

Groundwater Quality

Waimea Plains

Tasman District

Glenn Stevens – Resource Scientist



Groundwater Quality

Is determined by:

- Chemical characteristics of groundwater
- Influenced by:
 - The physical setting of the aquifer
 - The geological make up of the aquifers
 - Degree of groundwater/rock interaction
 - Human impact over the recharge area

Groundwater Quality

Natural influences

- Carbonate rocks (Golden Bay)
- Ultra-mafic rocks (Dun Mt / Red Hills)
- Total dissolved solids (increases with residence time of the groundwater)

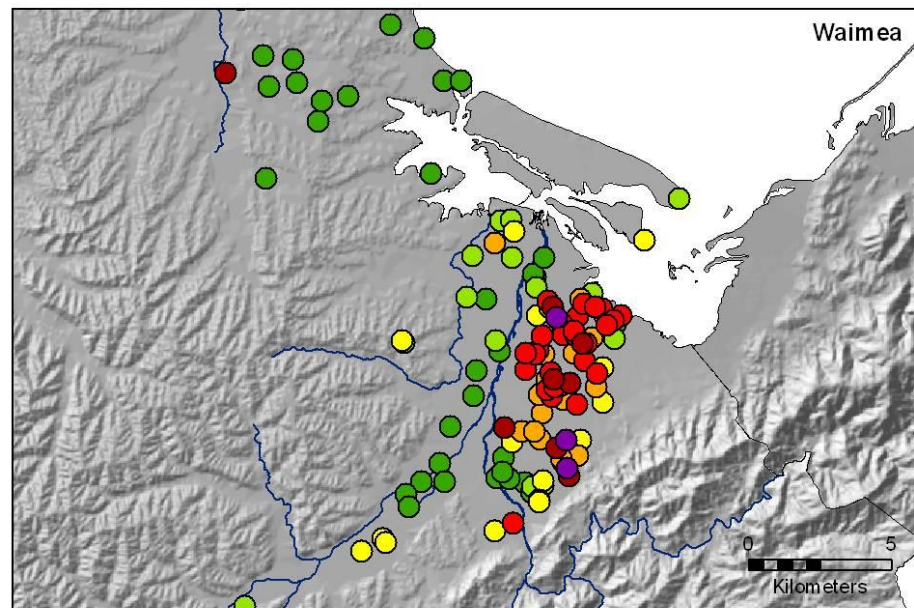
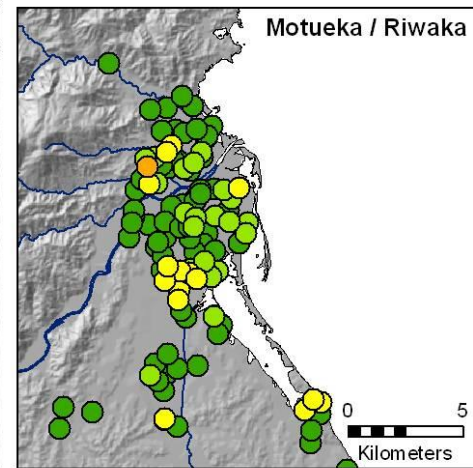
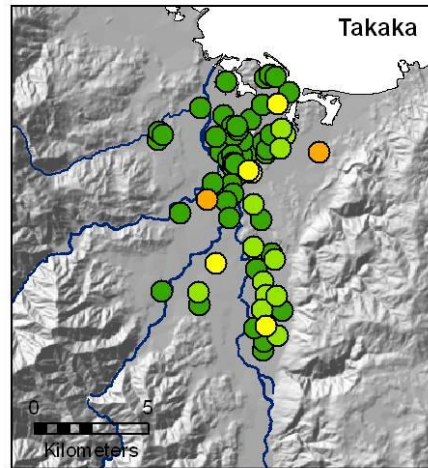
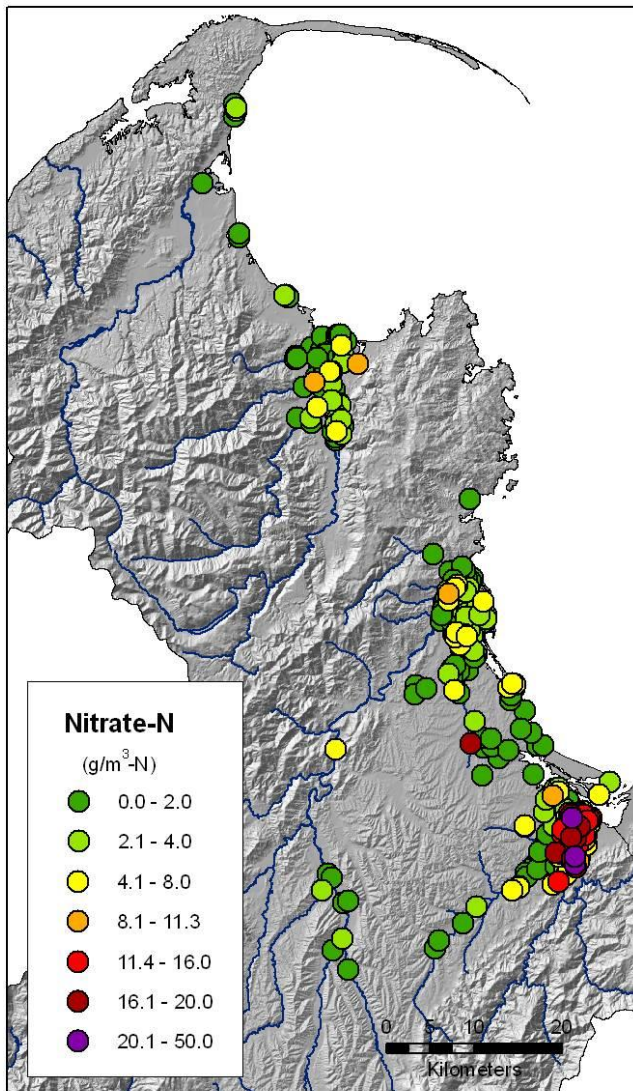
Groundwater Quality

Human impacts can increase concentrations of:

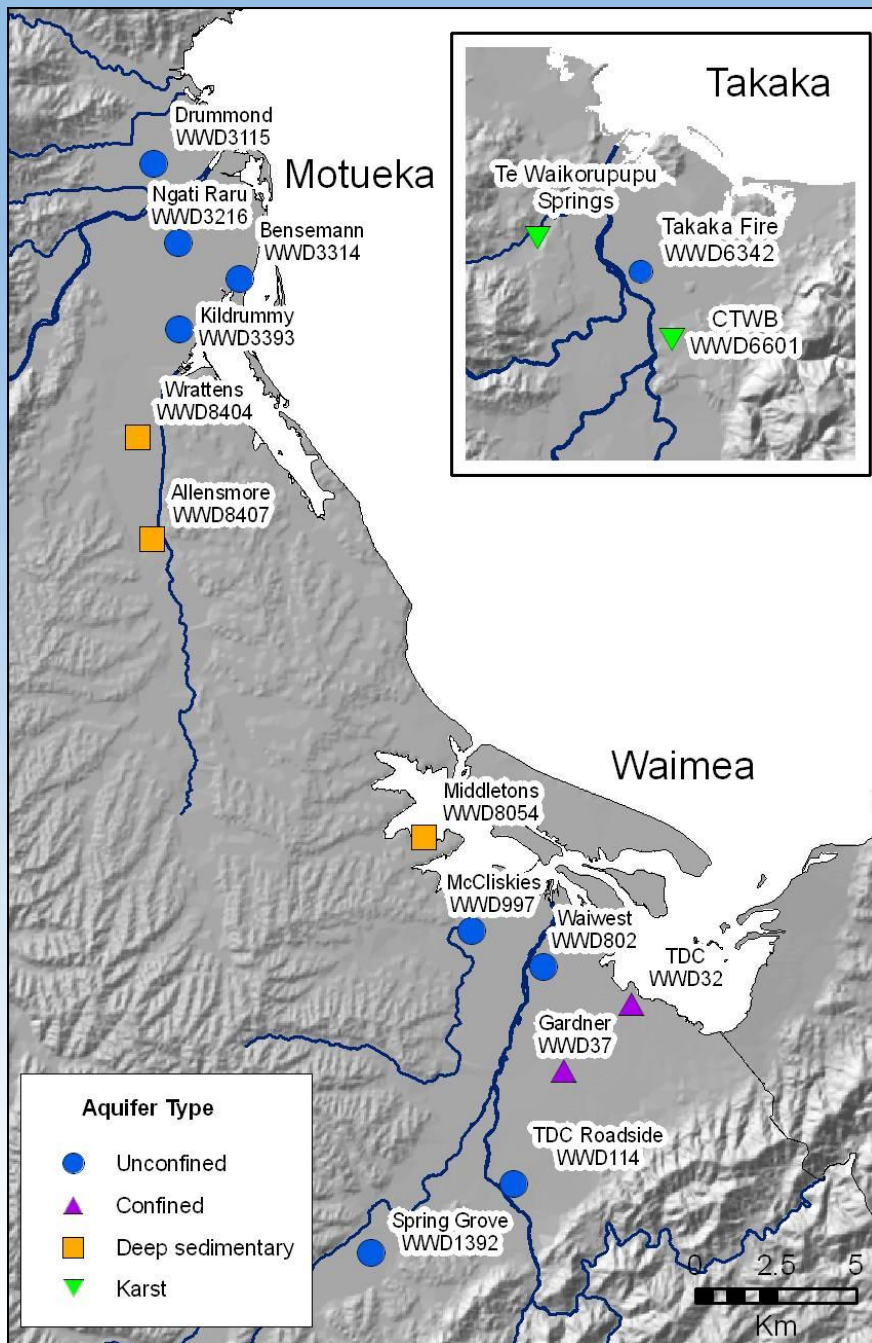
- nutrients (nitrate-N, ammonia)
- sulphate, potassium, chloride
- bacteria

Derived from:

- Fertiliser
- Wastewater
- Animal effluent



Nitrate-N concentrations
(all data from 2000 to 2008)



