BEFORE A HEARINGS PANEL OF THE GREATER WELLINGTON REGIONAL COUNCIL AND MASTERTON DISTRICT COUNCIL

[GWRC Ref: WAR 090066]

In the matter of	a resource consent application to Greater Wellington Regional Council pursuant to section 88 of the Resource Management Act and its Amendments.
&	
In the matter of	a Notice of Requirement to Masterton District Council pursuant to section 168 of the Resource Management Act and its Amendments.
By	Masterton District Council
For	The Proposed upgrade of the Masterton Wastewater Plant

ADDITIONAL EVIDENCE OF STEVE GREEN
ON BEHALF OF MASTERTON DISTRICT COUNCIL

Subject Area: Land Treatment System AND Storage Model

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1. INTRODUCTION

1.1 This supplementary evidence provides responses to issues that have been raised in the evidence presented by submitters. My statement will address issues raised about the operation of the land treatment system.

2. COMMENTS ON ISSUES RAISED BY SUBMITTERS

Reference: Ian Gunn paragraph 10.15 specific points, page 35

Concern:

Mr Gunn states that "the model has assumed average conditions yet the sampled area in the proposed border strip area outside of the stop banks has few sampling points even though the AEE described the area as variable".

Response:

2.1 I presume the term 'average conditions' is in reference to soils within the berm area. Mr Gunn has misunderstood this aspect of the modelling. It is important to understand soil variability is reflected in the modelling results where average soil properties are used for each area of like soils that have been identified and mapped by soil experts from Landcare Research.

Concern:

Mr Gunn raises concerns with "The downtime associated with flooding on 40% of the land disposal area is not allowed for in the model"

Response:

2.2 It is worth noting that the flood plain areas are located on the free draining soils to the north of the site, and so they will drain the quickest. During a flood there is greater opportunity for disposal to the river, so that pond storage volumes would be decreasing during a flood period. Additional downtimes are already included in the calculations, to account for harvesting (2 weeks) and large rainfall events (2 additional days whenever more than 20 mm of rainfall occurs). I do not expect the occasional downtime for floods to affect the storage model predictions significantly.

2.3 Concern:

Mr Gunn raises concerns that "The pulses of nutrients and bacteria following renovation are not included in the model".

Response:

I do not expect the renovation period for new pasture development to have significant effects given that flooding on the berm area has a return period of five years, on average.

2.4 Concern:

Mr Gunn is concerned that "suspended solids have not been included in the model".

Response:

Mr Gunn is probably not aware that the modelling framework explicitly treats the movement of organic matter (suspended solids) through the soil profile. This is an important feature of the calculations with regard to the mineralization of organic carbon and organic nitrogen in the soil.

2.5 Concern:

Mr Gunn is concerned, in Section 11.7, that "excessive volumes of irrigation water could degrade soil structure by blocking pores, limiting aeration, and reducing soil permeability to water. Suspended solids have not been included in the model".

Response:

My response is as follows. We understand that effluent from the WWTP would contain about 22 g-SS m^{-3}. Taking the worst-case summer application rate of 100 mm every 10 d (i.e. 10 mm d^{-1}, on average) to the free-draining soils, this would result in an average loading of 0.22 g-SS m^{-2} d^{-1}, or 2.2 kg-SS ha^{-1} d^{-1}.

In a study at Waitarere, 60 mm $week^{-1}$ of effluent at 185 g-SS m^{-3} was applied over 7 years, and Magesan et al. (1999) (Hydraulic conductivity in soils irrigated with wastewaters of different strengths: Field and laboratory studies. *Australian Journal of Soil Research* 37:391-402) noted the hydraulic conductivity of the surface soil changed insignificantly from 39 mm h^{-1} to just 35 mm h^{-1}. At the 10-20 cm depth, there was also no significant change in the hydraulic conductivity

of the soil. The suspended solids loading at Masterton, even in the worst case, is significantly less than this rate at Waitarere (1.6 g-SS m^{-2} d^{-1}).

In 2003, Winter and Goetz (The impact of sewage composition on the soil clogging phenomena of vertical flow constructed wetlands. *Water Science Technology* 48(5):9-14) noted that in order to prevent clogging in vertical flow constructed wetlands, the loading of suspended solids should be lower than 5 g-SS m^{-2} d^{-1}. The worst-case Masterton loading is just 0.75 g-SS m^{-2} d^{-1}, and lass than half that value on the silty-clay soils.
The Leeston border strip system has a pond effluent application of 2.7 m yr^{-1} on average, compared to the proposed 2.0 m yr-1 for Masterton. The report on Leeston soil structure, attached to Neal Borrie's evidence, prepared by Trevor Webb of Landcare research, showed no degrading or deterioration of the soil structure after 34 years of application.

If the irrigation is properly managed at Masterton, I do not expect soil clogging to have a major impact on the treatment capacity and hydraulic performance of the soils over the lifetime of the scheme.

2.6 Concern:

Mr Gunn is concerned, in Section 13.3, that "The AEE does not include an in depth assessment on climate change", and he has concluded that the modelling assumes "the river flow characteristics should remain similar to past years".

Response:

I have already addressed this point in my statement of evidence (Section 8.8) Mr Gunn has possibly misunderstood that the modelling the future climate was done to address the issue with respect to storage only. Our calculations are based on NIWAs medium-high climate change scenario (that suggested a 5-10% decrease in rainfall and a four-fold increase in the occurrence of severe drought). In the absence of future river flow records, at a daily time step, we have had to adopt the conservative position of assuming the future rainfall decreases by the maximum and the river flow drops in proportion. We have also reduced the change in inflow volumes by half that amount, recognising that about half of Masterton's wastewater comprises storm-water that enters the system. So the modelling did consider a reasonable future change in river flow characteristics, albeit a simple linear decrease by 10%. We have no data to suggest otherwise.

2.7 Concern:

Mr Gunn is again confused over the irrigation applications, in Section 15.3, stating that he is unsure if "the irrigation has been modelled as 100 mm applications every 10 days or 10 mm every day"

Response:

I have already addressed this point in my supplementary statement of evidence (Section 6.2).

Dr S Green
11 March 2009