STAFF REPORT

TO: Environment & Planning Committee

FROM: Glenn Stevens – Resource Scientist (Water & Land)

REFERENCE: R03032

SUBJECT: **MONITORING OF PESTICIDES RESIDUES IN SHALLOW GROUNDWATER, TASMAN DISTRICT – REPORT EP07/09/05 -** Report prepared for 12 September 2007 Meeting

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1. INTRODUCTION

Many land owners use various pesticides to some degree to control pests and weeds in their horticultural and agricultural operations. However, if used inappropriately pesticide residues can persist in the soil and potentially leach down into the underlying groundwater. Therefore, the presence of pesticide residues in groundwater can indicate inappropriate land use practises in the recharge areas. Elevated concentrations may also render the groundwater unfit for drinking and/or other uses such as irrigation. The term pesticide is taken include the various insecticides, herbicides, fungicides and related substances used in horticultural and agricultural land use.

The Institute of Environmental Science & Research Limited (ESR) has coordinated national surveys of pesticides in New Zealand groundwaters at four yearly intervals since 1990. In the Tasman District pesticide surveys have now been undertaken on three occasions: December 1998 (14 sites); December 2002 (15 sites); and December 2006 (15 sites). The results of the national survey have been summarised by ESR and forwarded to the participating Regional and District Councils.

This report presents the 2006 pesticide monitoring results for the Tasman District and compares them to the previous sampling rounds.

2. METHODS

The 2006 survey re-sampled the same 15 groundwater sites that were sampled in 2002 and included the 14 sites that were sampled in 1998. These sites are distributed throughout the Waimea, Moutere, and Motueka districts. All three areas include intensive horticultural and/or agricultural land use where pesticides have been, or currently are, used. As such, there is the potential for these pesticides to enter the underlying groundwater systems if used inappropriately. Table 1 lists the current surrounding land use at each sample site. Land use from the 1970s has been inferred from historic aerial photographs and is also listed.

The sampled bores/wells in the Waimea and Motueka areas are relatively shallow and only penetrate the surface unconfined aquifer. In the Moutere area bores/wells tapping the shallow unconfined aquifer and located in the valley floor were selected. These sites were selected for this study as they represent shallow groundwater which is more susceptible to pesticide leaching than deeper and/or confined groundwater systems.

Each groundwater sample was collected into sterilized glass bottles that were supplied by the analytical laboratory. Each bore was purged as per the instructions supplied from ESR prior to the collection of each sample. The samples were then placed in chilled storage (chilli-bin) and couriered overnight to AgriQuality's Lower Hutt analytical laboratory. Direct field measurements of pH, conductivity, and water temperature were collected where possible.

In addition to the 15 groundwater samples collected, a blind duplicate sample was also collected as per ESR's instructions. The blind duplicate sample was collected from the Waimea (Appleby Gavel Unconfined Aquifer) from bore WWD508 and given a fictitious ID number and forwarded to the lab along with the other samples.

The samples were analysed by AgriQuality Limited for a range of organo-chlorine pesticides, organo-phosphorus pesticides, organo-nitrogen herbicides and acid herbicides. A complete list, including the limits of detection for each method is presented in Appendix 1.

Seven of the sites are also sampled on a quarterly basis as part of the Council's State of the Environment monitoring programme (although this does not include monitoring for pesticide residues). Additional groundwater quality data are available for these sites.

3. RESULTS

Figure 1 shows the location of the bores/wells sampled for pesticide residues in the Tasman District. Where a pesticide has been detected during any of the three surveys to date (i.e. 1998, 2002 or 2006) it is listed in the table adjacent to the sample location. The Maximum Acceptable Value (MAV) specified in the Ministry of Health's *Drinking-water Standards for New Zealand 2005* for the detected pesticides is also listed. Only the pesticides that were detected (i.e. had concentrations above the detection limit of the analysis method used) are tabled in Figure 1. A full list of all pesticide and residues tested for and their respective detection limits is provided in Appendix 1.

In the 2006 survey, there were only five sites out of the 15 sampled where any pesticide residues were detected. In the previous surveys there were ten sites where pesticide residues were detected in 1998 and nine sites in 2002.

All pesticide residues detected in the 2006 survey were at levels considerably below the NZ drinking water MAV. The highest concentration compared to the respective MAV measured in the 2006 sampling round was at WWD4096 where simazine was detected at 1.3% of the MAV.

The five sites where pesticide residues were detected in the 2006 survey also showed low levels of pesticide residues when tested during both previous surveys (1998 and 2002).

There are three sites where no pesticides have been detected during all three surveys and a further two sites where pesticide residues were only detected in the 1998 survey.

The pesticide residues detected during the 2006 sampling round were (soil half life data from the New Zealand Agrichemical Manual 2004):

Simazine a pre-emergence herbicide (half life in soil of 30 – 100 days).

Metalaxyl an organo-nitrogen fungicide (half life in soil in the order of 20 days and 20 – 30 days in water). Its use is restricted to the asparagus industry.

