APP-20222055
Summary of evidence by Alexandra Badenhop 4/07/2023

1. I am able to represent all of the evidence presented on behalf of the three authors as it is within the area of my expertise and I provided the final review of the evidence. The evidence was co-prepared due to the short time period we had to review all of the evidence and submit it, and due to the uncertainty regarding the hearing date (which did change).

2. I will try to summarise all of our evidence briefly, which I will take as read, in light of the 'moving feast' of additional evidence that has been submitted since our evidence was prepared, and everything that has been discussed today.

3. Firstly, in terms of catchment context, we all know that we are talking about a degraded catchment and therefore whatever we do, we need to be improving water quality. Whilst it is not the responsibility of one landholder to make all of the improvements, we need to consider cumulative impacts. I acknowledge that the proposal of the applicant might be an improvement on what their neighbours are practicing, but again that is not what we are considering today – the question is whether or not the proposal will cause a degradation of water quality relative to the baseline of this property.

Overseer

4. There has been a lot of discussion about the use of Overseer and it is important to state again that Overseer cannot represent the nutrient fluxes that will occur on this site. This site is heavily drained and nutrient losses will occur in rainfall driven events. At the site visit we learned that there were over 100 tile drains draining this property. Overseer using monthly timesteps cannot replicate the nutrient fluxes that will occur here – averaging out over a month simply does not show the big rainfall events that can happen even in summer and will rapidly mobilise nutrients through the drains.
5. To repeat the issues again, *Overseer*

    - *Is a steady state model attempting to simulate a dynamic, continually varying system;*
    - *Uses monthly time-steps;*
    - *Uses average climate data and, therefore, cannot model episodic events, or capture responses to climate variation;*
    - *Does not balance mass;*

- *Does not account for variation in water and nutrient distribution in the soil profile;*
- *Does not adequately accommodate deep-rooting plants;*
- *Focuses on nitrate and omits ammoniacal nitrogen and organic matter dynamics; and*
- *Lacks consideration of surface water and nutrient transport, as well as critical landscape factors. "*

"As a result of these concerns, we do not have confidence that Overseer's modelled outputs tell us whether changes in farm management reduce or increase the losses of nutrients, or what the magnitude or error of these losses might be." *https://www.mpi.govt.nz/dmsdocument/46360-Overseer-whole-model-review-Assessment-of-the-model-approach*.

6. There is no treatment of lateral nutrient transport or consideration of the landscape setting in the application of the OVERSEER model. This is particularly problematic in the Farm 444 application since the location of the proposed intensive dairy operation in on drained wetlands with gleyed and peat hydric wetland soils and likely high water tables still.

Site Constraints

7. The site constraints of this property are considerable; Winton experiences 175 rain days/events per year which means that more than approximately 1 in 2 days will see rain that could mobilise nitrate and other nutrients to groundwater and local streams and that this rain event frequency is similar in all months of the year, as we can see in the provided graph which demonstrates big rainfall events in summer.

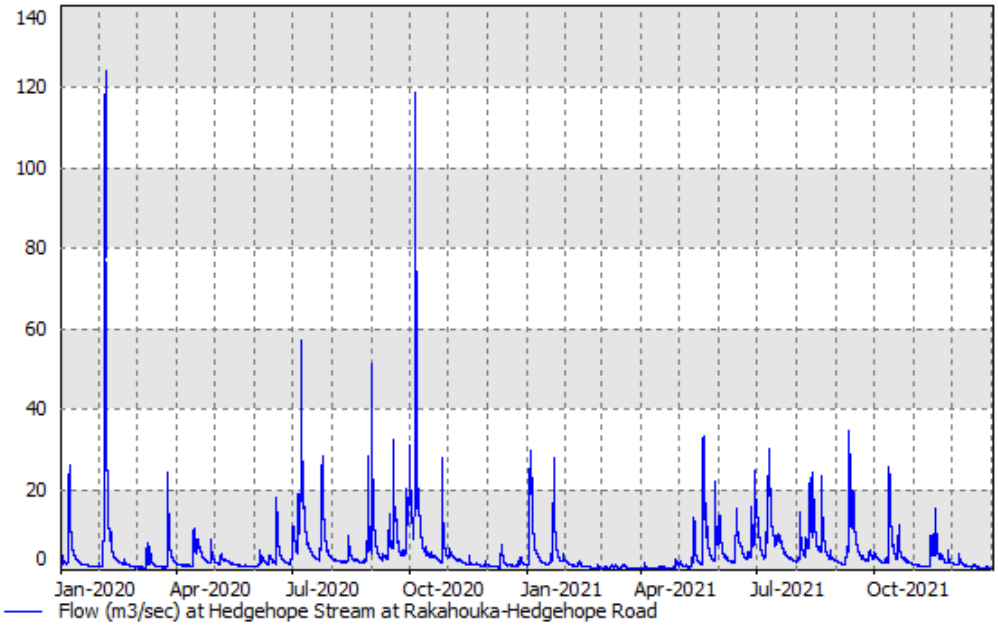

Figure 1: Local streamflow reflects rain event driven runoff across two recent years. Note, increases in streamflow reflect rain event driven water and nutrient transport to streams in every month of the year.

