

Summary of Evidence for PC7 Hearing

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aqualinc



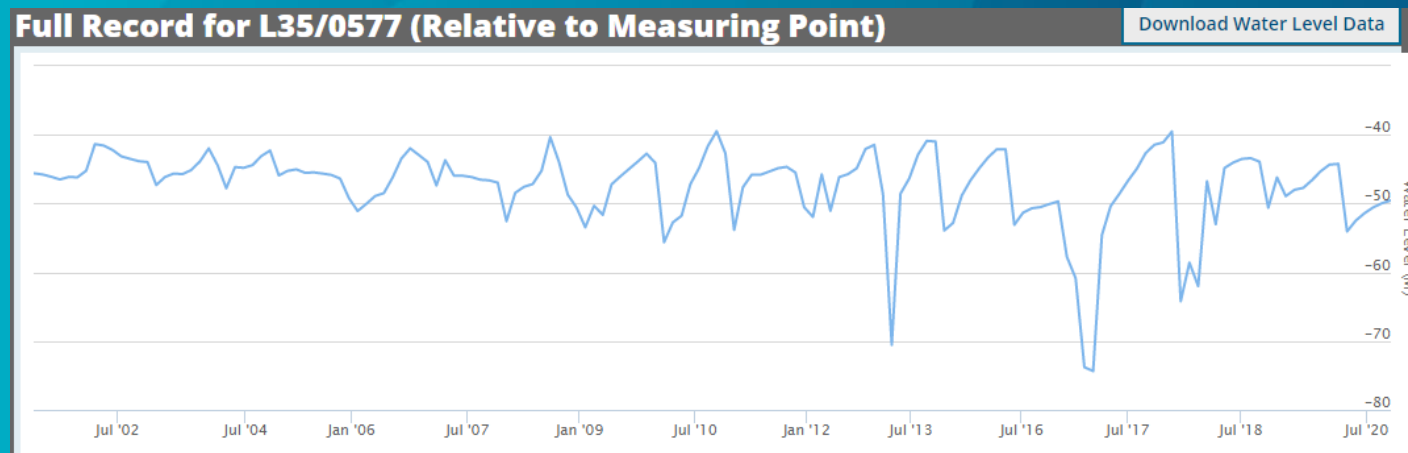
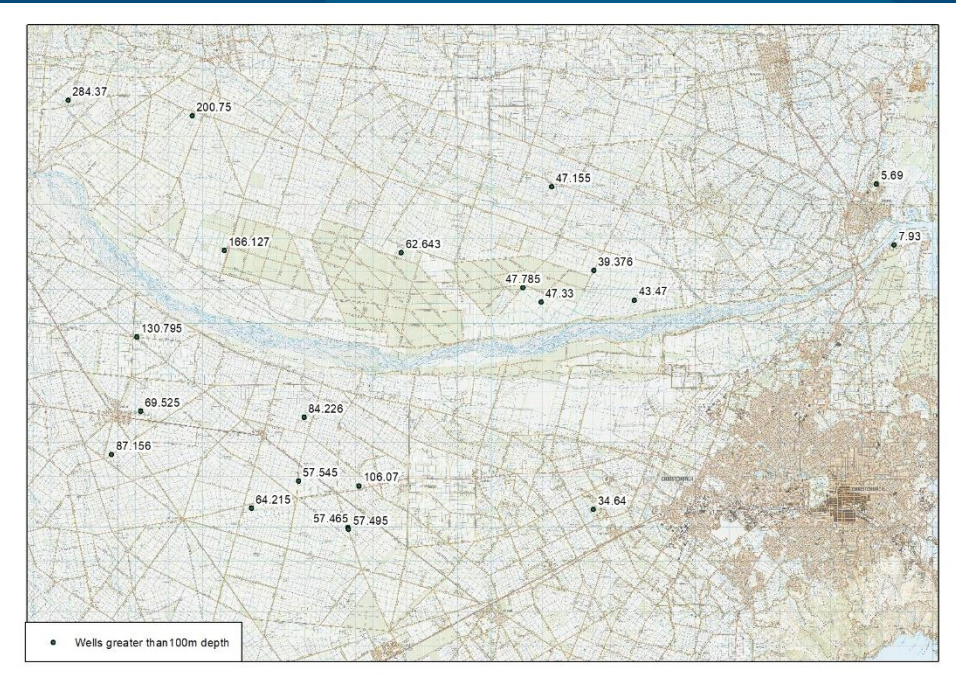
Main issues