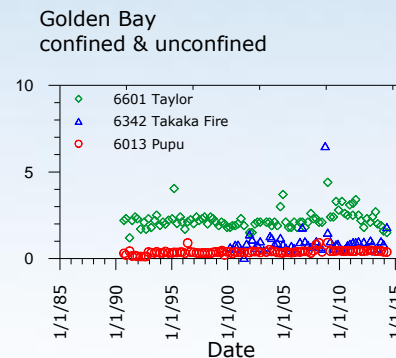
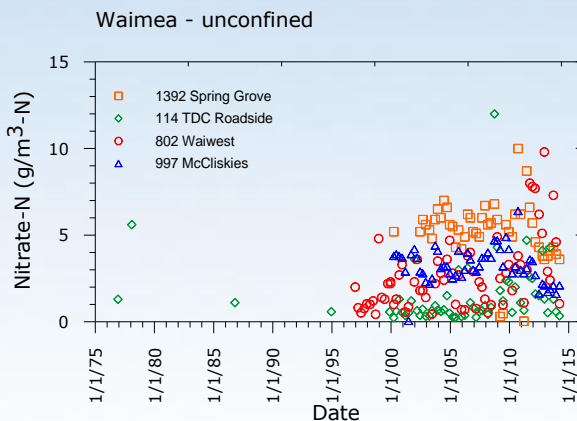
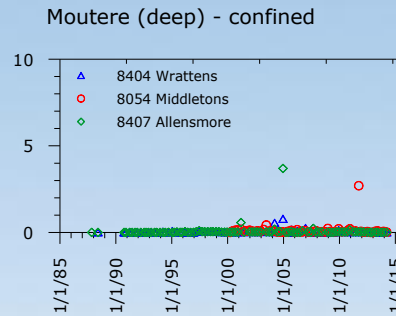
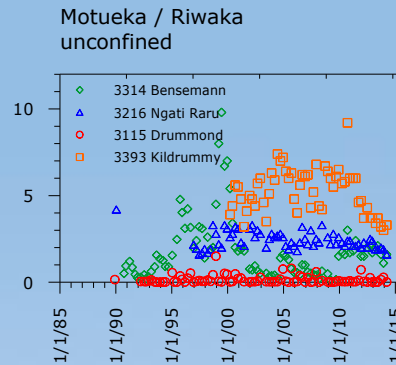
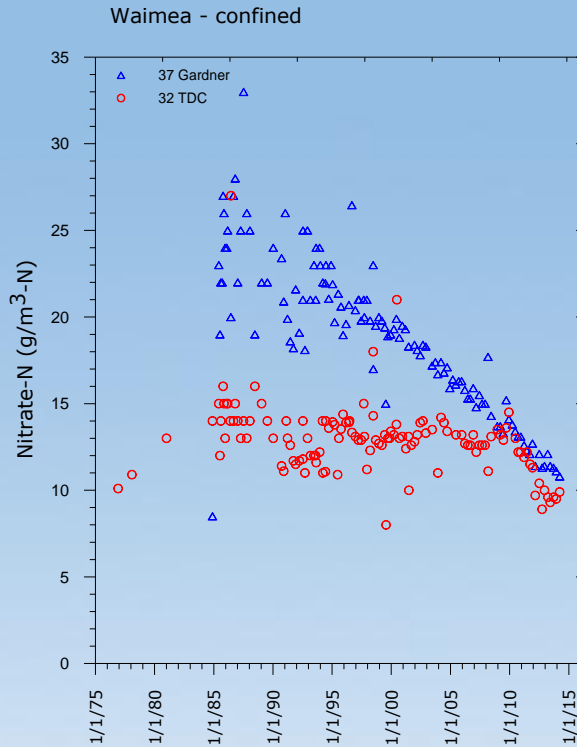
Groundwater Quality SOE Monitoring

- 16 sites across District (6 in Waimea Plains)
- Sampled quarterly for a range of standard groundwater quality parameters
- Represent a range of land uses and aquifer environments

Groundwater Quality SOE Monitoring

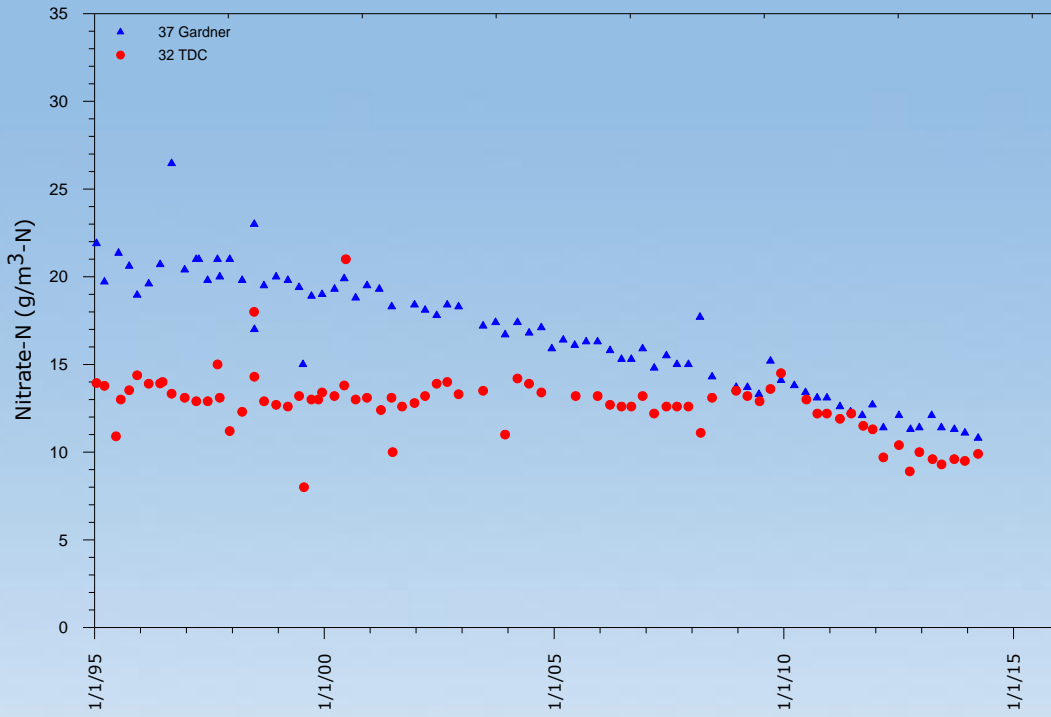
Nitrate-N concentrations

16 sites across District
Sampled quarterly

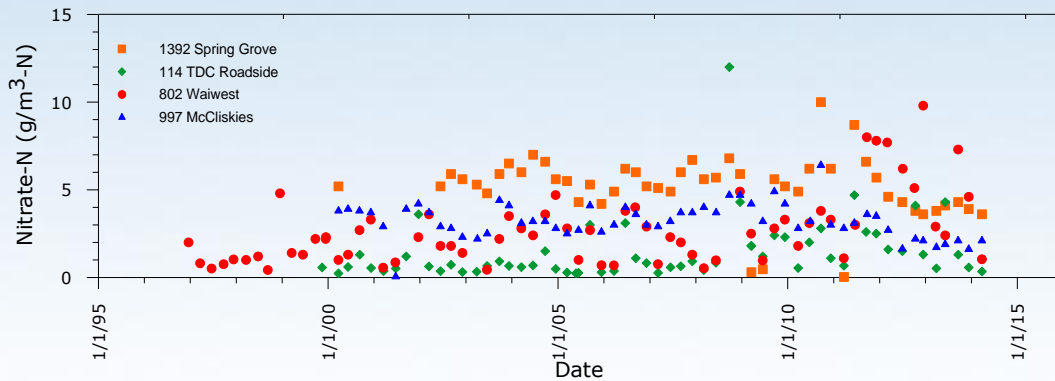


- National median = $1.7 \text{ g}/\text{m}^3\text{-N}$
(GNS National Groundwater Monitoring Programme)
- Tasman SOE monitoring bores
(all 16 sites)
median = $2.1 \text{ g}/\text{m}^3\text{-N}$
- Tasman SOE monitoring bores
(excluding Waimea confined aquifers)
median = $1.0 \text{ g}/\text{m}^3\text{-N}$

