

Report No:	REP11-07-06
File No:	G901
Date:	30 June 2011
<b>Information Only - no decision required</b>	

## REPORT SUMMARY

**Report to:** Environment & Planning Committee  
**Meeting Date:** 14 July 2011  
**Report Author:** Glenn Stevens, Resource Scientist  
**Subject:** **Pesticide Residues in Groundwater - 2010 Survey**

### Executive Summary

Council participates in the *National Survey of Pesticides in New Zealand Groundwaters* which is coordinated by Environmental Science & Research Ltd.

In Tasman 15 sites are currently sampled at four yearly intervals. Tasman has participated in this programme since 1998 completing four surveys to date. This report presents the results of the latest round of sampling undertaken in 2010.

Overall, the 2010 sampling confirms the continued presence of trace level pesticide residues in groundwater at some locations. Pesticide residues are encountered at five sites and are all at very low levels and significantly below the respective maximum allowable values prescribed in the 2005 NZ Drinking Water Standards. No sites show any significant increases in pesticide residues compared to the previous sampling results.

### Recommendations

1. That the Committee receives this report.
2. That Council staff continue to offer advice and information and advocate best practise with respect to the use and disposal of pesticides to land owners/users when opportunities arise and/or in response to queries.
3. That Council staff continue to support ESR's National Survey of Pesticides in Groundwater by repeating this survey in approximately four years time (i.e. 2015).

### Draft Resolution

**THAT** the Environment & Planning Committee receives the report Pesticide Residues in Groundwater - 2010 Survey Report REP11-07-06

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## 1. Introduction

- 1.1 Many land owners use various pesticides 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. The term pesticide is taken to include the various insecticides, herbicides, fungicides and related substances used in horticultural and agricultural land use.
- 1.2 The Institute of Environmental Science & Research Limited (ESR) has coordinated the National Survey of Pesticides in New Zealand Groundwaters at four yearly intervals since 1990. In the Tasman District pesticide surveys have now been undertaken on four occasions:
- December 1998 (14 sites)
  - December 2002 (15 sites)
  - December 2006 (15 sites)
  - December 2010 (15 sites)
- 1.3 These surveys are an integral part of Council's State of the Environment Monitoring Programme. As such, they contribute to Council fulfilling its obligations under the Resource Management Act (1991) and the Tasman Resource Management Plan.
- 1.4 This report presents the 2010 pesticide monitoring results for the Tasman District and compares them to the previous surveys.

## 2. 2010 Survey

- 2.1 The 2010 survey re-sampled the same 15 groundwater sites that were sampled in 2002 and 2006 and also included the 14 sites that were sampled in 1998. These sites are distributed throughout the Waimea (7), Moutere (2), and Motueka (6) areas of the District. Appendix I contains location maps of the sampling sites. These areas include intensive horticultural and/or agricultural land use where pesticides have been, or currently are, used. Appendix II lists the sample sites, the current surrounding land use and previous land use from the 1970's (inferred from aerial photographs).
- 2.2 The sampled sites all represent shallow unconfined groundwater as this is more susceptible to pesticide leaching than deeper and/or confined groundwater systems. The Waimea and Motueka sites penetrate the surface unconfined gravel aquifers. The Moutere sites tap less productive aquifers (than the unconfined gravel aquifers) and both are located in the Moutere valley floor.
- 2.3 Seven of the sampled sites are also part of the Council's State of the Environment groundwater monitoring programme. Additional groundwater quality data are available for these sites.

## 3. Results

- 3.1 Figures 2a and 2b (Appendix I) show the location of the groundwater sites sampled for pesticide residues in the Tasman District.
- 3.2 Where a pesticide has been detected during any of the four surveys to date (i.e. 1998, 2002, 2006 or 2010) it is listed in the table adjacent to the sample location. The Maximum Acceptable Value (MAV) for the detected pesticides as specified in the Ministry of Health's Drinking-water Standards for New Zealand 2005 are also listed.
- 3.3 Only the pesticides that were detected (i.e. had concentrations above the detection limit of the analysis method used) are listed in Figures 2a and 2b. A complete list of all pesticide residues tested for and their respective detection limits is provided in Appendix II.
- 3.4 In the 2010 survey pesticide residues were only detected at five sites. Three of these sites were for traces of simazine. The 2006 survey only detected pesticide residues at five sites as well, though not all were the same sites as in 2010. There were ten sites where pesticide residues were detected in 1998 and nine sites in 2002. All the pesticides detected during the 2010 and previous surveys are listed below in Paragraph 0.

