

**BEFORE THE GREATER WELLINGTON REGIONAL COUNCIL AND MASTERTON
DISTRICT COUNCIL HEARINGS PANEL**

IN THE MATTER of resource consent applications to
Greater Wellington Regional Council
pursuant to section 88 of the Resource
Management Act 1991

AND

IN THE MATTER of a Notice of Requirement to
Masterton District Council pursuant to
section 168, 168A and 181 of the
Resource Management Act 1991

BY Masterton District Council

FOR the proposed upgrade of the Masterton
Wastewater Treatment Plant

**SUPPLEMENTARY STATEMENT OF EVIDENCE OF GRAEME PROFFITT
ON BEHALF OF MASTERTON DISTRICT COUNCIL**

**RESPONSE TO H LOWE'S SUPPLEMENTARY EVIDENCE AND REVISED CONSENT
CONDITIONS**

Subject Area: Groundwater Modelling

1.1 This supplementary evidence provides responses to points raised in supplementary evidence by Hamish Lowe and comment on Greater Wellington's revised proposed conditions. I restrict my comments to groundwater issues.

2. COMMENT ON LOWE RESPONSE

2.1 Mr Lowe at paragraph 56 discusses maintaining a 1 m separation between the ground surface and the shallow groundwater surface. He mentions introducing further monitoring conditions to require monitoring of additional piezometers to ensure a 1 m gap is maintained. I assume this is a reference to monitoring additional existing monitoring wells within the irrigation area.

2.2 The existing monitoring wells all terminate in the gravel aquifer. Caution is required applying piezometric pressures measured in the gravel when the intent is to monitor shallow groundwater that has its surface in the overlying silts. The condition and the way it is applied needs to recognise that the piezometric pressure in the gravel aquifer may not be the same as the water level surface (the watertable) within the silts. It is the level in the silts which is of most importance for the irrigation, not the piezometric level in the gravels.

2.3 The silt layer overlying the gravel aquifer means the gravel aquifer is a confined or semi-confined system. The piezometric pressure (i.e. the level to which water will rise in a piezometer terminating in the aquifer) in a confined aquifer responds very quickly to changes in piezometric pressure elsewhere, for example from pumping in a well or a flood wave passing down a river in hydraulic connection with the aquifer. Such rapid response has been seen on the site from floods passing down the Ruamahanga River.

2.4 The water level in the overlying silts cannot respond quickly to such changes because of the resistance to flow within the low permeability silts. This means that a short term increase in piezometric level in the gravel from a flood in the river (as measured by a monitoring well) will not be reflected in an equivalent increase in water level in the silts. In fact, a transient piezometric pressure increase in the aquifer from a flood will have passed before the water level in the silts has time to fully respond.

- 2.5** If a condition is set that requires action if the level in a monitoring well is less than 1 m from the surface, then that might trigger unnecessary action if the condition was breached by a transient event. However, on average I expect that the piezometric level in the gravel aquifer will be a reasonable representation of the level of the watertable in the silts. I therefore suggest that such a condition be applied to a rolling average water level. Alternatively, the condition should not be considered breached until three successive measurements are within 1 m of the surface.
- 2.6** Mr Lowe at paragraph 76 confuses some related concepts with respect to contaminant travel times.
- 2.7** Firstly he refers to a three year travel time for the contaminants and expresses some surprise. I did not refer in my evidence to three year travel times but stated in paragraph 2.7 of my supplementary evidence in response to the s42A report, that travel times from the top to bottom of the site are of the order of hundreds of days. Mr Lowe may be getting confused with my reference in 2.39 that an initial period of monitoring should not be less than 3 years to allow for a “ramping up” of groundwater concentrations. The ramping up of concentrations is a consequence of extended travel times, but it is not the same thing.
- 2.8** Never-the-less, travel times are extended from top to bottom of the site and that is a direct consequence of the hydraulic conductivity of the aquifer. I have carried out a simple calculation using the Darcy Equation (the basic equation of flow through porous media), as a “back-of-the-envelope” confirmation. However, as I explained in supplementary evidence in response to the evidence of submitter Ian Gunn, it is also the same hydraulic conductivity (and hence transmissivity when depth is considered) that results in little mounding when all the factors are taken into account.
- 2.9** Obviously, travel times to a point of discharge will vary from place to place, depending on the distance from the irrigation point of application to the point of discharge to receiving waters. The hundreds of days is the maximum travel time. Thus, shorter times will result for irrigated areas close to the drains, the Makoura Stream and the eastern and southern reaches of Ruamahanga River. It is the close proximity of these water bodies that results in the mounding being lower than it might otherwise be.