8. The majority of the farm overlies the Gleyed Physiographic Zone, with the remaining area located in the Peat Wetlands and Bedrock/Hill Country Physiographic Zones. These soils indicate the historic and potentially current presence of wetlands across the site, and the potential for rapid mobilisation of nitrate and dissolved reactive phosphorous to shallow groundwater and subsurface and surface lateral transport to nearby streams.

9. Groundwater levels are likely close to the surface. While it has been stated that they are artesian at the bore, the description fits normal seasonal fluctuations of groundwater levels at a break in slope.

10. I visited the site on 27th June, 2023. There had only been 3.5 mm of rain in the two weeks preceding and 36.5 mm since the beginning of the month compared to the average of 82 mm for June so it was relatively dry, however there was still a lot of water across the property with large amounts of ponding at breaks in slope showing lateral transport and lots of water flowing out of the tile drains, demonstrating just what a wet site it is and how a lot of water flows through it which will rapidly transport nutrients. Based on the site visit, I also question whether the Baseline scenarios of intensive winter grazing would be permitted, given that the land has many critical source areas which have not been mapped

by the Applicant, and many areas of slope that appear to be greater than 10%, particularly in the Hancox block which was stated to be used for intensive winter grazing.

Effluent Management

11. In terms of effluent management, I understand that the Farm Effluent Storage Calculator used to calculate the storage uses a daily timestep to calculate storage needs which is good. However, it was based on the cows being only in the winter barns from May to September, which we have said may not be the case in a wet year, so it did not calculate the extra storage required during those years. It is also not clear if it allows for the required 28 day return period for effluent irrigation in those very wet years.

Wetlands

12. With respect to wetlands, the assertion that the wetland doesn't count because of the pasture exclusion rule is incorrect, and does not represent an adequate assessment in terms of the Pasture Exclusion Methodology Assessment[1].The assessment is not based on the intent to graze or an overall site percentage but on assessing individual vegetation communities that are present across the site. During my site visit, I observed areas of obligate wetland vegetation that I verified with terrestrial ecologists via photos. Also, the assessment needs to be completed under normal conditions "*Assessments should also be applied under 'normal' circumstances, for instance not during atypical situations (such as extreme drought or flood events) or immediately following recent disturbance (such as fire, clearance, intensive grazing, or infilling*)." (p.18, MfE,2022). In this instance where the land has been recently tilled, you would use the other methods of assessing soil and hydrology to confirm wetland presence. During my site visit we could clearly see thick peat across which is a wetland soil, and water pooling. The methodology also recommends using aerial imagery, and we can see in the Applicants own aerial imagery that there is standing water on the wetland.

[1] Ministry for the Environment. 2022. *Pasture exclusion assessment methodology*. Wellington: Ministry for the Environment.

13. This “Pasture Exclusion” clause does not apply where there is land use change. “*The exclusion is not targeted at pasture being converted for urban development or for other land uses. It does not apply to wetlands in other areas of grassland that are not grazed, (such as in parklands, golf courses, landscaped areas and areas of farmland not used for grazing purposes*)” (MfE,2022). Given we are at a land use change consent hearing, it is possible that the pasture exclusion rule does not apply – I do not believe this has been tested.

Assessment

14. Overall, given there is an increase of RSU in this proposal and a higher generation of waste, I do not think we can be confident that there will be water quality improvement from this proposal. The site is very wet site – this is why it is heavily drained, and there will be drains under every critical source area, and those drains are designed to quickly transport water away from the site. What Mr. Lowe’s figure regarding ‘grazing days’ fails to present is that during summer there is an equivalent of twice the number of cows shown on the graph due to the application of effluent.

15. There are strong limits to how much organic nitrogen can be used – it can’t just be stored forever in the soils as they become “nitrogen saturated” and start to leak more and more[2].

16. The mitigations proposed are not designed to deal with dissolved nutrients such as nitrates and dissolved reactive phosphorus.

[2] Schipper, L.; Percival, H. & Sparling, G. (2004). “An approach for estimating when soils will reach maximum nitrogen storage”. *Soil Use and Management,* Issue 20, p281-286 provided via email.