- 3.5 All five of the sites that encountered pesticide residues in the 2010 survey had also encountered pesticide residues during past surveys. However, only two of the five sites had encountered pesticide residues during the previous survey in 2006.
- 3.6 Two of the five sites that encountered pesticide residues in the 2010 survey only previously encountered pesticide residues in the 1998 survey. In both instances it was simazine that was detected.
- 3.7 There are three sites where no pesticides have been detected during all four surveys and one site where pesticide residues were only detected in the 1998 survey.
- 3.8 All pesticide residues detected in the 2010 survey were at trace levels and considerably below the NZ drinking water MAV. The highest concentration compared to the respective MAV measured in the 2010 sampling round was at WWD4096 where desethyl atrazine was detected. There is no MAV available for desethyl atrazine (a breakdown component of atrazine) and it is assumed to be similar to atrazine<sup>1</sup>. On this basis the measured concentrations were only 1.15% of the MAV (for atrazine).
- 3.9 The pesticide residues detected during the 2010 sampling round are listed below. Soil half life data are from the New Zealand Agrichemical Manual 2004 and are for surface soils. Pesticide residues may persist longer in deeper soils and in groundwater.

Simazine	a pre-emergence herbicide (half life in soil of 30 - 100 days).
Terbuthylazine	a herbicide for grass and broadleaf weed control (half life in biologicaly active soils of 30- 60 days).
desethyl atrazine	a breakdown component of atrazine which is a herbicide for grass and broadleaf weed control. No half life in soils is listed for desethyl atrazine, however, atrazine has a half life of 35 - 50 days.

Previous sampling rounds in 1998, 2002 and 2006 have also detected:

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.
Diazinon	an organo-phosphate insecticide, used to control a wide range of common pests.
Endosulfan	an organo-chloride broad spectrum insecticide (half life in soil of 30-70 days).

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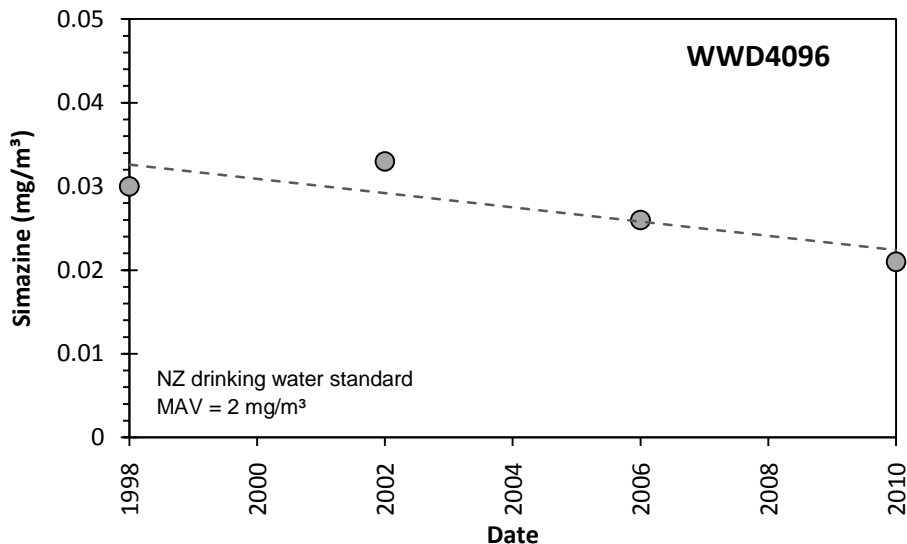
<sup>1</sup> This is the same approach used in Close and Skinner (2011), *National Survey of Pesticides in Groundwater 2010*.

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

3.10 Overall, the 2010 sampling confirmed the continued presence of pesticide residues in groundwater at some locations. The pesticide residues that were encountered were all at very low levels. Given the limited number of sample rounds to date and that pesticide residues have not always been consistently detected at the sites it is difficult to conclusively determine any trends over time. There are no sites showing any significant increases in pesticide residues compared to the previous sampling results.

3.11 There are two sites, WWD4096 and WWD524, where pesticide residues have been encountered since 1998 in all four previous sampling rounds.