- 2.10** In summary, the results are not surprising; it is the hydraulics of the situation, which the model is seeking to reproduce, that will dictate the numbers.
- 2.11** In addition, Mr Lowe is adopting a faulty argument in stating that if travel times are less the degree of conservatism of the modelling will be less. As noted, both mounding and travel times for the water follow directly from the hydraulic properties of the aquifer. If he accepts that the mounding will not be too great, as he does in paragraph 76, then he must also accept the travel times are generally as modelled. He cannot pick and choose which parts of the modelling he wants to believe, as the contaminant modelling is inextricably linked with the hydraulic modelling.
- 2.12** However, it is worth pointing out that travel times of contaminants are not the same as travel times for the water. Contaminants undergo a phenomenon known as retardation, which means travel times are actually greater (velocity is smaller) than the travel times for water. Some contaminants are retarded much more than others.
- 2.13** Apart from partially for bacteria, factors to model retardation were not used in the model as a deliberate measure of conservatism. In reality, all contaminants will be retarded to some degree, some considerably so. That is, if attenuation factors had been applied to all contaminants in the model, contaminant travel times would have been greater than modelled.
- 2.14** I presume Mr Lowe's reference in the next paragraph (paragraph 77) to conditions being set to monitoring mounding are a reference to monitoring groundwater levels as in paragraph 56. As noted above, mounding in the gravel aquifer (which was modelled as a piezometric pressure increase, not a physical groundwater rise) will generally be reflected in an average way in the silts, but there is a danger that short term transients will misrepresent what is happening in the silts.
- 2.15** Mr Lowe in paragraphs 93 and 94 discusses monitoring. I concur with Mr Lowe that there is a need to monitor performance. Where we differ, with respect to the groundwater monitoring, is how much and what is done with the monitoring information. As I have pointed out in earlier supplementary evidence, my belief is that groundwater monitoring results at variance from the predictions are a signal to examine the assumptions, not trigger actions to change the irrigation regime.

Mr Lowe may also have that position, but the conditions as currently proposed do not appear to reflect that.

2.16 If the main concern for groundwater discharges is DRP in the river, and that is my understanding, what appears to be being lost sight of is that the calculated DRP values are predictions for the long term (30 years). DRP in groundwater at the beginning of the project's life will be very much lower. Thus there is time to consider initial monitoring and examine the model assumptions well before any effects in the river from groundwater discharges will become apparent.

2.17 Because of this, there is actually no initial need to set numerical compliance values for groundwater quality. Instead, a condition could be written that merely required a review of assumptions based on the monitoring results. Such a review could then trigger varying the management and if necessary the consent conditions, if groundwater quality was much worse than predicted. However, there appears to be discomfort at not having numerical values, perhaps to guard against the HortResearch and PDP modelling being very wrong. I have therefore attempted to come up with values that will not unreasonably (unnecessarily) trigger changes to the irrigation regime, while still being protective of the river in the unlikely event that the modelling is very wrong.

2.18 I am of the view that these numbers should not be used as compliance limits but rather should be used as triggers for a review by the consent holder and if necessary the Regional Council, of the way the scheme is operating. My understanding of compliance standards is that they should be directed at adverse effects rather than at ensuring that an applicants modelling is correct.

3. CONDITIONS

3.1 I have previously commented on the consent conditions related to groundwater in supplementary evidence on the monitoring conditions. Greater Wellington has since proposed some additional changes. My position is essentially as it was before with respect to the parameters to be monitored, the proposed frequencies and the actions required in the event of non-compliance. I accept some other changes

3.2 In my earlier evidence on condition 36 I proposed additional downgradient monitoring wells where significant discharge to the Makoura Stream and drain is

predicted to occur. GW sees no need for these additional wells, which I accept. Given that, I suggest the well I proposed southeast of HB12 as better located than HB12 also be dispensed with, as the discharge to the river at this point is less significant than the wells beside the Makoura Stream and drain that GW sees no need for.

