BEFORE A HEARINGS PANEL OF THE GREATER WELLINGTON REGIONAL COUNCIL

UNDER	the Resource Management Act 1991 ("the Act")
IN THE MATTER OF	Resource Consent Applications to Greater Wellington Regional Council pursuant to section 88 of the Act to discharge contaminants to land, air and water
BY	South Wairarapa District Council
FOR	the proposed staged upgrade and operation of the Featherston Wastewater Treatment Plant

---

BRIEF OF EVIDENCE OF CHRISTOPHER ROBERT JAMES SIMPSON ON BEHALF OF SOUTH WAIRARAPA DISTRICT COUNCIL

GROUNDWATER EFFECTS – RESPONSE TO SUBMITTERS TECHNICAL EXPERTS

DATED 10 MAY 2019

Counsel:	**Philip Milne** **Barrister**
Telephone:	021803327
Email:	philip.milne@waterfront.org.nz

EVIDENCE OF CHRISTOPHER ROBERT JAMES SIMPSON ON BEHALF OF SOUTH WAIRARAPA DISTRICT COUNCIL

1. My full name is Christopher Robert James Simpson.

2. My primary evidence has been taken as read i.e. my relevant experience and role in the project is set out in my evidence in chief dated 29 March 2019.

SCOPE OF EVIDENCE

3. This response will address the following:

(a) Response to submitters technical expert (Dr Burbery).

(b) Consent conditions relevant to the issues raised by Dr Burbery.

(c) Conclusions.

RESPONSE TO SUBMITTERS TECHNICAL EVIDENCE

4. The following response is to Dr Lee Burbery's statement of evidence dated 2nd May 2019 on behalf of Wairarapa Regional Health.

5. I note in paragraph 9 the list of documents that Dr Burbery has reviewed. I would comment that there are a number of other relevant and more recent documents related to the groundwater assessment that should also be reviewed including:

   - April 2013 - Evaluation of Potential Land Treatment Sites – LEI
   - 5th November 2015 - Site Investigations - Hodder Farm – LEI
   - July 2016 - Streambed Conductance Survey – PGES
   - 14th December 2018 - Further Site Assessment - GWS Limited
   - 20th December 2018 - PDP/LEI/GWS Joint Witness Statement
   - 27th February 2019 - PDP Review for GWRC
   - 29th March 2019 - SWDC Experts Evidence – LEI, GWS, NIWA

   It is unclear whether Dr Burbery has considered these documents which, in my opinion, address many of the matters he has raised in his submission and statement of evidence.

6. I note that the logarithmic removal rates through the wastewater treatment process as discussed in Paragraph 11 of Dr Burbery's statement of evidence are consistent with those discussed by Mr McBride in Paragraph 24 of his statement of evidence, and as such there is agreement on this matter. It is acknowledged that effective pathogen reduction in the treated effluent discharge relies on the wastewater treatment system performance and maintenance. Effluent standards, monitoring of the effluent stream and maintenance procedures for the

treatment plant equipment will provide assurance that the proposed high level of treatment is undertaken prior to irrigation of treated wastewater occurs.

7. In response to Paragraph 15. Rotavirus is no longer used in the effects assessment as a viral tracer. Through discussion with the GWRC reviewers (PDP), and in agreement with NIWA, Norovirus has been adopted as being the more conservative viral tracer in groundwater movement. The reasons for this are discussed in Paragraph 8 of Mr Mc Brides statement of evidence.

8. In response to Paragraphs 17 to 19. Brown Soil has been adopted from the Land AEE (LEI, 2017), as this is described as being the dominant soil group across the site. There are some areas of Gley Soil (Ahikouka silt loam) within Site B which occur in lower lying areas near to Donald Creek and include areas subsequently identified for exclusion of irrigation due to groundwater rising to within 0.6 m of the soil surface. I consider that Brown Soil was the correct soil group when considering effluent treatment within the vadose zone.

9. With regard to Dr Burbery's observation of the S-Map description of the Ahikouka silt loam at Site B, this is consistent with the field observations. Ms Beecroft's statement of evidence (Table 1) gives the links between the soils described, and the soils that are mapped on the S-Map database. Dr Burbery notes that areas of the site are mapped as vulnerable to bypass flow. The primary means of minimising bypass flow on these soils is the application of wastewater at a rate less than the soil's unsaturated hydraulic conductivity (i.e. water moves into and through the soil under tension, not by gravity). Simply put, this means macropore flow is avoided by preventing saturated soil conditions from developing. The proposed irrigation regime is designed to specifically avoid continuous saturated conditions and to enable the soil to recover in between irrigation events. Ms Beecroft's evidence discusses the irrigation management and the effects on soils in more detail.

10. In response to Paragraphs 20 and 21. I still consider the adoption of brown soils to be appropriate for this assessment, as this is what is observed in the upper soil profile across the site. I would comment, however, that (as indicated by Dr Burbery) the soil type is only relevant when assessing pathogen movement based on filtration and die-off over distance. As discussed later in this statement of evidence, this assessment has been revised based on pathogen die-off over time and is deemed to be a more conservative methodology.