3.12 WWD4096 has encountered low levels of simazine during each previous each sampling round. These are plotted below (Figure 1). Overall, the measured simazine concentrations at this site show a decreasing trend.



**Figure 1:** Measured simazine concentrations at WWD4096 (Motueka - residential land use).

3.13 Whilst pesticide residues have been detected in WWD524 on each survey, it has been different pesticide residues detected each time. Consequently, there are no discernable trends over time at this site. The low levels of detected pesticide residues at this site are propazine (1998), endosulfan I (2002), metalaxyl (2006), and desethyl atrazine (2010).

3.14 The results of the National survey are summarised in *National Survey of Pesticides in Groundwater 2010*, Close M. And Skinner A., ESR Ltd, April 2011. A copy of this report is available upon request.

3.15 Nationally there were 38 sites (24%) out of a total of 162 sampled sites where pesticide residues were detected. In Tasman only 5 (33%) of the sampled sites encountered pesticide residues.

#### **4. RECOMENDATIONS**

- 4.1 That the Committee receives this report.
- 4.2 That Council staff continue to offer advice and information and advocate best practise with respect to the use and disposal of pesticides to land owners/users when opportunities arise and/or in response to queries.
- 4.3 That Council staff continue to support Tasman's participation in ESR's National Survey of Pesticides in Groundwater by repeating this survey in approximately four years time (i.e. 2015).

#### **5. DRAFT RESOLUTION**

**THAT** the Environment & Planning Committee receives the report Pesticide Residues in Groundwater - 2010 Survey Report REP11-07-06.

