

**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 SUBMITTERS' EVIDENCE

Subject Area: Groundwater Modelling

1. INTRODUCTION

- 1.1** This supplementary evidence provides responses to submitters' evidence. I restrict my comments to groundwater issues.

2. EVIDENCE OF IAN GUNN

- 2.1** Mr Gunn comments on hydrogeology and groundwater modelling in Section 8 of his evidence.

- 2.2** Mr Gunn criticises the groundwater modelling, and in particular its use for the surface silt layer and the hydraulic conductivity. He will be familiar with hydraulic modelling of rivers and should be familiar with the how such modelling inevitably uses approximations, but deals with the uncertainties by calibrating against real data and erring on the safe side by being conservative.

- 2.3** This is the case with the groundwater modelling. I noted in my supplementary evidence with respect to the officer's report at paragraph 2.11 that the groundwater model was conservative in a number of respects. In addition, as set out in my main evidence the model was calibrated against actual water level data.

- 2.4** In paragraphs 8.3 and 8.4 Mr Gunn points out the silt thickness is variable whereas the model used an average thickness. This is an approximation, but the way the groundwater model is set up, it is not sensitive to the silt thickness and Mr Gunn's concern is misplaced. The silt acts as a low permeability cap, so that the aquifer is modelled as semi-confined, as it should be. However, as the aquifer recharge is taken from the HortResearch modelling and applied directly to the gravel aquifer in the groundwater model, the fact that there is a greater or lesser thickness of silt above where the recharge is applied is not particularly important to the model.

- 2.5** Mr Gunn also takes issue with the hydraulic conductivity values used in the model in paragraph 8.5. I am aware that the hydraulic conductivity values used in the updated model were different from the updated model. However, the additional hydraulic conductivity measurements taken over the 107 ha area produced somewhat lower values than some of the values measured on the original land. It was appropriate to use a lower average in the updated model to reflect this. This is indeed an approximation, but calibration of the model, in which the model

closely reproduced actual water levels, showed this to be a reasonable approximation.

- 2.6** Mr Gunn's simplistic calculation in paragraph 8.6 attempting to show that mounding would be several metres is incorrect and suggests a misunderstanding of groundwater flow concepts. The calculation fails to take into account time, in effect assuming that 2013 mm would be applied to the aquifer instantaneously. That is, of course, far from the true situation. To use an analogy, it is akin to saying 2000 mm applied to the surface of a river over a year would cause a similar rise in the river level. Of course it does not, as the river conveys the water away over the year. An aquifer behaves similarly to a river in conveying the water away, albeit at reduced rates because of greater resistance to flow (quantified by the hydraulic conductivity).
- 2.7** At paragraph 8.10 Mr Gunn has misunderstood the reason given in my evidence why average summer groundwater concentrations were used in calculating mass flux and hence river concentrations at low flow. He is of the view that maximum concentrations should have been used. I disagree.
- 2.8** Firstly, the issue is not that these highs and lows are real, as Mr Gunn appears to think. In fact they will be damped out by the way the irrigation scheme will be operated in practice. Calculating averages reflect this damping.
- 2.9** Secondly, I make the point in my evidence that the modelled concentrations will be conservative (i.e. higher than reality).
- 2.10** Thirdly, there is no reason to suspect that a (conservatively calculated) transient high in groundwater concentration will coincide with a short term low in river flow. As pointed out in my evidence, it is unreasonable to combine two extreme conditions to get a very worst case that is unlikely in reality. The averaging is a reasonable thing to do in the circumstances.
- 2.11** In paragraph 8.11 Mr Gunn suggests that I have not understood groundwater flow is rapid under the site. On the contrary, the hydraulic conductivities we have measured in the shallow aquifer using pumping tests are indicative of quite permeable conditions, typical of the observed geology. It is this very permeability that results in mounding being as small as it is.

2.12 In summary, the modelling is typical of its kind and appropriate for making conservative predictions in order to assess potential effects. The built-in conservatism should ensure actual effects are smaller.

3. EVIDENCE OF ANDREW DUNCAN

3.1 I do not have any comments on any groundwater issues that Mr Duncan may raise as he does not touch on any matters that I have had an involvement with.

3.2 However, Mr Duncan has submitted at some length in Section 4.7 about the existing pond leakage and PDP reports on the subject. His submission appears to be a regurgitation of a submission he made to the 2007 application.

3.3 Much of Mr Duncan's submission was incorrect in 2007 and is still incorrect, but given the existing pond leakage is no longer a major issue I don't see a need to address the errors except to say the water balance method he advocates to best measure the pond leakage (inflow – outflow = change of storage with time) was in fact the method used. He appears to have missed that fundamental point and therefore his comments on that matter become irrelevant.

4. EVIDENCE OF MALCOLM GARDNER

4.1 Mr Gardner expressed concern about his bore. I covered this issue in paragraph 11.3 of my main evidence and have not changed my view.

5. EVIDENCE OF ANNETTE WULLENS

5.1 Ms Wullens has covered a number of issues in her evidence regarding her bore and stream and their relationship to the Forbes bore, and the groundwater flow direction generally.

5.2 I covered these issues in paragraphs 11.4 to 11.12 of my main evidence. I am confident that flow direction is generally north to south and that the bore will not be adversely affected by the proposed effluent irrigation. Ms Wullen's concern with respect to the irrigation is misplaced. However, the bore's yield may be affected in future by naturally occurring dry years and poor water quality may result from local surface infiltration, problems common to all shallow bores.

Graeme Proffitt

March 2009