In addition to simazine, the previous sampling rounds in 1998 and 2002 have also detected the following:

Diazinon an organo-phosphate insecticide, used to control a wide range of common pests.

Terbuthylazine a herbicide for grass and broadleaf weed control (half life in biologicaly active soils of 30- 60 days).

Endosulfan an organo-chloride broad spectrum insecticide (half life in soil of 30-70 days).

Propazine an organo-nitrogen herbicide (half life in soil of 80 – 100 days).

(Metalaxyl was only detected in the 2006 sample round)

Overall the 2006 sampling confirmed the continued presence of pesticide residues at some locations. The pesticide residues that were encountered were all at very low levels. Given only three sample rounds have been undertaken it is not possibly to conclusively determine any trends over time, however, no sites are showing any significant increases in pesticide residues compared to the previous sampling results.

The only possible exception being well WWD524. Whilst pesticide residues have been detected in this well during previous surveys, traces of metalaxyl were encountered for the first time during the 2006 survey. The New Zealand Agrichemical Manual 2004 lists the use of metalaxyl (a fungicide) as being restricted to the asparagus industry. The land use surrounding this well includes market gardening and glass houses.

The concentration of metalaxyl encountered in well WWD524 (0.056 mg/m^3) is not significantly above the detection limit of 0.01 mg/m^3, particularly when compared to the NZ drinking water MAV of 100 mg/m^3. Given that metalaxyl has only been detected in a single result and at a low concentration, it is difficult to draw any firm conclusions. It is recommended that this well is included in future monitoring of groundwater for pesticide residues.

4. RECOMMENDATIONS

a) That the Committee receives this report.

b) That Council staff continue to offer advice and information and advocate best practise with respect to the use of pesticides to land owners/users when opportunities arise and/or in response to queries.

c) That the Committee continues to support ESR's National Survey of Pesticides in Groundwater by repeating this survey in approximately five years time (i.e. 2011).

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Figure 1: Location of sample sites and results of pesticide residues screening.