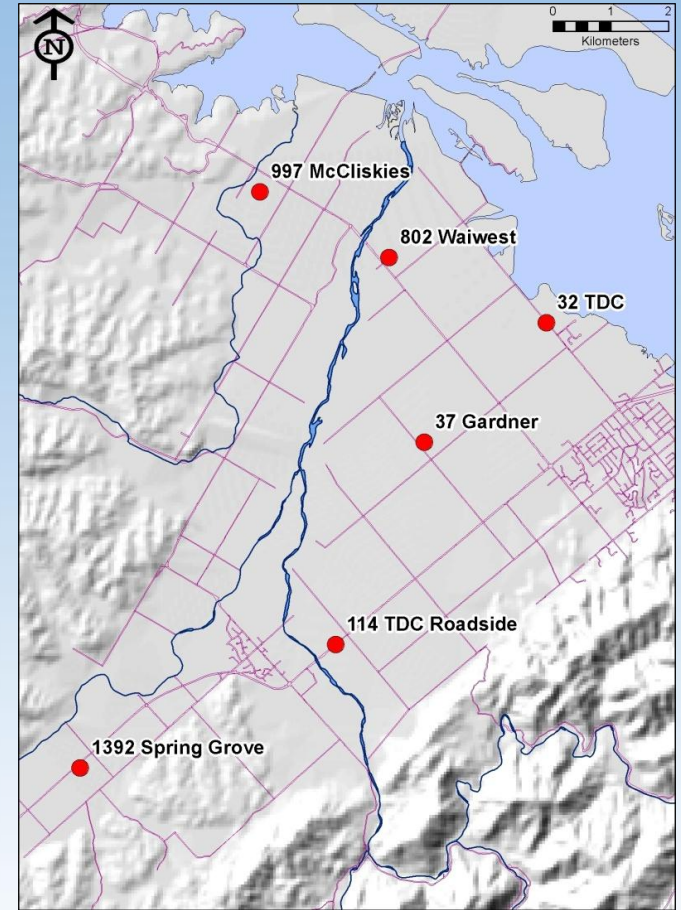
Waimea - confined



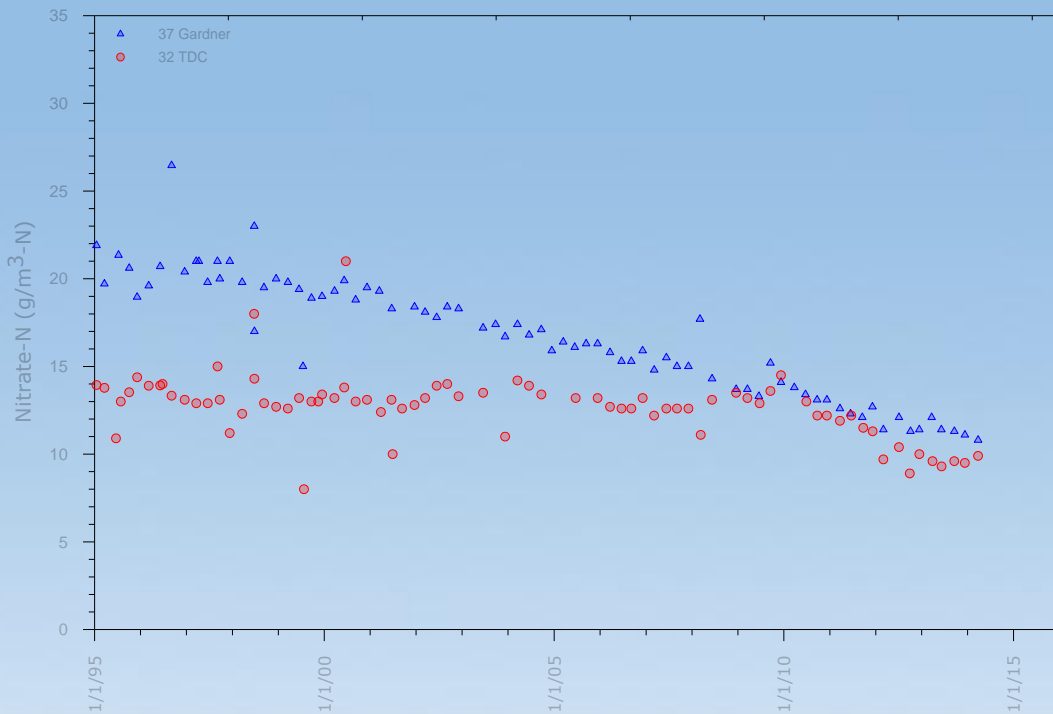
Waimea - unconfined



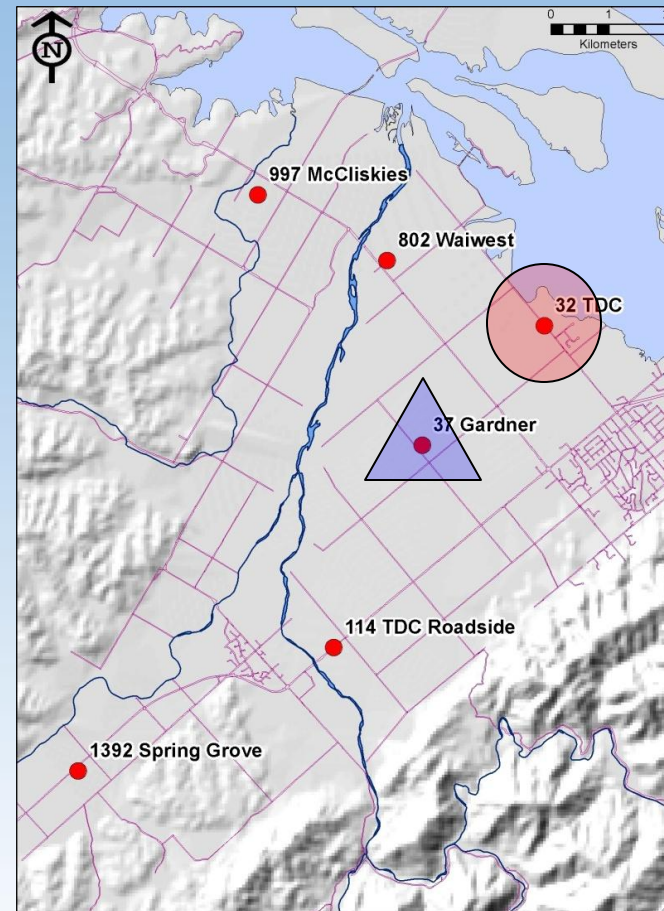
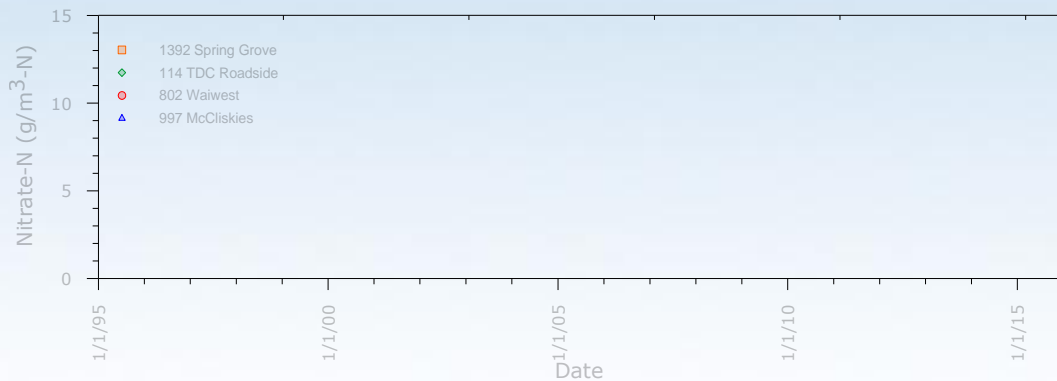
Waimea Plains SOE monitoring sites Nitrate-N concentrations



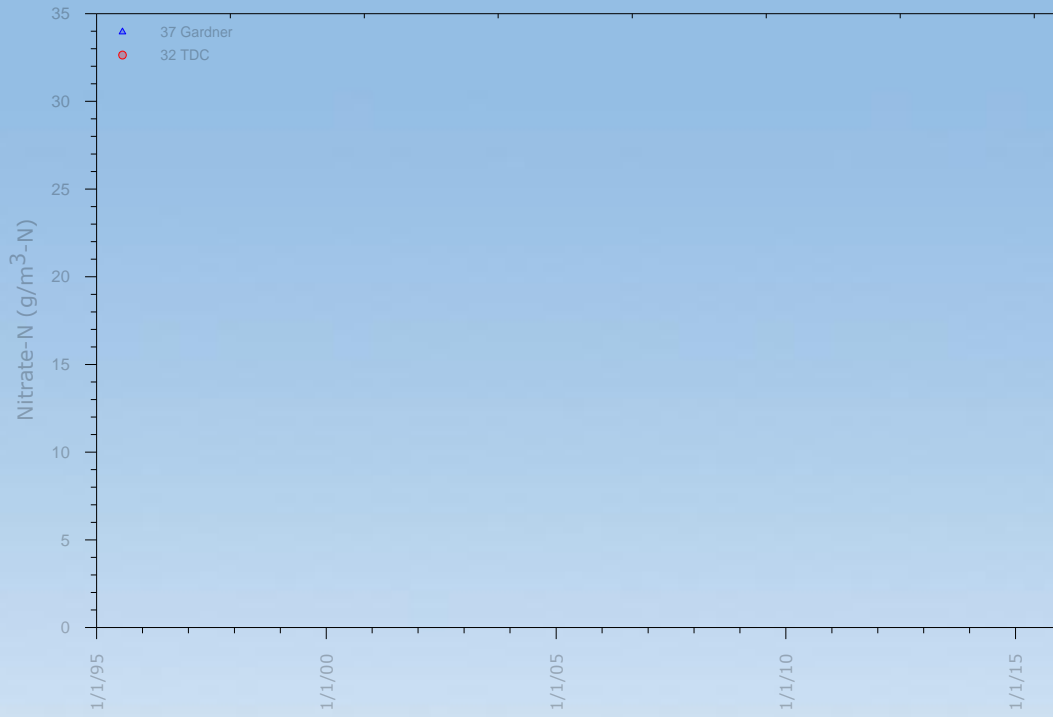
Waimea - confined



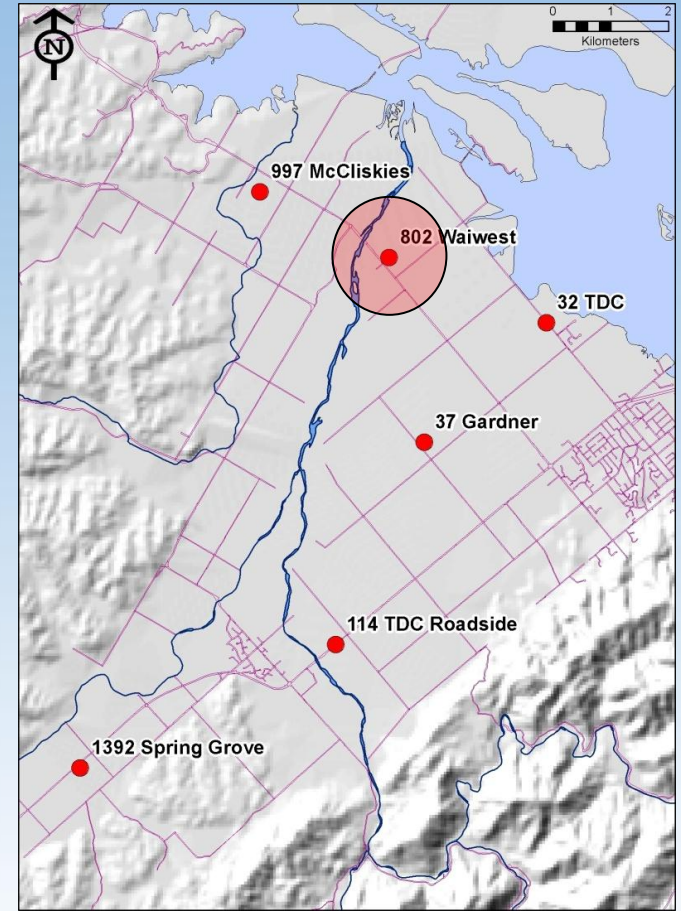
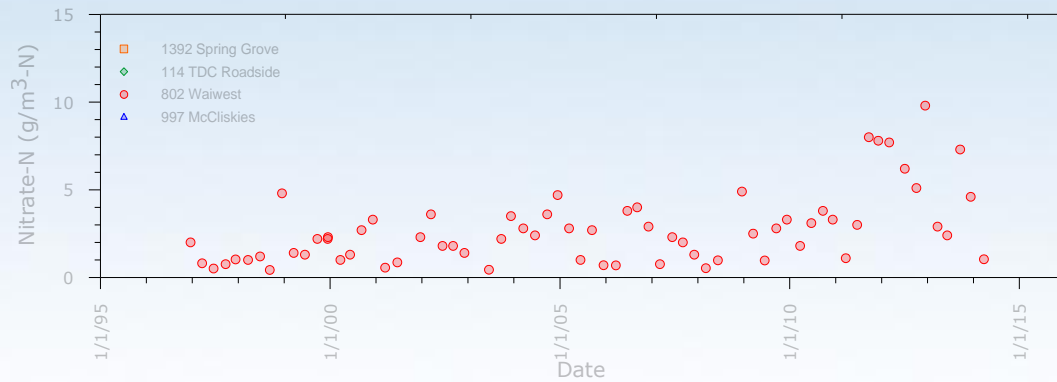
Waimea - unconfined