- Lack of data for the deeper aquifer, including aquifer properties and piezometric data
- Difference between measured groundwater nitrate-N data and many of the model predictions
- Lack of documented peer review of the model, and apparent concerns from the expert panel members who provided input into the modelling
- Need for specific monitoring plans and adaptive management response to monitoring data

What we do know

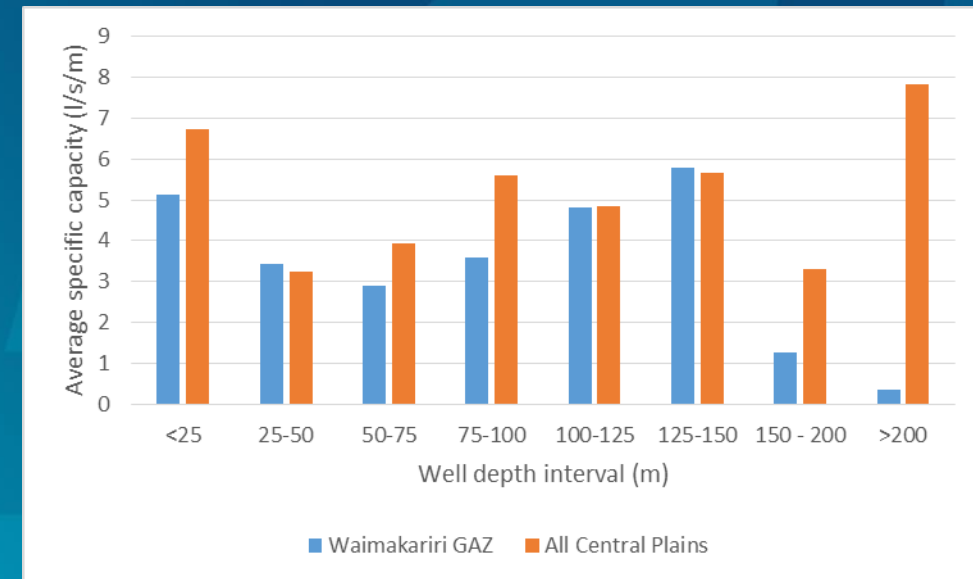
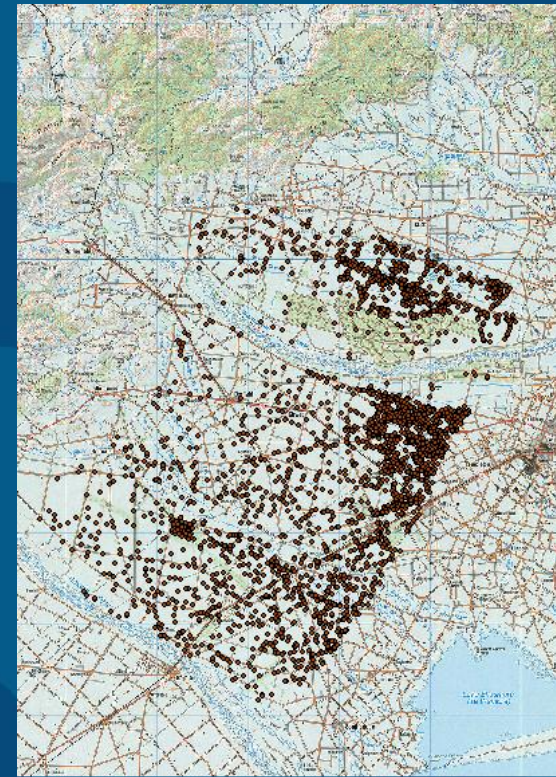
Groundwater levels and flow direction