- 3.3** No justification has been provided for monitoring of CBOD, soluble iron or chloride in condition 37. GW states that the monitoring is “best practice” however it is not best practice to require monitoring with no specific objective. It may be that these parameters are aimed at determining whether the soil health is deteriorating. However, there are soil monitoring conditions to determine this more directly.
- 3.4** In condition 38 I earlier stated that quarterly monitoring was adequate for downgradient wells. The current monitoring to assess pond leakage is quarterly and will measure the main seasonal cycle. Monitoring more frequently will not provide additional information.
- 3.5** GW’s stated intention is to manage the irrigation through effects on groundwater, rather than the river and talks of wanting an early warning (as noted in a comment against Condition 46). This may be why two-monthly monitoring is wanted, but this is not stated directly. Given effects at any point are delayed by relatively large amounts (months), relating effects at any point with what has happened with the irrigation (or many other variables that affect land treatment performance) will be difficult. Simply, it is a relatively crude and indirect monitoring tool and trends will only become apparent over extended periods of time. It is therefore my view that quarterly monitoring will be more than adequate for this and has the advantage that it will be less costly than two-monthly monitoring.
- 3.6** GW has made the comment against Condition 40 that it would be simpler to have the same compliance values for all downgradient monitoring, and just wants to take a worst case. I agree that it would be simpler, but as pointed out in my earlier supplementary evidence, different downgradient locations contribute different amounts to the effects on receiving waters. By the time concentrations approached the proposed values in some wells, the performance would be well off what was predicted. The values would not be providing an early warning in those cases, which is the expressed desire. However, if GW is happy to tolerate this then I accept this change. I do not however agree that these figures should be compliance limits.

- 3.7** GW has modified their originally proposed DRP value in condition 40 from 0.012 to 0.25 g/m³. I must point out that this increased value is still too low as it is likely to be exceeded by the existing groundwater quality. The new value was exceeded 5 times in HB2 (a downgradient, or Group 1b well) over the last four years, 4 times in 2005 alone. Until the current ponds are decommissioned, there is a risk that DRP will routinely exceed 0.25 g/m³ in this well. It will signify nothing more than that the current ponds are leaking. The value would need to go to 0.35 g/m³ to avoid this or, alternatively, before and after pond decommissioning triggers should be used as I have previously proposed.
- 3.8** I do not agree with the rationale for the proposed DRP in stream compliance limit of 0.015 g/m³. I will leave Dr Hickey to discuss that. However, I again note that given the delay in build up of DRP levels, the in-stream standard will initially be meaningless. The need for a numerical value for an in-stream standard could be reassessed long before it becomes relevant (presumably as part of the process of developing a regional plan standard).
- 3.9** With respect to dissolved inorganic nitrogen (DIN) the revised proposed primary value of 5 g/m³ has been exceeded in HB2 on several occasions in 2003 (highest value 7.2), although not recently. Again there is a risk that both the primary and secondary values for DIN will be exceeded until the existing ponds are decommissioned.
- 3.10** At HB21 (another Group 1b well) we do not know the existing DIN but the well is close to HB10, for which current monitoring is available. The mean and median DIN in HB10 is 3.2 g/m³ with a 2003/08 high of just over 5 g/m³. The modelling predicts DIN increases in the vicinity of HB21 of the order of 3 – 4 g/m³. If the current DIN in HB21 is similar to HB10, then DIN in HB21 will routinely exceed the GW proposed primary and secondary values. Despite this, at the proposed compliance values the predicted increase in DIN in the receiving waters will be within the currently measured DIN variability or “noise”, i.e. effects will not significant.
- 3.11** If routine exceedance are to be avoided, and if a before and after pond decommissioning value is not be used for HB2 and HB4, then I suggest a DIN primary value of 9 g/m³ and secondary value of 12 g/m³. Note, however, my

earlier stated preference that DIN be monitored purely for performance, and not have triggers set.

- 3.12** GW has not accepted my argument that it is pointless having E coli compliance values. I reiterate my previous position that these values will not provide a useful early warning. The E Coli monitoring would be better focussed on the period just before and just after direct discharge to the river ceases. It is not a ground water issue.
- 3.13** Exceeding condition 40 triggers actions in conditions 46 to 48. With respect to DIN, unless the modelling is a long way out, effects in the receiving waters will not be significant until very much higher values than the GW proposed values. Thus, should there be an exceedance, the only logical conclusion that MDC can come to in reporting to GW is that the compliance values are set too low. Hence my previous suggestion that the first level of action should be to review performance against predictions, rather than to propose actions to achieve compliance.
- 3.14** GW has proposed an additional monitoring action condition that requires monthly monitoring in the event of an exceedance of conditions 46 or 47. This additional condition is unreasonable in conjunction with the repeat sampling already required in 46 and 47. The effect of the additional condition is to require not just monthly but twice monthly monitoring at uneven intervals.
- 3.15** Secondly, if on reviewing a continuing exceedance it is found that there is no real issue and what is really required is a variation of the compliance values, the additional condition requires frequent monitoring until such time as a varied condition was put in place. This approach seems back-to-front since in the meantime the consent holder might technically and legally be non-compliant but the non-compliance may have no effect. At the very least, there needs to be an “out” so that GW can relax the more frequent sampling.

Graeme Proffitt
Director, Pattle Delamore Partners Limited
23 March 2009