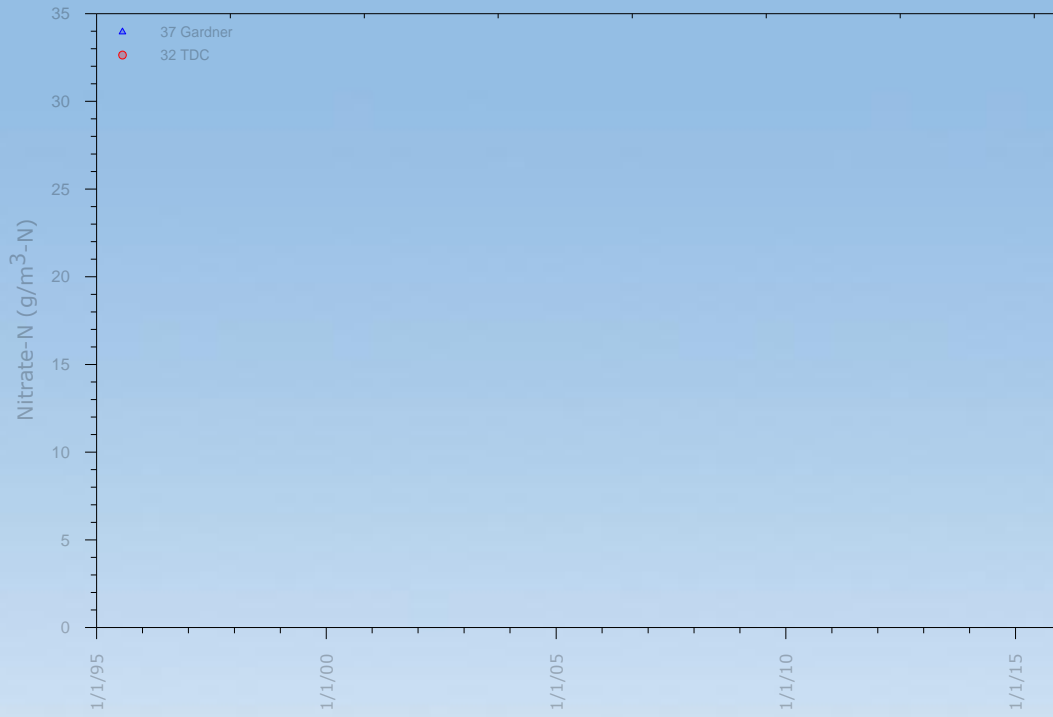
Waimea - confined



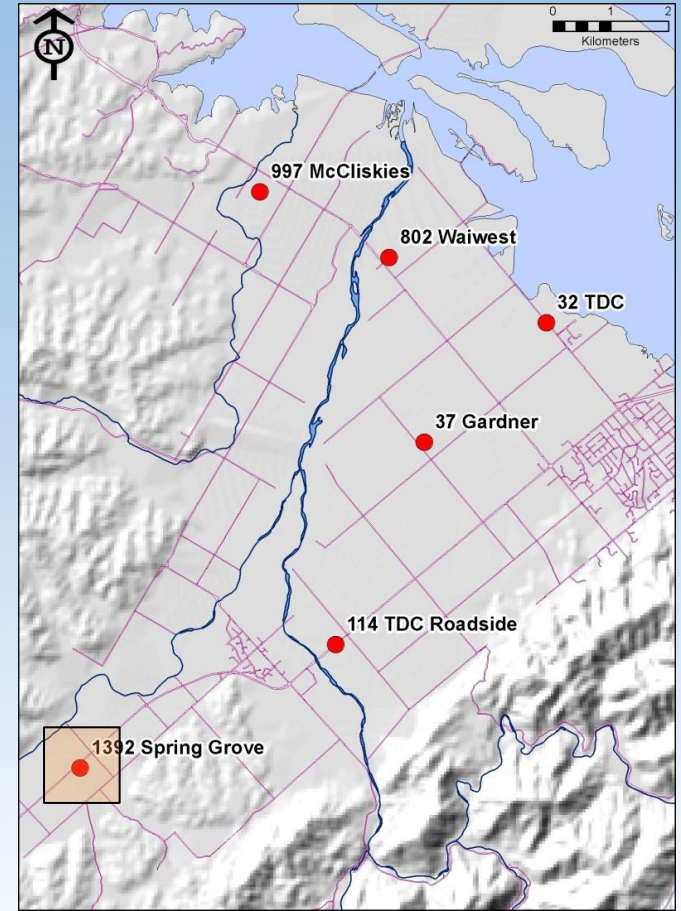
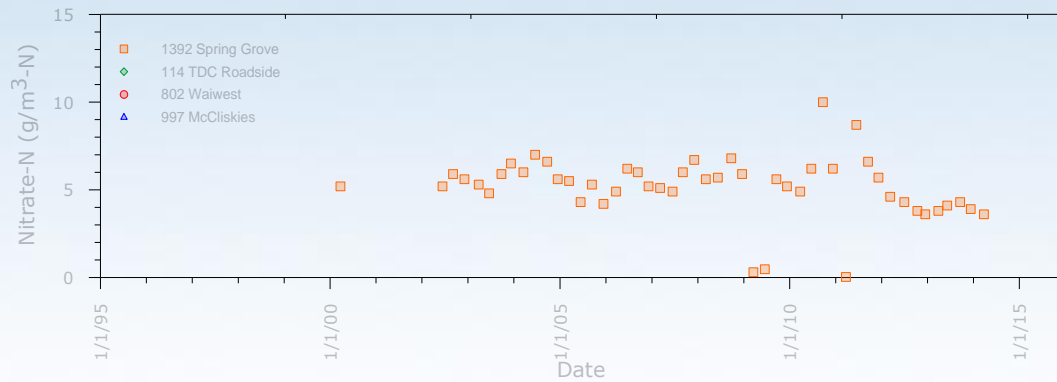
Waimea - unconfined



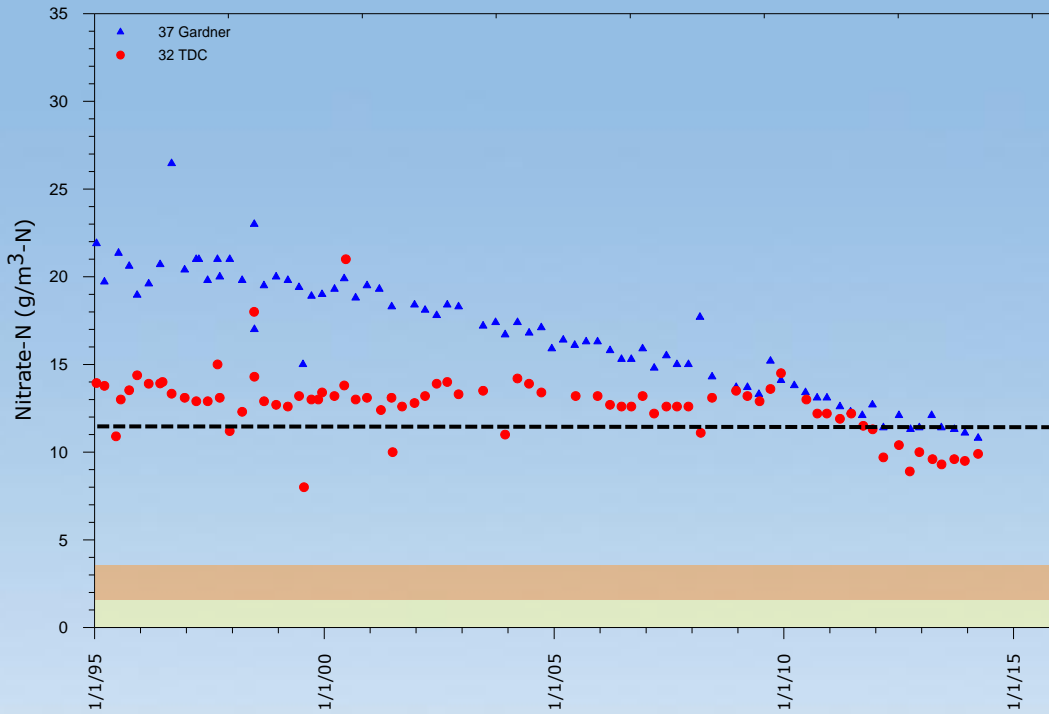
Waimea - confined



Waimea - unconfined



Waimea - confined



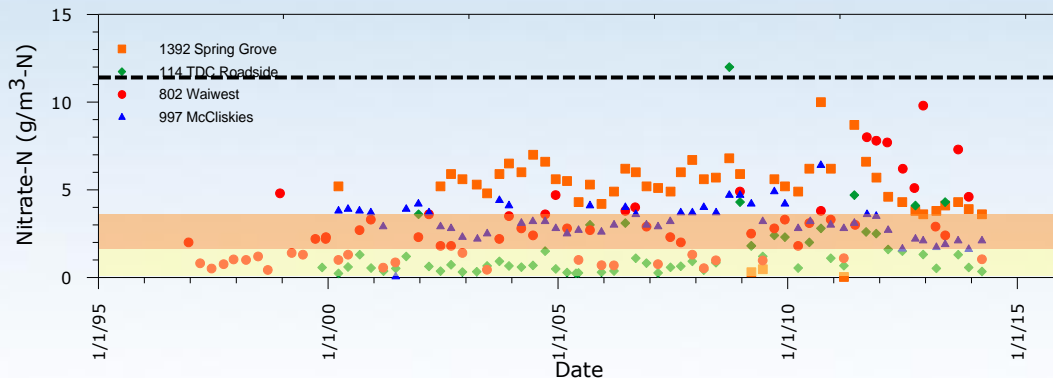
Groundwater Quality SOE Monitoring

Nitrate-N concentrations

Possible human influence¹
> 1.6 g/m³-N

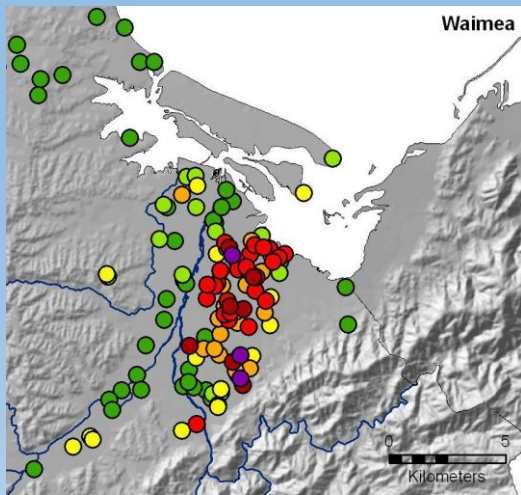
Definite human influence¹
> 3.5 g/m³-N

Waimea - unconfined



Drinking Water Standard
11.3g/m³-N

¹ Daughney, C.J. and Reeves, R.R. 2005. Definition of Hydrochemical Facies in the New Zealand Groundwater Monitoring Programme. In *Journal of Hydrology (NZ)* 44(2), New Zealand Hydrological Society.