11. In response to Paragraph 22. I agree that groundwater velocities have not been measured, however, they are not "assumed". Velocities have been calculated based on the maximum potential hydraulic gradient (i.e. a groundwater level at the near surface within the irrigated areas) and measured hydraulic properties, as discussed in Paragraph 17 of my evidence in chief.

12. In response to Paragraph 25. It is acknowledged that preferential flow paths may possibly, be present as discussed in Paragraph 41 of my evidence in chief. The effects assessment encompasses this uncertainty in the context of the groundwater travel time effects envelope being 5 years, rather than 3 years as indicated by Seitz et. al (2011) based on Norovirus as a tracer.

13. In response to Paragraph 28. The removal rate for Norovirus is based on a 1.1 Logarithmic reduction over 3 years in groundwater, which is essentially the rate of natural die off of the virus. The method of using die off rates for viruses is considered to be more conservative than applying logarithmic reduction factors based on soil type and distance as used by Dr Burbery. Having acknowledged that, I still consider that there could be a further 1-2 logarithmic reduction in pathogens in the 0.6 m vadose zone prior to the treated effluent entering groundwater. This has not been included in the calculations. Accordingly, the calculations are conservative.

14. In response to Paragraph 31. I note that my assessment has identified 17 bores as being potentially at risk and it is proposed that an alternative water source be offered to all of these land owners who use their bores for potable supply.

15. As discussed in Paragraph 33 of Dr Burberry's evidence, I agree that the potable use of shallow groundwater in Featherston is not advised due to wells being insecure under the MoH (2000) definition. Mr McBride has pointed out in paragraphs 28 and 28 of his evidence that use of shallow bores for potable supplies is undesirable since it carries risk of pathogen contamination from other sources.

16. In response to Paragraph 34. The effects of groundwater mounding and the influence of pumping on groundwater flow paths from the irrigated areas has been assessed though detailed groundwater modelling that simulates the effects of these stresses on groundwater flow paths (GWS, 2018). This process has been undertaken to identify potentially affected bores.

17. In response to Paragraph 35. I note that the modelling referenced has been superseded by more recent work (GWS, Dec 2018). I also note that the Kv and Kh values (vertical and horizontal hydraulic conductivity respectively) used in my assessment have been constrained by measured values and are not assumed as stated. This is discussed in Paragraph 17 of my statement of evidence.

18. In response to Paragraph 38. While I accept there has been limited long term monitoring of groundwater levels across the site, there is sufficient data available to assess the likely seasonal changes from monitoring of the existing piezometers. This information is included in the Groundwater Modelling Report (GWS, 2018) and is referenced in Paragraph 16 of my evidence in chief. In addition to this monitoring over time, the depth to groundwater under winter high conditions

was measured at a number of locations over the site as described in the Update on Further Investigations report (GWS, 2018). Lastly, I would comment that the information for the wider site hydrogeologic environment has, in fact, been incorporated into my assessment (GWS, 2018).

19. <u>In response to Paragraphs 47.</u> The anisotropy factor used in the assessment of 0.2 is based on ring infiltrometer and stream bed conductance studies. This has also been the subject of model sensitivity analysis. I do not consider the value adopted to be erroneous for these reasons, particularly with respect to the shallow, near surface, groundwater system.

20. <u>In response to Paragraphs 48 and 49.</u> I agree that the hydrographic structure affects the Kv/Kh ratio. I would also comment that in a setting where braided rivers and streams have formed the alluvial deposits, that low permeability soil horizons are not laterally extensive in all directions, forming channels with deposits of variable permeability. This results in the shallow aquifer having a bulk aquifer Kv/Kh ratio towards the upper end of what could be expected (e.g. 0.5). By contrast, laterally regionally extensive clay layers, such as those formed during interglacial periods during higher sea levels, are likely to result in a bulk aquifer Kv/Kh towards the lower end of what might be expected (e.g. 0.01).

21. <u>In relation to the Kv/Kh ratio</u>, I note the Table attached to Dr Burberry's evidence and I am familiar with this report and would comment that the Kv/Kh ratio in that reference relates to a multi-layer aquifer system (17 layers) that extends to the full depth of the alluvial deposits within the Wairarapa Valley. This is an example of a Kv/Kh ratio where laterally extensive mud deposits are laid down during interglacial periods through multiple marine transgression and regression events. These layers are what separate the various aquifers and form confining aquifer conditions. Table 10.2, included in my attachment to this evidence, demonstrates this sequence, which reflects the low Kv/Kh ratio proposed by Dr Burbery. In summary, I do not consider the Kv/Kh ratio derived from that model calibration to be applicable in the context of the assessment of shallow groundwater effects.

22. <u>In response to Paragraph 53.</u> I note that ponding of surface water will not be allowed to occur and this is reflected in the proposed conditions of consent and will be incorporated into the irrigation monitoring and management plan.