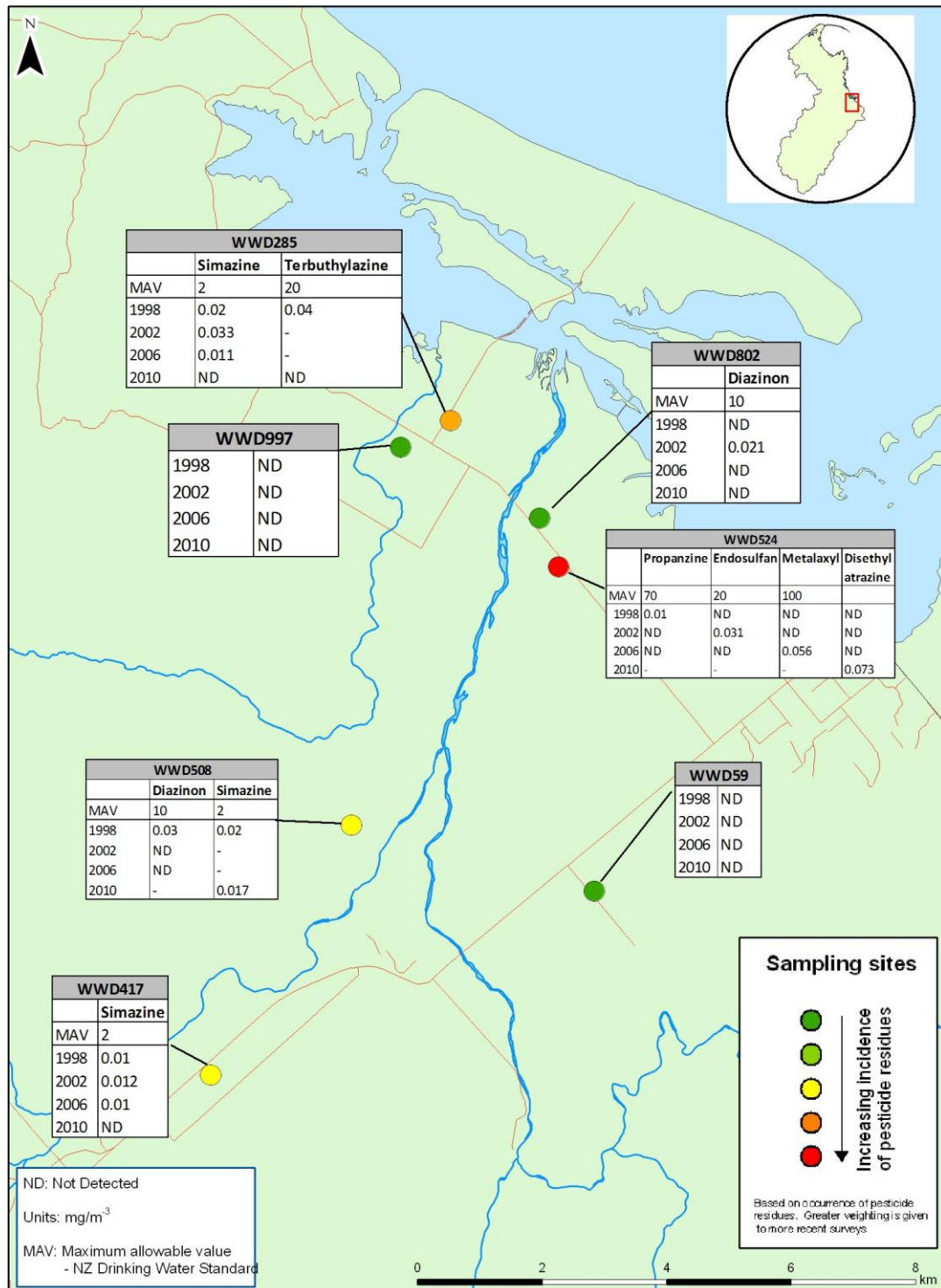
#### **6. Appendices:**

- Appendix I Location of sampling sites and the results of pesticide residues screening (1998 to 2010).
- Appendix II Table of sampling sites and their surrounding land use
- Appendix III List of pesticides tested for and the limits of detection for each method.
- Appendix IV Sampling methodology