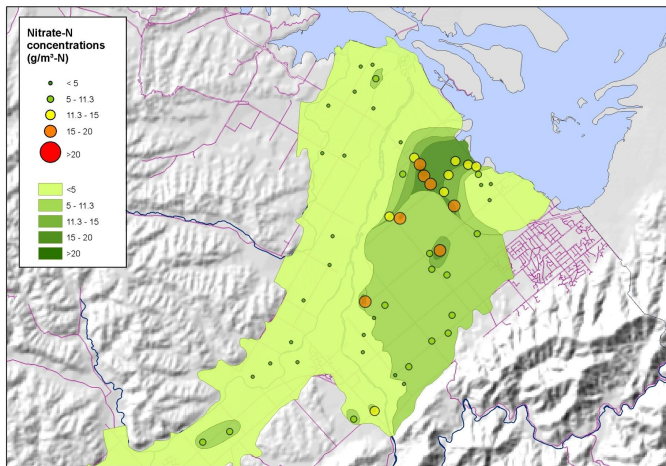
From the available nitrate data collected from bores contours of nitrate concentrations have been plotted. The contours represent nitrate data collected in 2005.

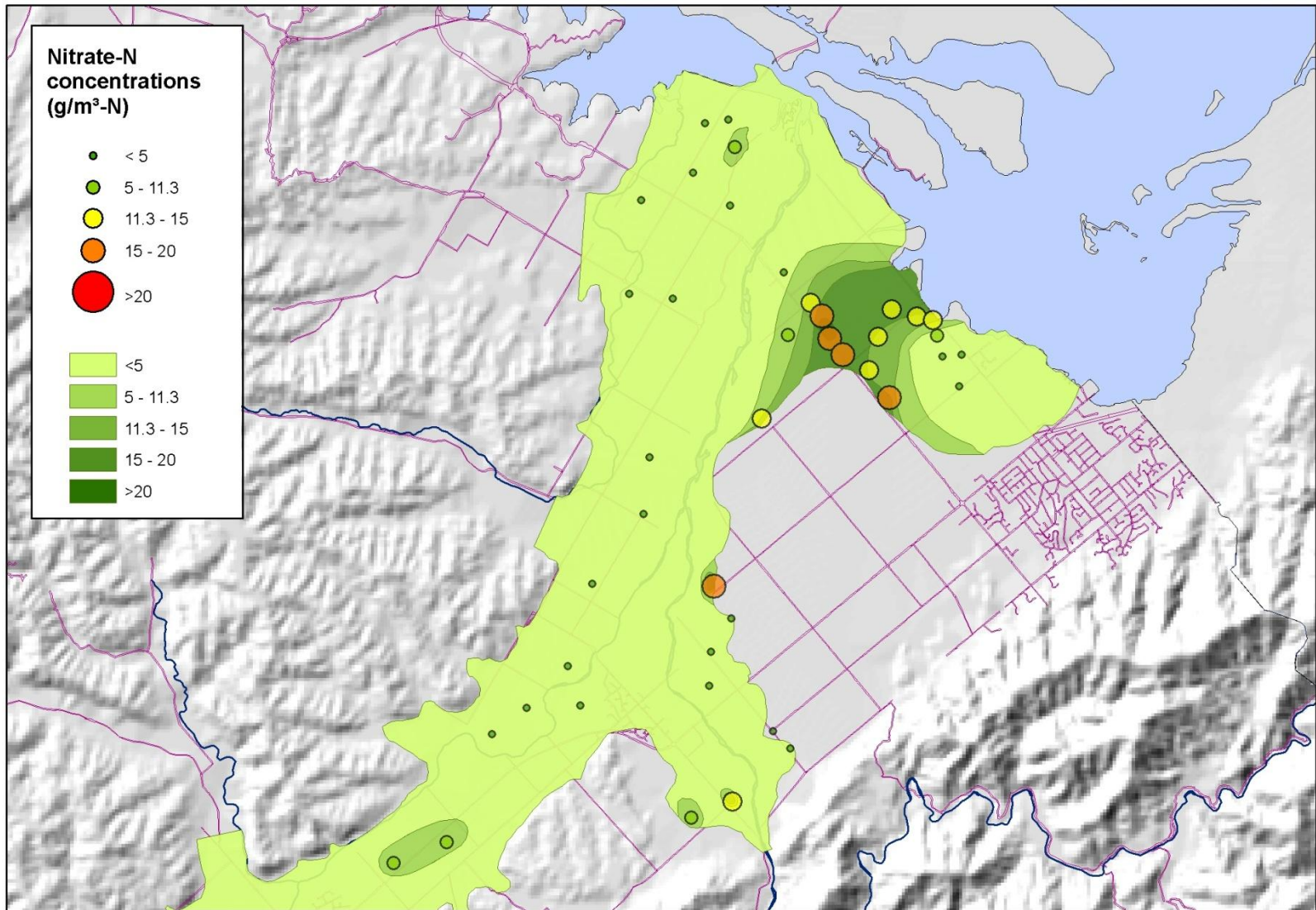
The contour plots are an estimated fit to the available nitrate data and constrained to be consistent to the extent of the various aquifers and their expected groundwater flow directions.

Whilst the measured concentrations have changed in places the overall pattern has persisted since the 1980s. Consequently the Contours are still considered to be a reasonable representation of the nitrate distribution. However, it would be prudent for this data to be updated.

Greater emphasis should be given to the general pattern of the nitrate distribution rather than the absolute location of the contour lines.

The coloured circles represent the measurement locations with the 2005 nitrate concentration indicated by the colour and the size of the circles.