23. <u>In response to Paragraph 54.</u> It is proposed that a 0.6 m (rather than 1m) vadose zone will be maintained at all times, so fully saturated conditions will not develop. Maintaining a minimum 0.6 m vadose zone thickness will be adopted as management tool for irrigation scheduling and will be incorporated into the irrigation management plan.

24. <u>In response to Paragraph 55.</u> I agree that mounding effects will limit the ability to irrigate certain areas at certain times, and this will limit disposal capacity. This is

discussed in Paragraphs 26 and 27 of my statement of evidence. In summary, this limitation would be addressed though adaptive management of the irrigation (i.e. resting and rotation of irrigation areas through high and low-lying areas). Irrigation management and land assimilative capacity is discussed in more detail in Ms Beecrofts evidence.

PROPOSED CONDITIONS

25. The following bullet points outline the proposed conditions relevant to the matters raised by Dr Burbery and that that manage the potential risks identified through the groundwater effects assessment:

    a) Prevention of surface ponding and breakout.

    b) Appropriate buffer distances to surface waters.

    c) Maintaining separation to the groundwater surface through groundwater level monitoring.

    d) Monitoring of groundwater quality at the site boundary to assess nutrient and pathogen loading.

    e) Offering an alternative source of potable water to those currently using shallow groundwater for potable purposes in areas affected by the land discharge (based on the 5-year travel envelope).

    f) Development of a groundwater monitoring and management plan which would include testing of representative existing bores.

    g) Development of an irrigation management plan that specifies the criteria for managing soil saturation conditions and irrigation scheduling.

    In my opinion these conditions adequately manage the risks raised in the Wairarapa RPH submission and discussed in Dr Burberry's statement of evidence.

CONCLUSIONS

26. In summary, I believe the main concerns of the Wairarapa RPH submission, expressed through Dr Burbery's statement of evidence, relate to potable use of groundwater from bores in the immediate surrounds of the irrigation areas. In response to this I would comment that this risk is proposed to be managed by offering an alternative potable water supply to affected bore owners that fall within a 5-year groundwater travel time envelope, based on Norovirus persistence.

27. The other concerns are that mounding of groundwater will cause ponding and bypass flow within the near surface soil, and it may also limit the ability to irrigate certain areas at certain times of the year. I would comment that these are valid concerns that can and have been addressed through conditions of consent and adaptive management of the irrigation scheme.

Signed:

NAME: Christopher Simpson

DATE: 10 May 2019

REFERENCES

Ministry of Health, 2000. Code HE1129.Secure Groundwater Bores and Wells for Safe Household Water.

Seitz et. al. 2011. Norovirus Infectivity in Humans and Persistence in Water. Applied and Environmental Microbiology, Vol 77, No 19.

Attachment

Table 10.2: Lower Valley catchment model layer configuration and corresponding hydrostratigraphic units

LOWER VALLEY FEFLOW MODEL LAYER SCHEDULE

LAYER	SLICE	Hydrogeological unit layer groups
1, 2	1, 2, 3	**Q1 Unconfined aquifer** (Ruamahanga, Huangarua, Tauherenikau) **Q1 aquitard** (Holocene lake sediments – lake basin) Q2-8 Alluvial fan gravels (Tauherenikau fan, Huangarua valley) mid Quaternary terraces (Martinborough, Onoke/Narrows)
3, 4, 5	4, 5, 6	**Q1 aquitard** (Holocene lake sediments – lake basin) Q2-8 Alluvial fan gravels (Tauherenikau fan, Huangarua valley) mid Quaternary terraces (Martinborough, Onoke/Narrows)
6, 7	7, 8	**Q2 aquifer** (Ruamahanga, lake basin, Onoke/Narrows) Q2-8 Alluvial fan gravels (Tauherenikau fan, Huangarua valley) Mid Quaternary terraces (Martinborough, Onoke/Narrows)
8, 9, 10	9, 10, 11	**Q3 aquitard** (Ruamahanga, lake basin, Onoke/Narrows) Q2-8 Alluvial fan gravels (Tauherenikau fan, Huangarua) mid Quaternary terraces (Martinborough, Onoke/Narrows valley side)
11	12	**Q4 aquifer** (Ruamahanga, lake basin) Q2-8 Alluvial fan gravels (Tauherenikau fan, Huangarua) mid Quaternary terraces (Martinborough, Onoke/Narrows valley side)
12, 13, 14	13, 14, 15	**Q5 aquitard** (Ruamahanga, lake basin, Onoke/Narrows) Q2-8 Alluvial fan gravels (Tauherenikau fan, Huangarua) mid Quaternary terraces (Martinborough, Onoke/Narrows valley side)
15	16	**Q6 aquifer** (lake basin) Q2-8 Alluvial fan gravels (Tauherenikau fan, Huangarua) mid Quaternary terraces (Martinborough, Onoke/Narrows valley side)
16, 17	17, 18	**Q7+ aquitard** (lake basin) Q2-8 Alluvial fan gravels (Tauherenikau fan, Huangarua) mid Quaternary terraces (Martinborough, Onoke/Narrows valley side)

key:
- aquifer
- aquitard
- slices

total slices = 18
total layers = 17