

**BEFORE INDEPENDENT HEARING COMMISSIONERS APPOINTED BY CANTERBURY
REGIONAL COUNCIL AND WAIMAKARIRI DISTRICT COUNCIL**

IN THE MATTER of the Resource Management Act 1991 (**RMA** or **the Act**)

AND

IN THE MATTER of the Waimakariri River Regional Plan (**WRRP**); the Canterbury Land and Water Regional Plan (**LWRP**); the Proposed Plan Change 7 to the LWRP (**pPC7**) and Proposed Plan Change 2 to the WRRP (**pPC2**); the Canterbury Air Regional Plan (**CARP**) and the Waimakariri District Plan (**WDC**)

AND

IN THE MATTER of applications to the Canterbury Regional Council by **Woodstock Quarries Limited** for various resource consents to establish and operate a hard rock quarry and a landfill (**CRC214073-CRC214077**)

AND

IN THE MATTER of an application to the Waimakariri District Council by **Woodstock Quarries Limited** for resource consents to establish a landfill and associated earthworks at 513 Trig Road within an area currently being used as a quarry (**RC215276 / 221101189245**).

**EVIDENCE OF ZEB ETHERIDGE FOR THE APPLICANT
IN REPLY TO MATTERS WHICH AROSE DURING THE HEARING**

29th April 2024

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- 1 My name is Zeb Etheridge. A full description of my qualifications and experience can be found in my Statement of Primary Evidence.
- 2 I have read the Environment Court's Code of Conduct and agree to comply with it. The matters addressed in my evidence are within my area of expertise. However, where I make statements on issues that are not in my area of expertise, I will state whose evidence I have relied upon. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in my evidence.
- 3 I provide this further statement of evidence in reply to matters that have arisen during the hearing of the applications.

Timperley Farming Limits and Timperley Manor Ltd

- 4 In his document to the hearing panel dated 8th April 2024 Mr Andrew Fitzpatrick explains that the location of the Timperley Farming Ltd and Timperley Manor Ltd surface water take recorded on the Environment Canterbury database, which I relied upon in my evidence, is incorrect. Mr Fitzpatrick explains that the actual location is downstream of the confluence with Woodstock Stream but does not provide exact location details. He also notes that the river intake is used for drinking water supply.
- 5 In reply to this submission, I agree with paragraph 33.2 of Dr Greer's Reply evidence of 23/11/2023: "It is simply not plausible to expect such a diluted discharge (1:23 million at median flow) to be detectable through available pH and conductivity field monitoring equipment".
- 6 In water quality science it is good practice to use an analytical method known as Statistical Power to determine whether monitoring will yield useful information before investing in monitoring. The method considers the effect size (i.e. the potential change in water quality) associated with an activity (in this case the landfill causing a change in pH and/or EC in the Eyre River) and the background variability of these parameters in that water body. The output of statistical power calculations is the probability that the potential water quality change could be detected with a sufficient degree of confidence to be

classified as statistically valid, and therefore useful. I recently co-authored a paper in a peer reviewed scientific journal which analysed the Statistical Power of New Zealand's national groundwater quality network to detect changes in nitrate concentrations¹. Although I have not calculated the statistical power of EC and pH monitoring at the Timperley Water intake on the Eyre River, it is very clear from the calculations presented in Dr Greer's evidence that the probability of detecting a statistically valid change in these parameters, given the effect size and background variability, is very low. Although further work could be undertaken to statistically prove that such monitoring would not yield useful information, it is clear to me that this is not necessary given the level of dilution involved and our knowledge of the background variability in pH and EC in hydrological systems such as the Eyre River.

- 7 It is also good practice, and indeed common sense, in water quality science to determine whether a water quality parameter can be measured at the concentration of interest within the accuracy constraints of the analytical equipment before undertaking monitoring. If we assumed that leachate is discharged from the landfill with an EC of 554 ms/m² and that this occurred during low flow conditions in the Eyre River (when dilution is at the minimum), EC would change by 0.0000716 ms/m. A standard YSI field conductivity meter has an accuracy of 0.105 ms/m after allowing for a conceivably low background EC in the river. This means that the accuracy of the meter would need to be at least 1500 times better than a standard use meter is able to achieve, to detect the worst-case scenario change. So even in a worst-case scenario, it would not be possible to measure the EC change in the Eyre River. The same is true for pH: the field meter accuracy would need to be 1,782 times more accurate than it is before a pH change would be measurable, ignoring both the buffering capacity of the river and (for both pH and EC), the matter of Statistical Power. Even if the EC of a leachate leak from the landfill was 27,900

¹ <https://www.sciencedirect.com/science/article/pii/S0048969724019028?via%3Dihub>

² This is the maximum value for Class 2 landfills in Table 5-5 of the WasteMINZ guidelines, noting that although the proposed landfill is not classified thus, this EC value is likely to be more representative of the waste stream at the proposed Woodstock landfill than the Class 1 landfill value in the guidelines.

ms/m (this being the maximum value for Class 1 landfills in Table 5-5 of the WasteMINZ guidelines), EC in the Eyre River would change by 0.00036038 ms/m and the accuracy of the EC meter would need to be eight times greater than it actually is to measure the change, before accounting for Statistical Power.

- 8 Considering both Statistical Power and analytical accuracy constraints together, it is very clear to me that the proposed monitoring would generate no usable information and would therefore be a waste of resources.
- 9 Paragraph 6 of the Timperley Farming response envisages a scenario where upstream monitoring "fails or is offline". This would equate to a failure by the applicant to comply with the proposed consent conditions. I do not consider it appropriate to require additional monitoring for this reason, but regardless of that this is a minor consideration, given that I have demonstrated above that the proposed Eyre River monitoring would not yield any useful information in the first place. The response goes on to discuss "previously unidentified path for leachate to be unintentionally discharged to the Eyre River". This point has no merit because the water quality effects assessment is based on a scenario where all leachate discharges to the Eyre River upstream of the Timperley water intake, with no attenuation.



Zeb Etheridge

29th April 2024