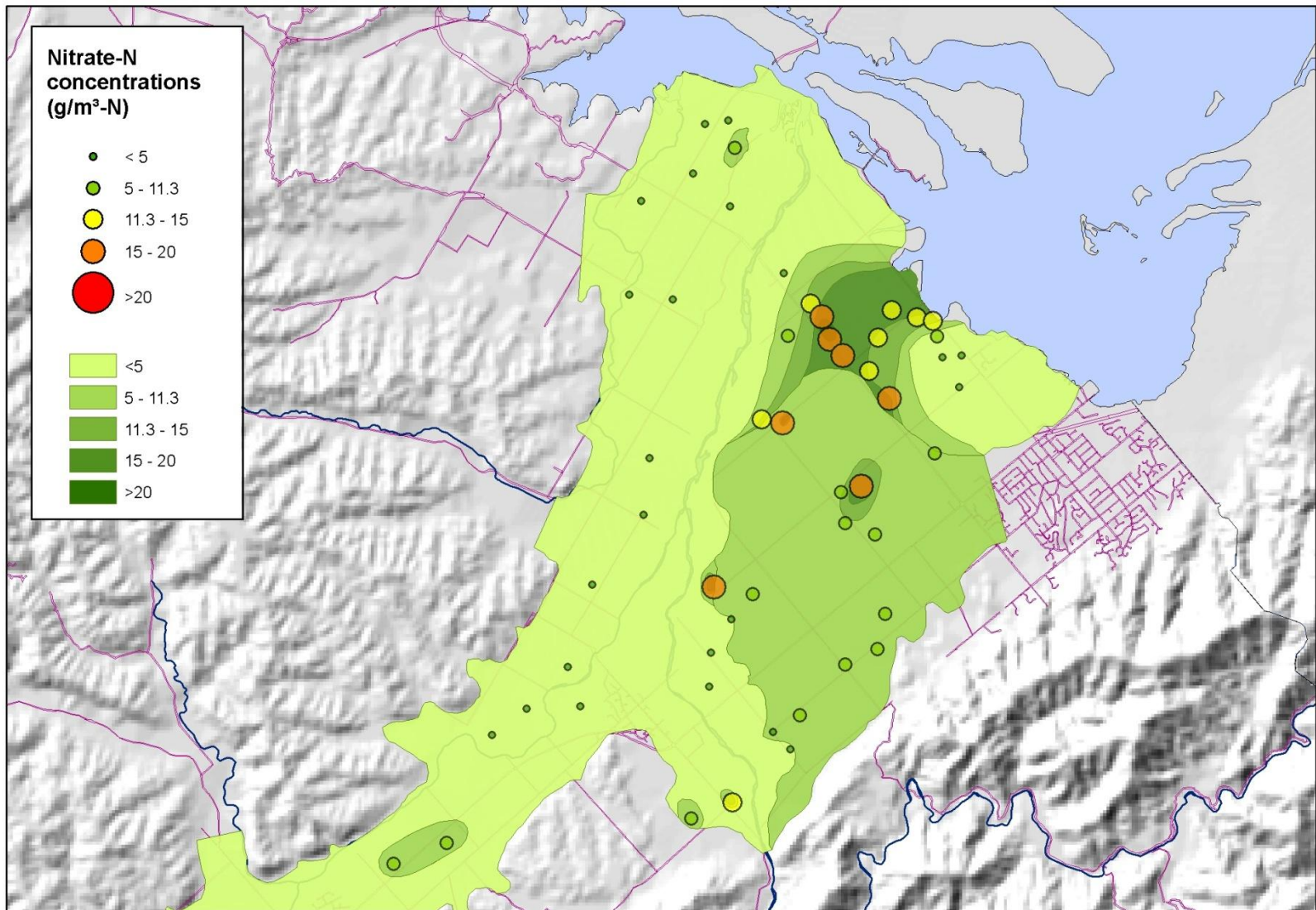




2005

Appleby Gravel Unconfined Aquifer

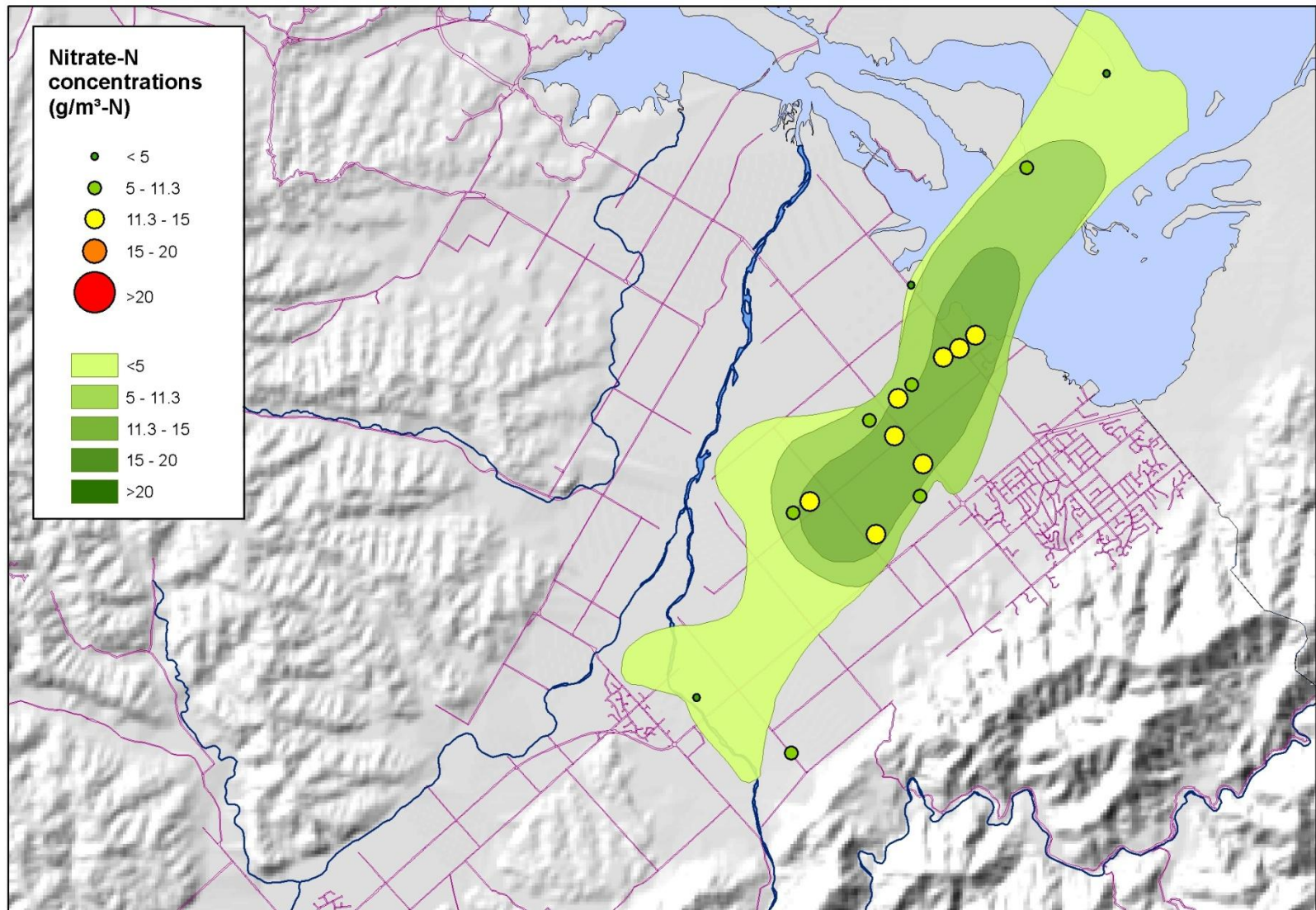
The area of elevated nitrate concentrations at the northeastern end corresponds to where the confining layer above the UCA pinches out and the AGUA lies directly on top of the UCA. In this area groundwater from the UCA discharges into the AGUA.



2005

Appleby Gravel Unconfined Aquifer & Hope Minor Confined and Unconfined Aquifer

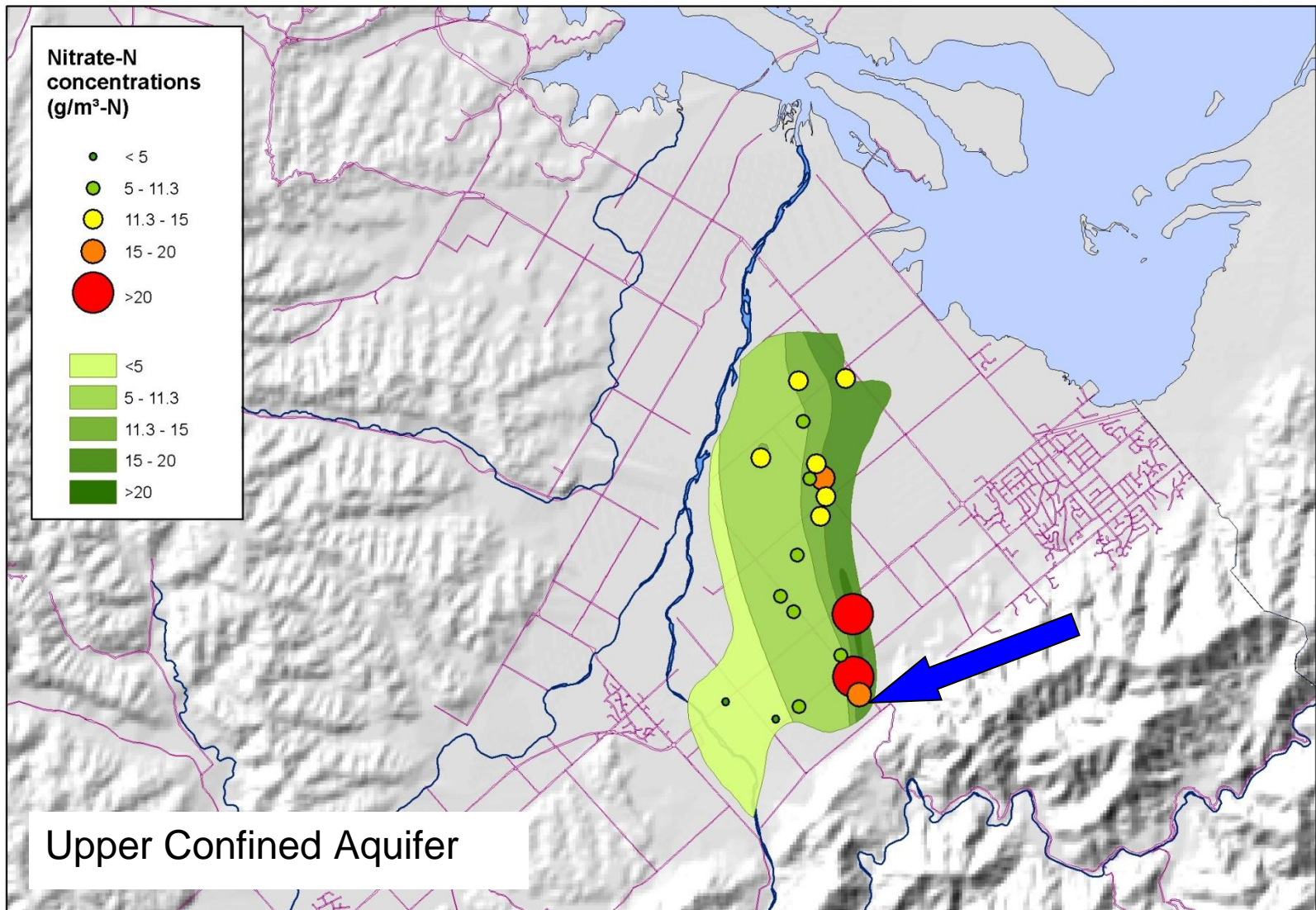
Whilst this shows the unconfined aquifers over the Waimea Plains, the Hope Aquifers are formed in much older and less permeable gravels than the AGUA. The more permeable AGUA is subject to relatively rapid recharge from the surface rivers.



2005

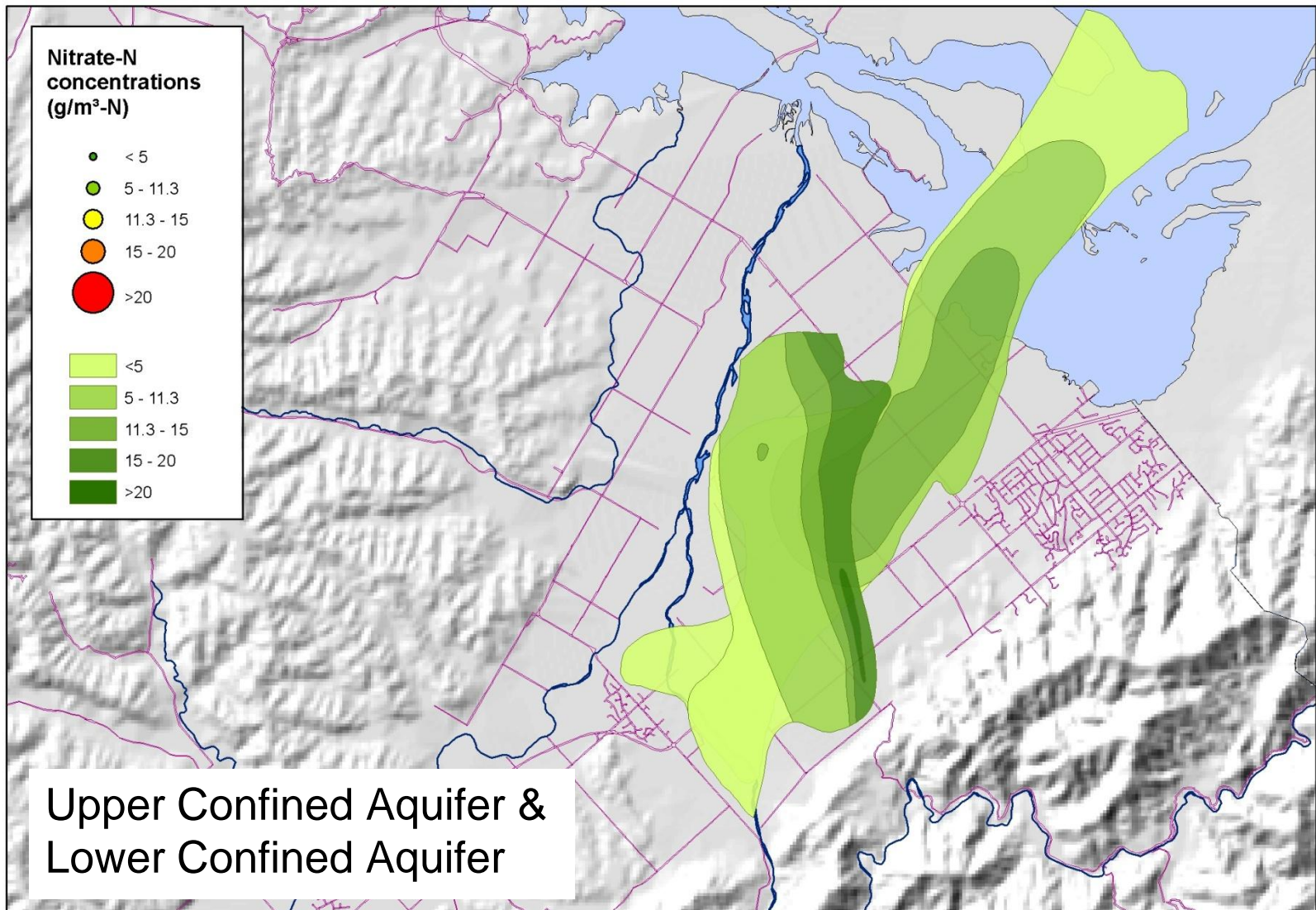
Lower Confined Aquifer

Recharge to the LCA is from the Wairoa River near Brightwater and from leakage between the LCA and UCA.