- Very limited deep groundwater level data
 - Abundance of shallow groundwater data
 - Gap filling issues
- Available data suggest flow towards the east



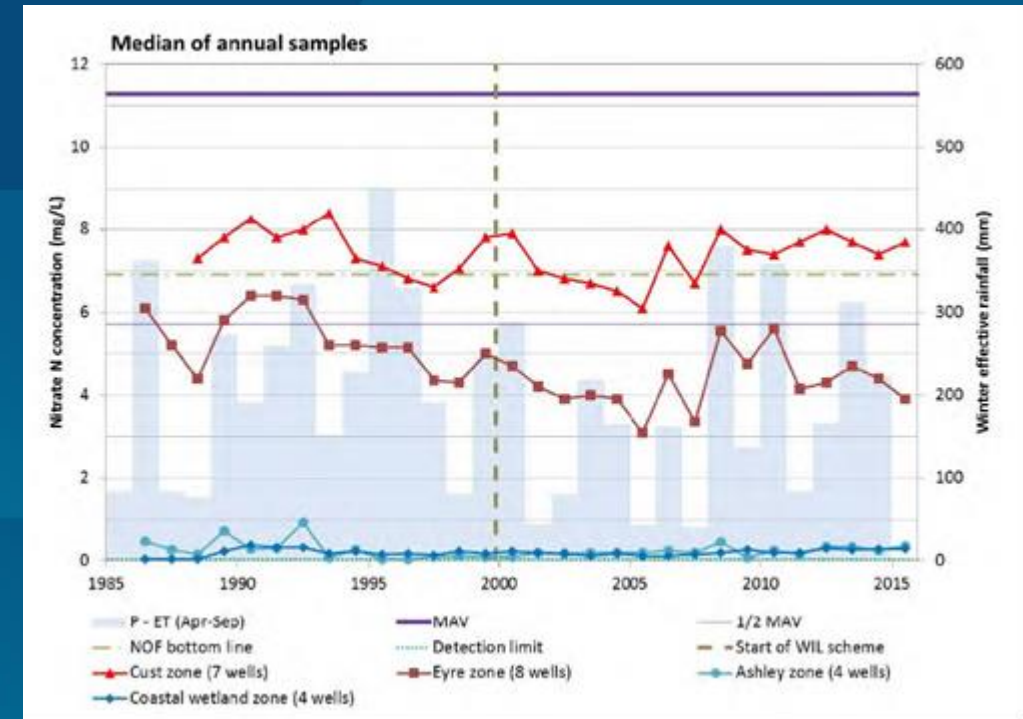
Evidence for nitrate transfer pathway at depth

- Specific capacity of wells used to indicate permeability and hence opportunity for deep nitrate transfer pathway
- Assessment by ECan was carried out on wells across the Selwyn-Waihora and Christchurch-West Melton GAZs as well as the Waimakariri GAZ
 - Suggested high permeability at depths > 200m
- No evidence for this in data for the Waimakariri GAZ