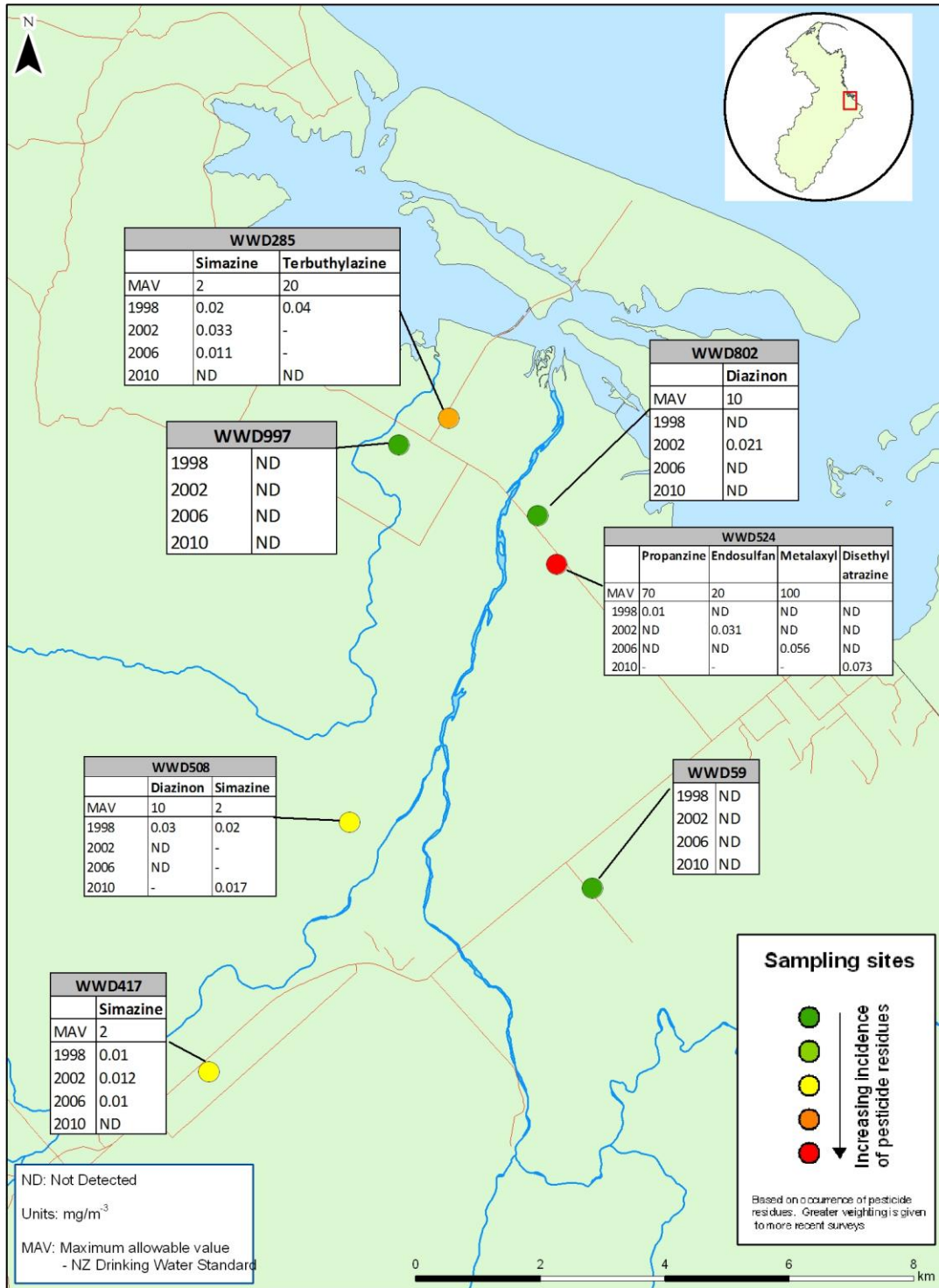
Glenn Stevens  
**Resource Scientist**

## APPENDIX I

Location of sampling sites and the results of pesticide residues screening (1998 to 2010).



**Figure 2a:** Location of sampling sites and results of pesticide residue screening



**Figure 2b:** Location of sampling sites and results of pesticide residue screening



## Appendix II

### Surrounding land use of the sampling sites.

		<b>Bore<sup>1</sup></b>	<b>Current surrounding land use (2010)</b>	<b>Previous land use<sup>2</sup></b>
Decreasing incidence of pesticide residues <sup>3</sup> ↓	Sites where pesticide residues have been detected on all four sampling rounds (1998, 2002, 2006 and 2010)	<b>WWD4096</b> (Motueka)	Residential (urban fire bore)	Residential (1978)
		<b>WWD524</b> (Waimea)	Glasshouses / industrial wastewater irrigation field	Orchard (1971)
		WWD285 (Waimea)	Viticulture	Pasture (1971)
		WWD8042 (Moutere)	Orcharding	Orcharding (1978)
		<b>WWD508</b> (Waimea)	Orcharding/kiwi fruit	Pasture? (possibly cropping/market gardening) (1971)
		<b>WWD3216</b> (Motueka)	Kiwi fruit	Cropping/market garden? (1978)
		WWD417 (Waimea)	Pasture/grazing	Pasture/grazing (1971)
		WWD8036 (Moutere)	Pasture	Horticulture (berry fruit?) and possibly including tobacco (1978)
		<b>WWD3393</b> (Motueka)	Orcharding	Pasture/grazing (1978)
		WWD4140 (Riwaka)	Orcharding - some residential (fire bore)	Tobacco (old tobacco kiln located on opposite side of road) (1978)
		WWD802 (Waimea)	Orcharding - market gardening across road (up-gradient)	Pasture/grazing (1971)
		WWD3115 (Riwaka)	Orcharding	Orcharding (1978)
	Sites where no pesticide residues have been detected during all four sampling rounds	WWD997 (Waimea)	Orcharding	Pasture? (possibly cropping/market gardening) (1971)
		WWD59 (Waimea)	Market gardening/ plant nursery (including glasshouses)	Market gardening/ glasshouses (Orcharding next door) (1971)
		WWD3314/ WWD23604 <sup>4</sup> (Motueka)	Residential	Orcharding (1978) Kiwi fruit - 1980's Residential - late 1990's

1. Bold denotes sites where pesticide residues were detected in the 2010 survey.
2. Land use inferred from aerial photography. Date of photography in brackets.
3. Based on occurrence of pesticide residues. Greater weighting is given to more recent surveys.
4. Bore WWD3314 replaced by new bore (WWD23604) in November 2009. New site ≈120m to the west of the old site.

**Appendix III**

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

**Organo-chlorine pesticides:**

lindane	0.01	<i>cis</i> permethrin	0.01
heptachlor	0.02	<i>trans</i> 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		
<i>p,p'</i> -dichlorodiphenyldichloroethylene (DDE)			0.01
<i>p,p'</i> -1,1-dichloro-2,2-bis(4-chlorophenyl)ethane (DDD)			0.01
<i>p,p'</i> -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
molinat	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		

## **Appendix IV**

### Sampling methodology

Each bore was purged as per the instructions supplied from ESR prior to the collection of each sample.

Each groundwater sample was collected into sterilized glass bottles that were supplied by the analytical laboratory.

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 WWD59 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 II.