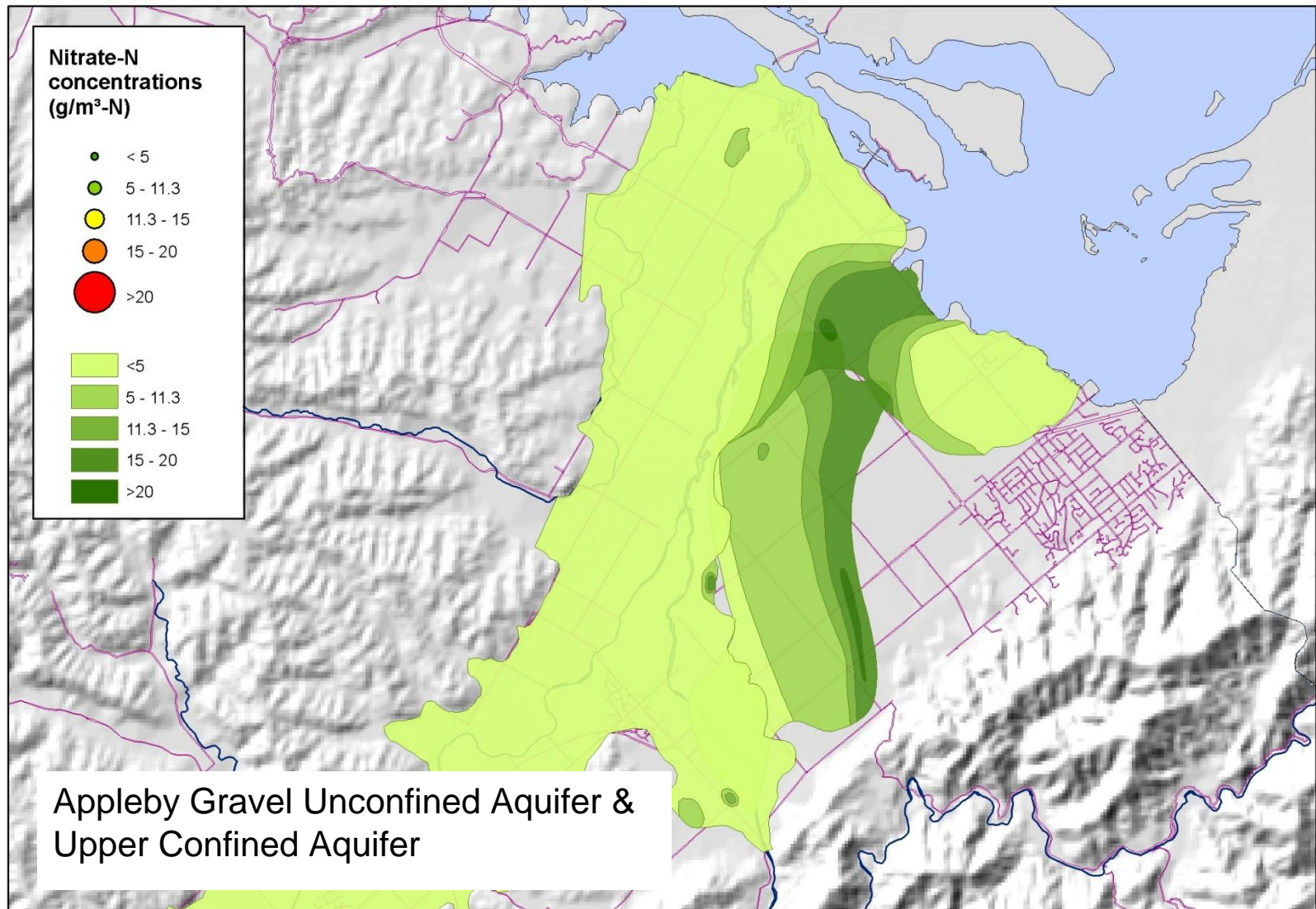


2005

Recharge to the UCA is from the Wairoa River near Brightwater and from the Hope Aquifers along the foot of the eastern hills.
 Historic piggery (~1000 pigs) – location shown by blue arrow. The piggery closed in the mid 1980's. The Hope area and along the foot of the eastern hills was also historically used for market gardening.

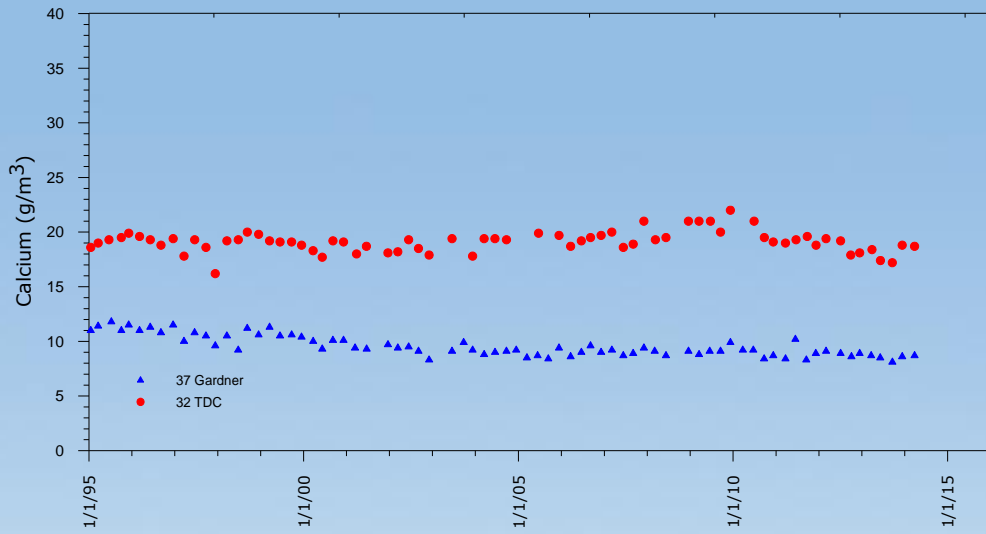


The LCA underlies the UCA. Shown together to illustrate the how the plume of elevated nitrates in the UCA coincides with where elevated nitrates are observed in the LCA. At this point the two aquifers are only separated by about 4 to 6 metres.

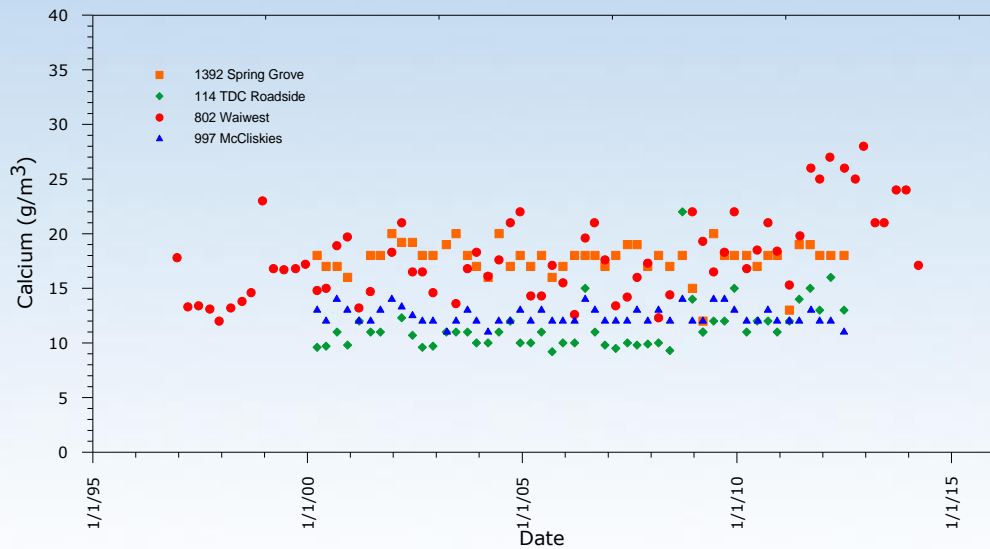


The UCA lies beneath, but hydraulically connected to the AGUA, at its northern extent. Shown together to illustrate how the plume of elevated nitrates in the UCA coincides with where elevated nitrates are observed in the AGUA.