Existing groundwater quality

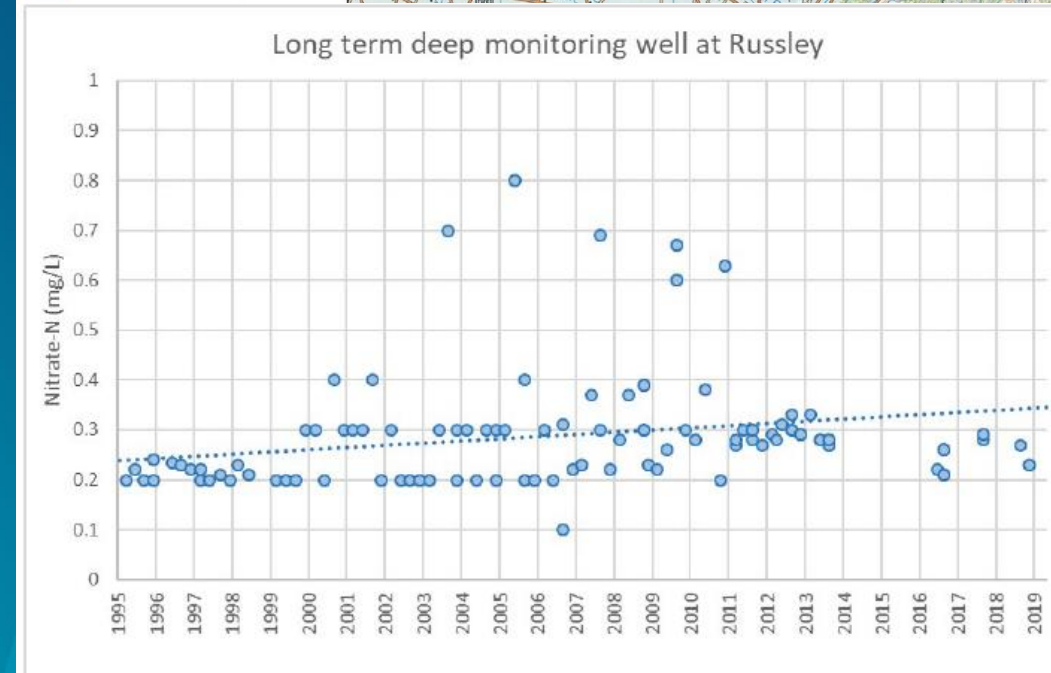
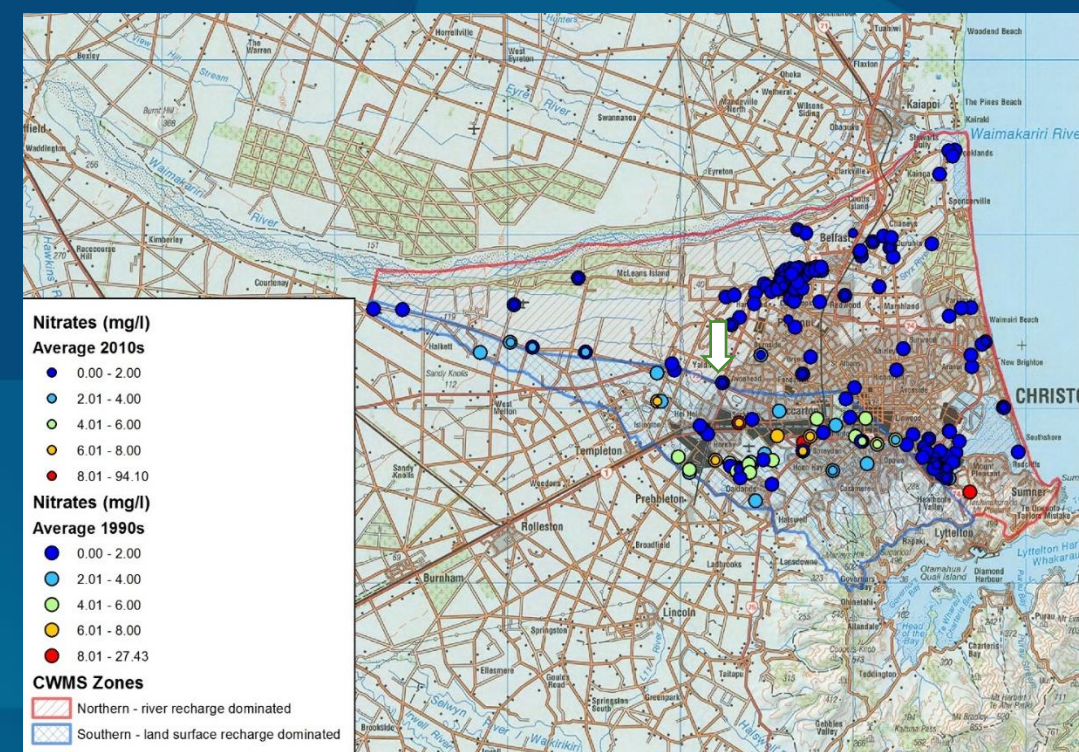
- ECan observations show no major change over recent decades in Waimakariri GAZ
- Groundwater quality in the Christchurch-West Melton zone dominated by river recharge in northeast and land surface recharge in southwest