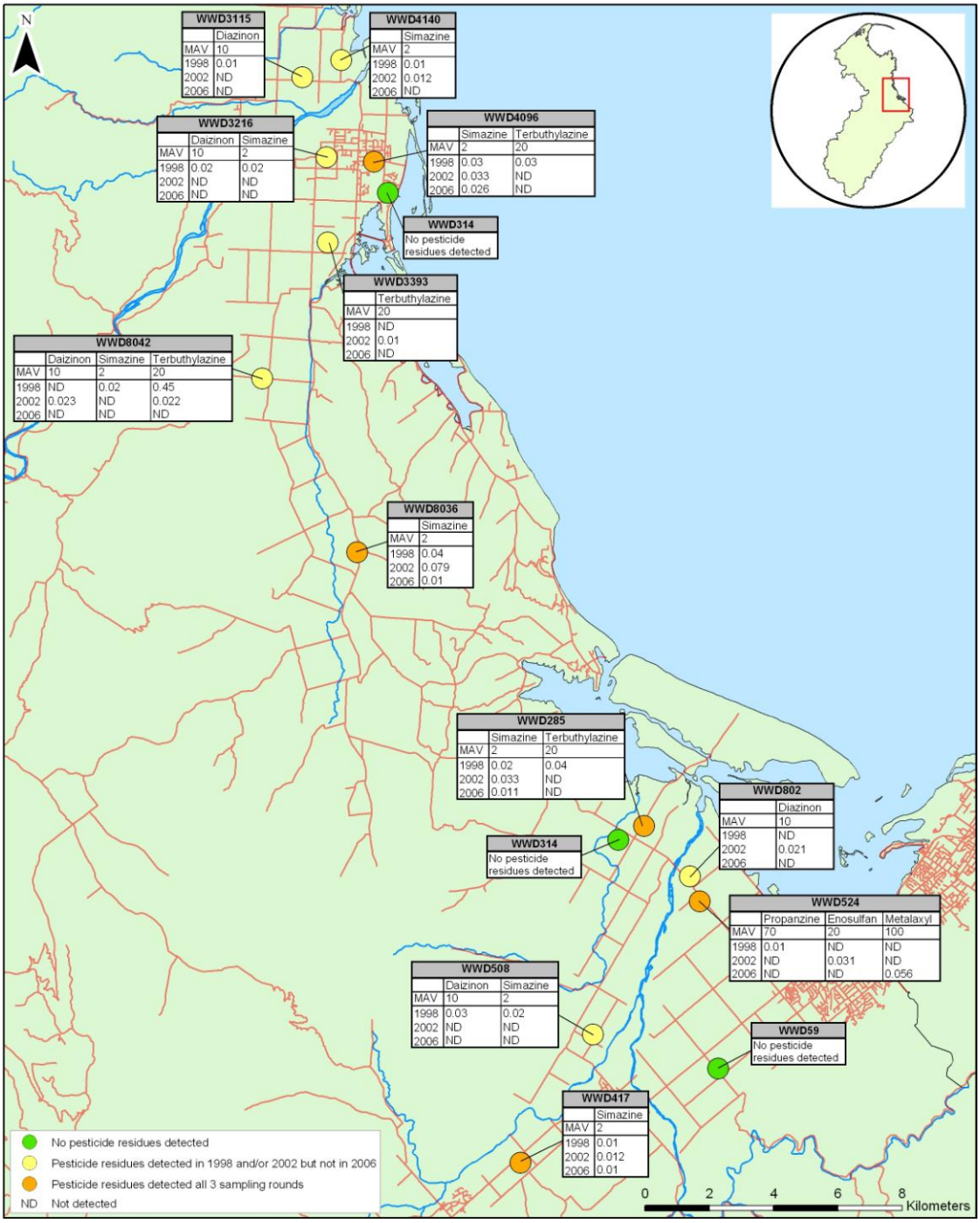

Table 1: Surrounding land use of the sampling sites.

	Bore	***Current land use (2006)***	***Previous land use****
Sites where pesticide residues have been detected on all three sampling rounds (i.e. 1998, 2002 and 2006)	WWD4096	Residential (urban fire bore)	Residential (1978)
	WWD8036	Pasture	Horticulture (berry fruit?) and possibly including tobacco (1978)
	WWD285	Viticulture	Pasture (1971)
	WWD524	Glasshouses / industrial wastewater irrigation field	Orchard (1971)
	WWD417	Pasture/grazing	Pasture/grazing (1971)
Sites where no pesticide residues have been detected during the latest sampling round (2006) but some pesticide residues were detected during previous sampling rounds.	WWD4140	Orcharding – some residential (fire bore)	Tobacco (old tobacco kiln located on opposite side of road) (1978)
	WWD3216	Kiwi fruit	Cropping/market garden? (1978)
	WWD3393	Orcharding	Pasture/grazing (1978)
	WWD8042	Orcharding	Orcharding (1978)
	WWD802	Orcharding – market gardening across road (up-gradient)	Pasture/grazing (1971)
	WWD3115	Orcharding	Orcharding (1978)
	WWD508	Orcharding/kiwi fruit	Pasture? (possibly cropping/market gardening) (1971)
Sites where no pesticide residues have been detected during all three previous sampling rounds	WWD3314	Residential (bore surrounded by rose garden)	Orcharding (1978)
	WWD997	Orcharding	Pasture? (possibly cropping/market gardening) (1971)
	WWD59	Market gardening/ plant nursery (including glasshouses)	Market gardening/ glasshouses (Orcharding next door) (1971)

* Land use inferred from aerial photography. Date of photography in brackets.

APPENDIX 1:

List of pesticides tested for and the limits of detection for each method. Units are mg/m^3 (ppb).

Organo-chlorine pesticides:

lindane	0.01	*cis* permethrin	0.01
heptachlor	0.02	*trans* permethrin	0.01
heptachlor epoxide	0.03	vinclozin	0.02
aldrin	0.02	endosulfan I	0.02
procymidone	0.02	endosulfan II	0.04
α-chlordane	0.02	endosulfan sulphate	0.02
γ-chlordane	0.02	endrin	0.02
dieldrin	0.02	endrin aldehyde	0.04
methoxychlor	0.02	endrin ketone	0.04
BHC	0.01		

p,p′-dichlorodiphenyldichloroethylene (DDE)	0.01
p,p′-1,1-dichloro-2,2-bis(4-chlorophenyl)ethane (DDD)	0.01
p,p′-1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (DDT)	0.01

Organo-phosphorus pesticides:

azinphos methyl	0.4	pirimiphos methyl	0.02
diazinon	0.01	chlorpyrifos	0.02

Organo-nitrogen herbicides:

trifluralin	0.02	metribuzin	0.02
simazine	0.01	bromacil	0.03
atrazine	0.01	oryzalin	2.0
propazine	0.01	linuron	0.04
terbuthylazine	0.01	hexazinone	0.02
desethyl atrazine	0.02	norflurazon	0.02
desisopropyl atrazine	0.1	metalaxyl	0.01
propanil	0.02	acetochlor	0.02
alachlor	0.02	oxadiazon	0.01
metolachlor	0.02	cyanazine	0.02
pendimethalin	0.02	terbacil	0.02
molinate	0.02		

Acid herbicides:

mecoprop	0.1	triclopyr	0.1
MCPA	0.1	2,4,5-T	0.1
MCPB	0.1	2,4-DB	0.1
Acifluorfen	0.1	bentazone	0.1
Bromoxynil	0.1	fenoprop	0.1
Dicamba	0.1	picloram	0.1
dichlorprop	0.1	3,5-dichlorobenzoic acid	0.1
dinoseb	0.1	pentachlorophenol	0.1
2,4-D	0.1		