greater WELLINGTON
REGIONAL COUNCIL

Report	08.625
Date	14 October 2008
File	ENV/05/02/21
Committee	Regulatory Committee
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Wairarapa targeted groundwater quality investigations

1. Purpose

To report the key findings of six targeted groundwater quality investigations undertaken in the Wairarapa during 2004 to 2008[1].

2. Background

Over the last decade there has been a major shift in the management of agricultural and municipal wastewater in the Wellington region, with wastewater discharges directed away from surface water bodies and onto land wherever practicable. As a result, there are no longer any authorised (consented) agricultural discharges to rivers, streams or lakes in the Wellington region. While discharges to land help reduce the impacts on surface water quality and ecology, discharging waste onto land has potential implications for soil and groundwater quality. This may include the leaching of nutrients, pathogens and other contaminants to groundwater. This can be a cause for concern where groundwater is used for potable or stock water supply and when groundwater enters surface water systems.

Routine state of the environment groundwater quality monitoring in the Wellington region has highlighted elevated nitrate-nitrogen concentrations (>3 mg/L) in some areas. This prompted intensive investigations in these areas to further our understanding of the extent and likely causes of poor groundwater quality. This report summarises the key findings from six such studies undertaken in the Wairarapa during 2004 to 2008. These studies targeted intensive farming areas in Te Ore Ore, Carterton and South Featherston, expanding coastal settlements (Riversdale and Flat Point) and an area with an increasing number of rural/residential subdivisions serviced by on-site wastewater treatment systems (Norfolk Road, Carterton).

[1] This report is a summary of the technical report: Tidswell, S. 2008. *Targeted groundwater quality investigations in the Wairarapa.* Greater Wellington Regional Council, Publication No. GW/EMI-T-08/81.

3. Sampling variables and data interpretation

Groundwater samples were tested for the dissolved nutrients nitrate-nitrogen (hereinafter referred to as nitrate), nitrite-nitrogen, ammoniacal nitrogen and dissolved reactive phosphorus (DRP), as well as faecal indicator bacteria *Escherichia coli* (*E. coli)* and faecal coliforms. Not all variables were tested in each targeted study.

Groundwater sample results were compared against the New Zealand National Drinking Water Standards (DWSNZ 2005). These standards apply to water used for human consumption and set a maximum acceptable value (MAV) of 11.3 mg/L for nitrate-nitrogen (NO_3-N), 0.06 mg/L for nitrite-nitrogen (NO_2-N), and no detectable *E. coli* or faecal coliform bacteria. There are no MAVs for ammoniacal nitrogen or DRP.

Groundwater nitrate concentrations were also evaluated in terms of likely human influence, with a threshold of 3 mg/L adopted as a means of defining nitrate contamination from anthropogenic sources (natural concentrations in groundwater in New Zealand rarely exceed 1 mg/L).

4. Results and discussion

Nitrate contamination exists to various degrees in all six areas studied. The greatest nitrate contamination is present in shallow groundwater in the Carterton (shown as an example in Figure 1) and Te Ore Ore study areas; the Drinking Water Standard MAV of 11.3 mg/L was exceeded in five instances in these areas and a number of bores also recorded nitrate concentrations of at least half the MAV.