Scott et al., 2016

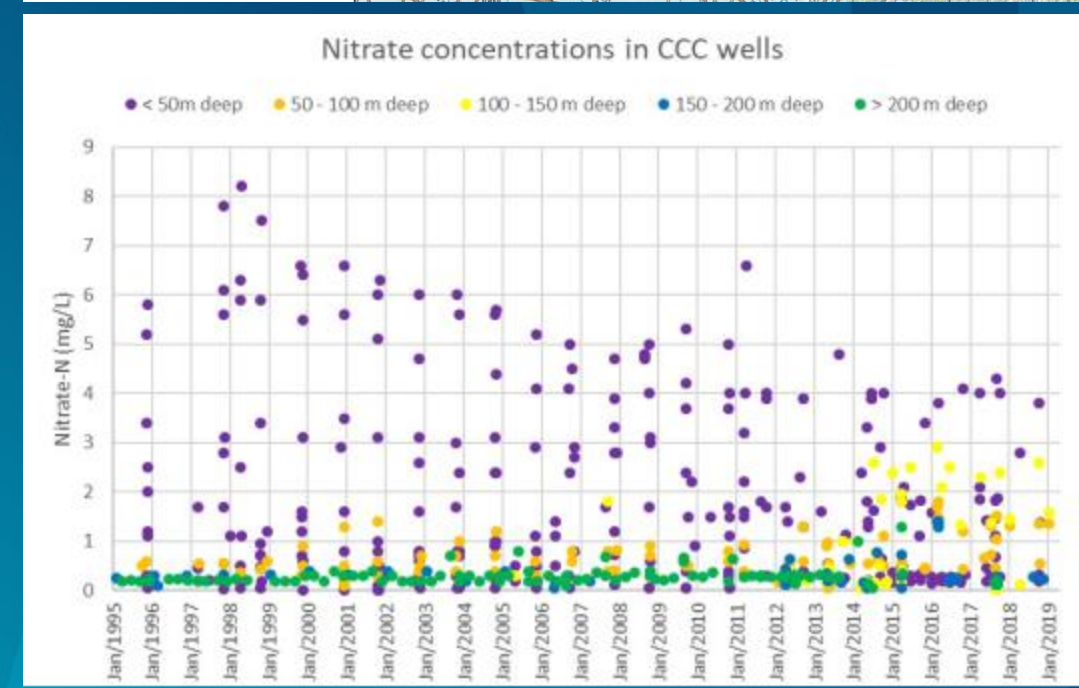
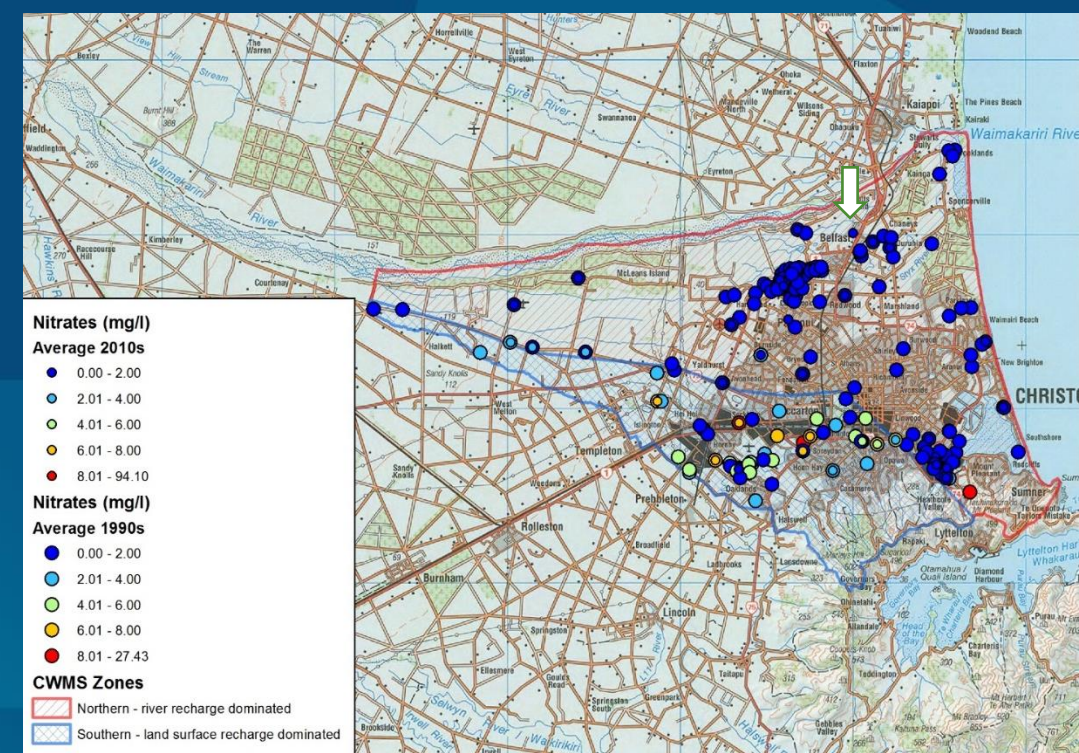
Existing groundwater quality at depth

