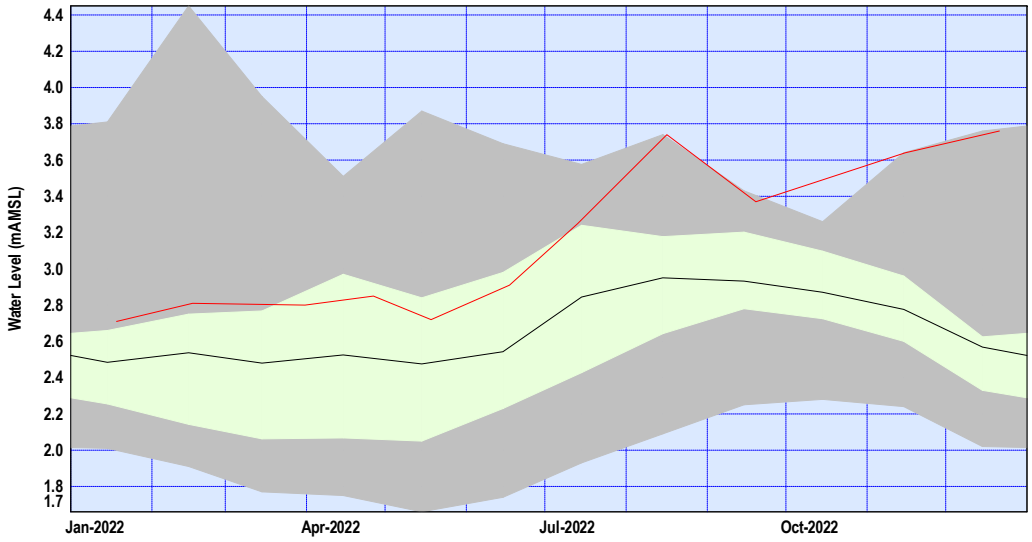
By who	Site visit	Closest GW measurement date	GW level (mMSL)	% of average	Average for period (mMSL)	Actual vs avg GW level	GWL as % of 90th percentile
BML	11/01/2021	20/01/2021	2.2	92%	2.39	-0.19	67%
BML	27/10/2021	26/10/2021	3.26	127%	2.56	0.7	99%
BML	31/05/2022	18/05/2022	2.72	116%	2.35	0.37	82%
BML	20/06/2022	17/06/2022	2.91	120%	2.43	0.48	88%
Drone survey	Sep-22	19/09/2022	3.37	117%	2.87	0.5	102%
BML	7-8/03/2023	23/02/2023	4.45	172%	2.58	1.87	135%
Sat img	Mar-23	23/03/2023	3.95	150%	2.63	1.32	120%
BML	22/03/2023	23/03/2023	3.95	150%	2.63	1.32	120%
RDL	28/09/2023	29/09/2023	3.09	108%	2.87	0.22	94%
RDL	5/10/2023	29/09/2023	3.09	108%	2.87	0.22	94%
		31/10/2023	3.16	119%	2.66	0.5	96%

Groundwater Level	mMSL
90%ile	3.30
95%ile	3.5

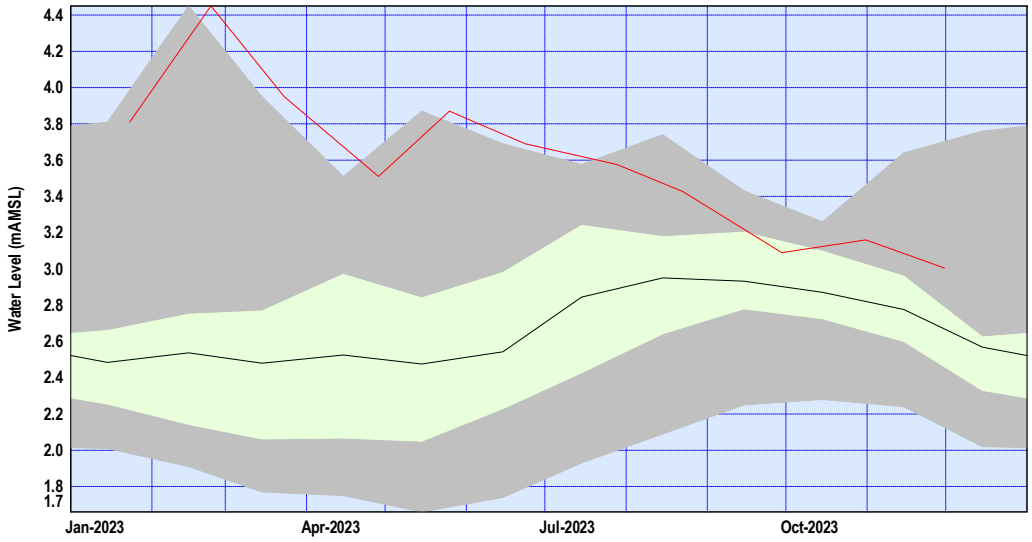
The figures below provide the measured groundwater level value in red for each year overlying two envelopes. The grey envelope represents the full extent of the record and the green envelope displays the range that 50% of measurements fall within.



Ruakaka GW at Peter Snell Rd (Race Course Main) from 1-Jan-2021 00:00:00 to 1-Jan-2022 00:00:00



Ruakaka GW at Peter Snell Rd (Race Course Main) from 1-Jan-2022 00:00:00 to 1-Jan-2023 00:00:00



Ruakaka GW at Peter Snell Rd (Race Course Main) from 1-Jan-2023 00:00:00 to 1-Jan-2024 00:00:00

Conclusions

Overall, I believe that this assessment was too simplistic, however, it does raise some important questions about how the estimates by RDL were developed. The satellite imagery from March 2023 is not a good reference considering the extreme weather events that preceded this period and the highly elevated groundwater levels that were recorded nearby. The estimate by RDL also included information from a drone survey, and two site visits at times when the groundwater levels would have been far closer to the average.

Most of the BML site visits occurred during classically drier periods. Although the groundwater levels were often above average for the month, they were usually well below the seasonal maxima (90^{th} %ile). This may have caused an underestimation of the natural extent of the wetland areas by BML.