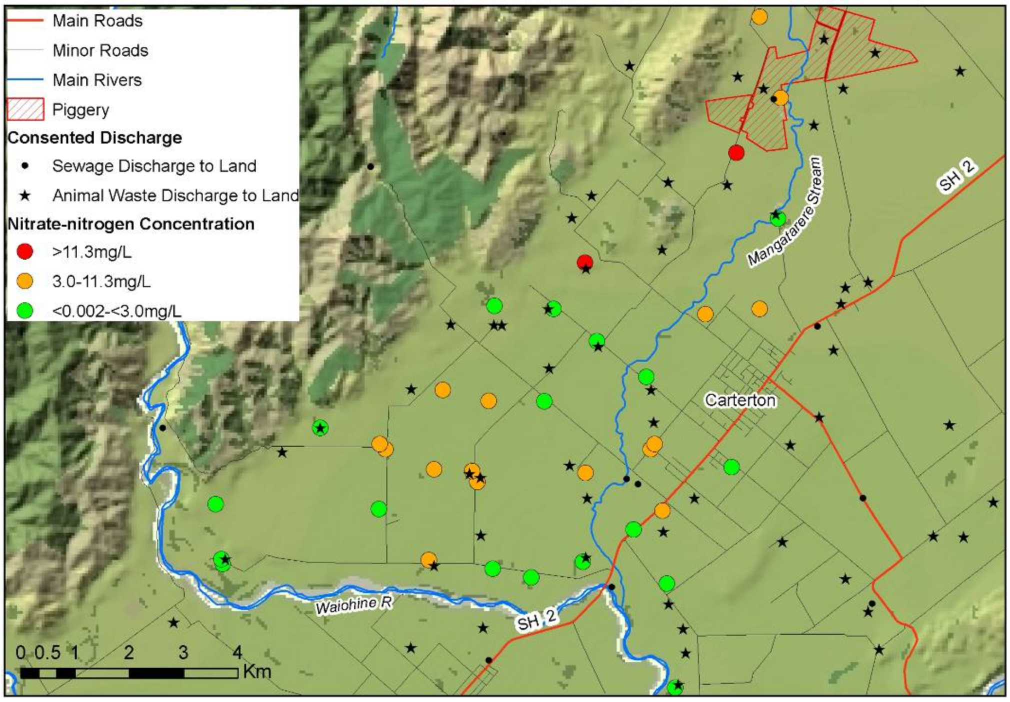

Figure 1: Nitrate concentrations recorded in Carterton (mostly the Mangatarere catchment) monitoring bores during November/December 2006. Key consented discharges to land are also shown.

Dissolved phosphorus concentrations were generally low with only four occasions where concentrations were above 0.1 mg/L in South Featherston and Carterton. Ammoniacal nitrogen and nitrite nitrogen concentrations were also low.

Bacterial contamination was present in a number of shallow bores, with counts of *E. coli* and faecal coliforms above the Drinking Water Standard MAV in a number of bores used for domestic supply. The highest faecal count recorded was 1,800 cfu/100mL.

Elevated groundwater nitrate concentrations can be linked to land use; the shallow aquifers in the Carterton, Te Ore Ore and South Featherston study areas show the greatest level of contamination and these areas are where intensive land use is most prevalent. The number of consented discharges to land is also greatest in these areas, the majority of which are dairyshed effluent discharges. In contrast, bores in the Norfolk Road, Riversdale and Flat Point study areas – where land use is either residential or is changing from pastoral to residential development – recorded significantly lower nitrate concentrations. Even so, some groundwater contamination is still present in these areas, particularly at Riversdale where there have been occasional guideline exceedances for nitrate and faecal bacteria.

Higher nitrate concentrations – along with higher *E. coli* and faecal coliform counts – were generally seen in winter when rainfall was greater, soils more saturated and groundwater levels higher. Under these conditions, there is a greater likelihood of the shallow groundwater being impacted by animal or human waste disposed onto land. However, groundwater contamination was not limited to shallow aquifers; a number of bores located in the deep confined or semi-confined aquifers in the South Featherston, Carterton and Te Ore Ore study areas recorded elevated concentrations that in some cases exceeded the Drinking Water Standard MAV for nitrate-nitrogen. This suggests a degree of connectivity between the shallow and deep aquifers and that contamination is possibly migrating into deeper aquifers. As the deeper aquifers generally contain older groundwater that is less affected by contamination, the full effects of recent land use intensification are probably yet to be seen in these aquifers.

Piezometric (groundwater level) surveying in many of the study areas suggests that groundwater discharges into adjacent or downgradient surface water bodies. Therefore, it is highly likely that elevated nitrate concentrations in shallow groundwater are contributing to the poor water quality identified in a number of surface water bodies monitored by Greater Wellington, including the Enaki Stream, Mangatarere Stream and Lake Wairarapa. This highlights the need for an integrated approach to managing the region's soil and water resources, particularly when assessing resource consent applications for wastewater discharges to land. Soil nutrient loadings and wastewater application rates must be assessed carefully, particularly in areas of intensive land use.

5. Conclusion

Groundwater contamination is evident in all six study areas, with the most significant nitrate contamination found in shallow aquifers in the intensively farmed areas of Carterton, Te Ore Ore and, to a lesser extent, South Featherston. Soil nutrient loadings and wastewater application rates must be carefully managed in these areas, especially given the linkages between shallow groundwater and surface water.

6. Communication

Copies of the technical report documenting the six targeted groundwater quality investigations have been circulated internally and a copy will be given to Wairarapa Public Health. The technical report is also available on Greater Wellington's website.

7. Recommendations

It is recommended that the Committee:

1. ***Receives** the report; and*

2. ***Notes** the contents.*

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