- Russley bores
 - M35/6791 188-200m
 - M35/6040 170-176m
- Data used to show evidence of increasing (but very low) nitrates at depth
 - Possibly due to land surface recharge south of the Waimakariri river



Existing groundwater quality at depth

- Increase in nitrate-N concentrations at > 100m depth based on one well in Belfast (M35/10632)
- There appears to be limited other evidence for an increasing trend in nitrates under Christchurch, other than in shallower wells (screened less than 40m depth) in the southwest of the city



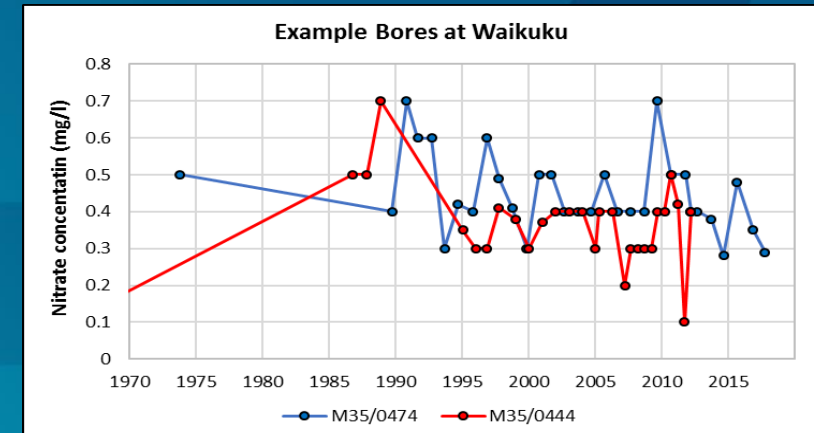
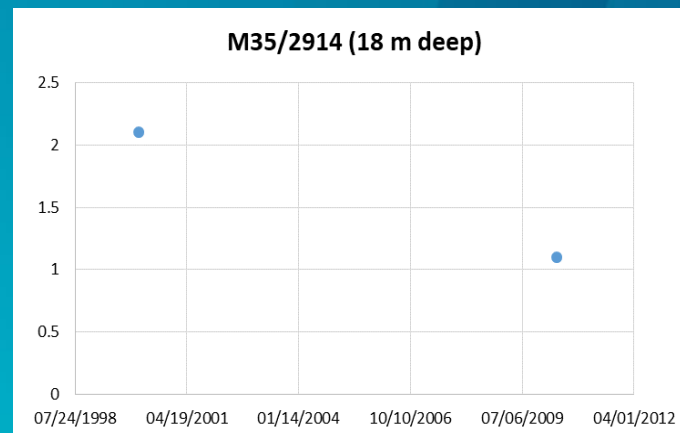
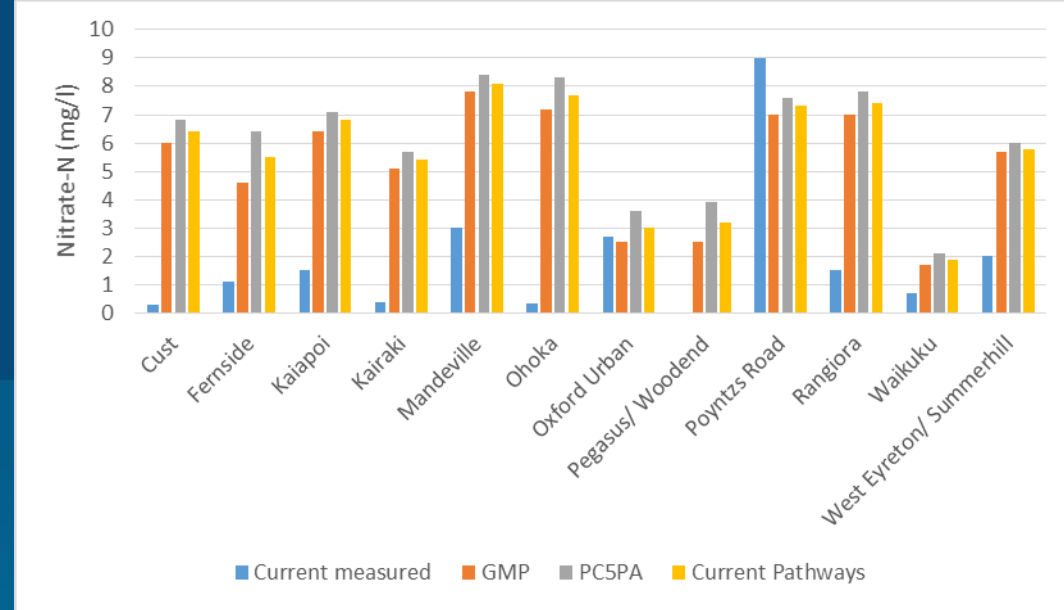
Issues

Data availability and impacts on model outputs

- Most data is from the shallower aquifer layers
 - Limited deep data
- Variography used to infer preferential flow direction
 - Issues with variography
 - Influence of variography on model outputs has not been assessed
- Model appears to over-predict deep groundwater levels in Eyrewell Forest area by around 20m
 - Implications on flow direction

Differences between measured concentrations and model predictions

- Can't expect model to match measured exactly
 - Uncertainty in inputs
 - Need to account for the lag time
- However, considerable disparity between modelled nitrate concentrations at WDC and private water supply areas, relative to modelled concentrations



Peer review

- Agreement that there is insufficient documentation about peer review of the model
- Reduces confidence in the outputs

Future monitoring and adaptive management

- Specifically designed monitoring programme needed to assess whether achieving objectives
- Put initial rules in place
- Robust monitoring to assess when nitrate loss reductions no longer required
 - Groundwater levels
 - Surface water flows
 - Nitrate concentrations
 - Fill in important gaps
- Further develop model based on new data