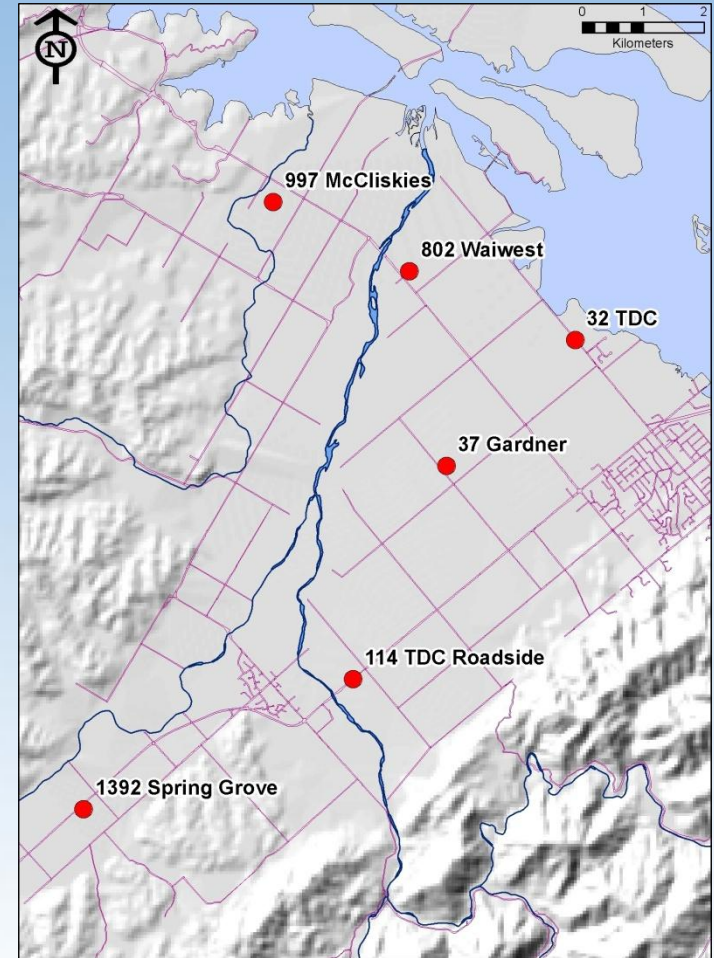
Waimea - confined



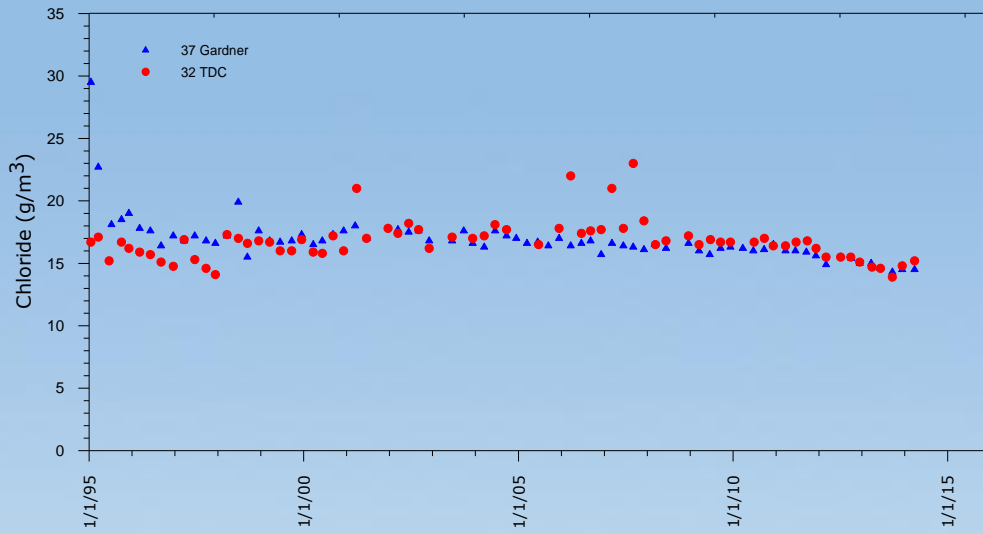
Waimea - unconfined



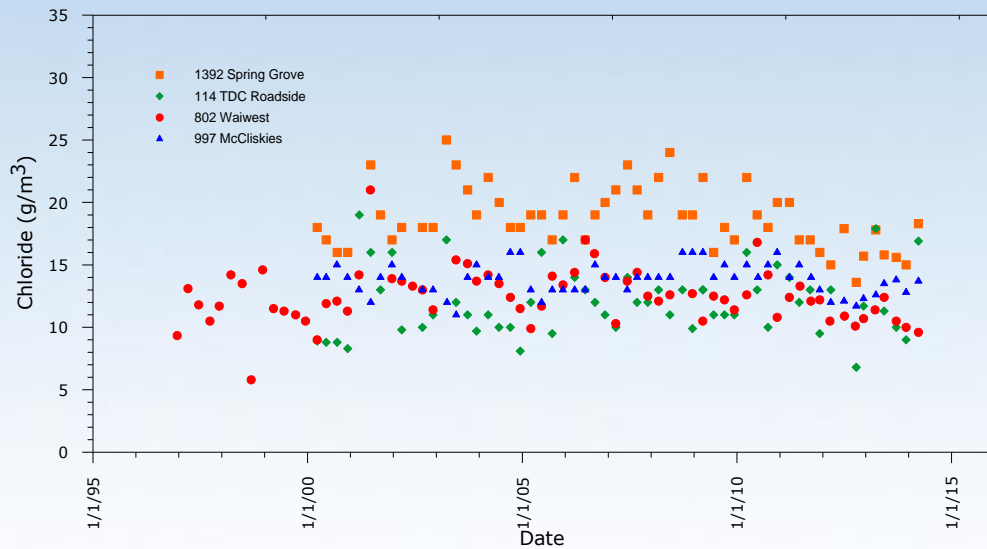
Calcium (g/m³)



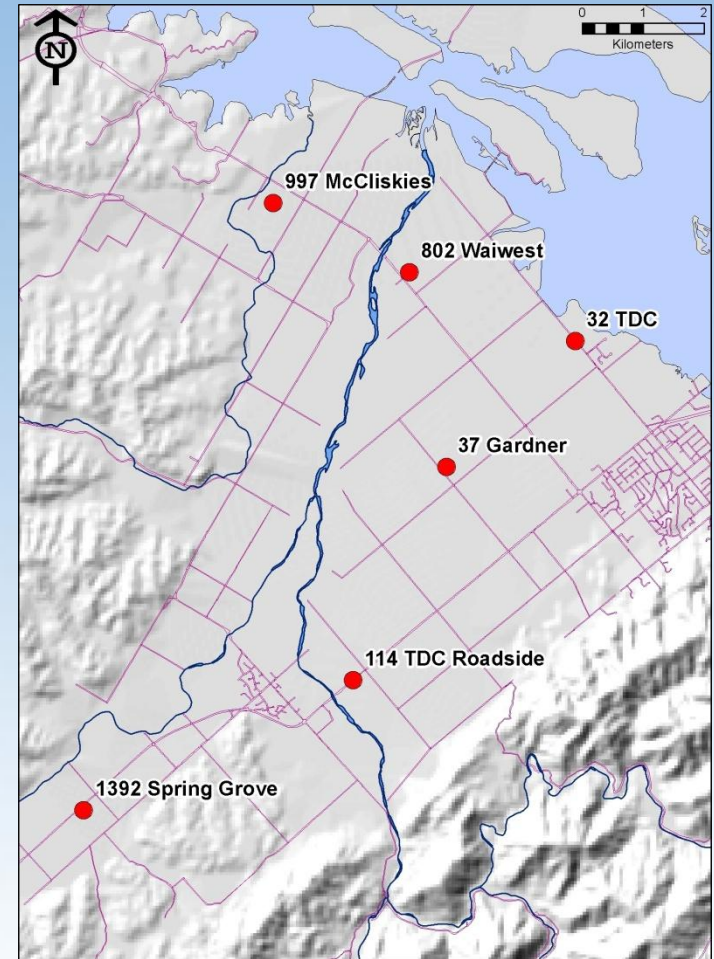
Waimea - confined



Waimea - unconfined

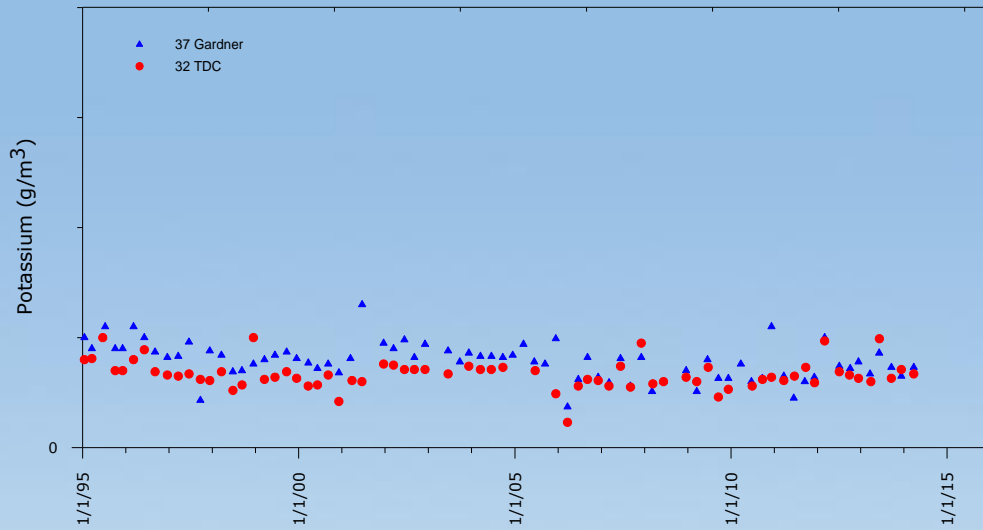


Chloride (g/m^3)

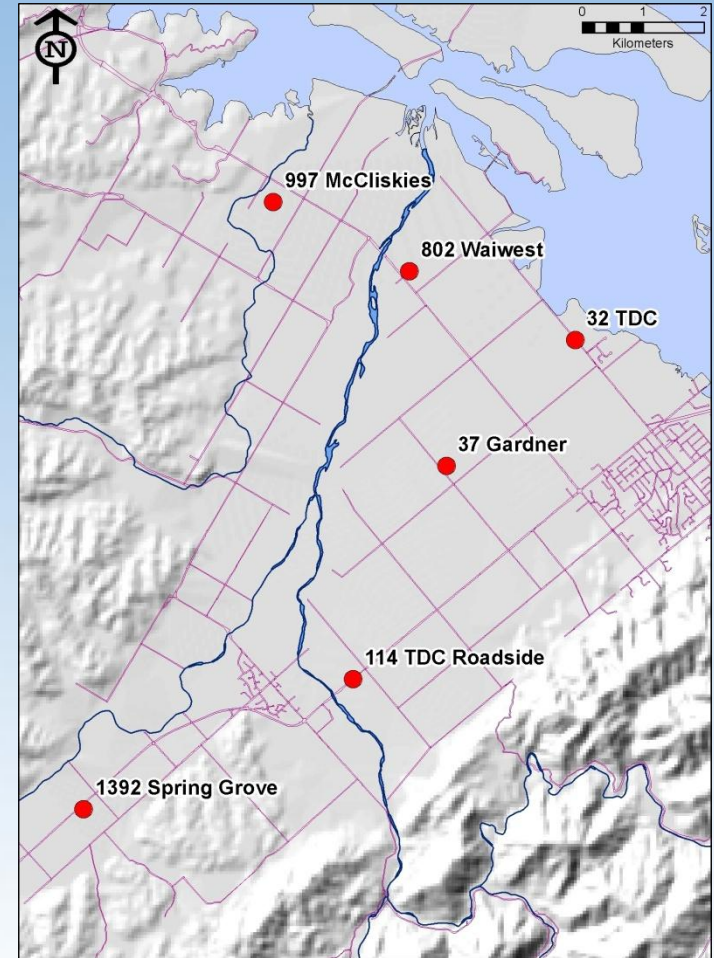
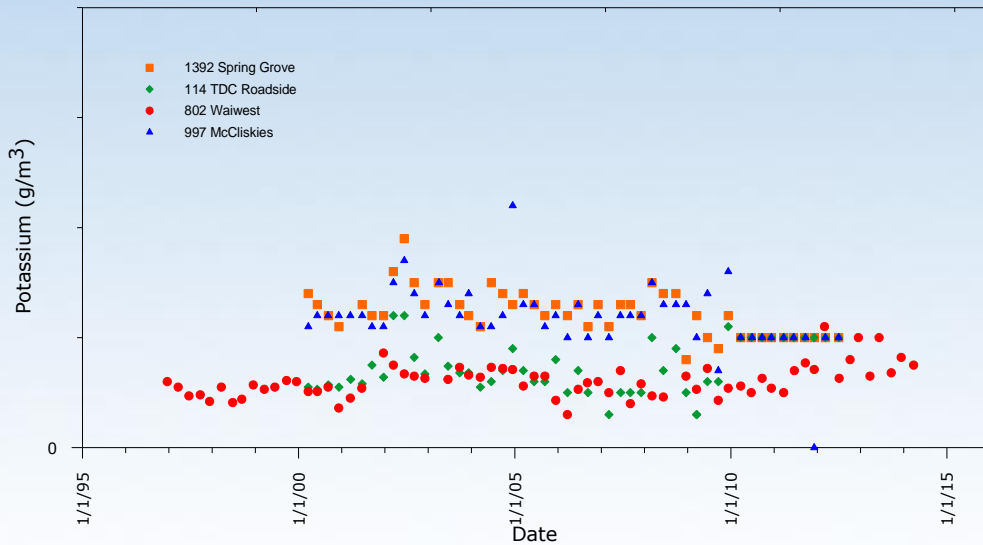


Potassium (g/m³)

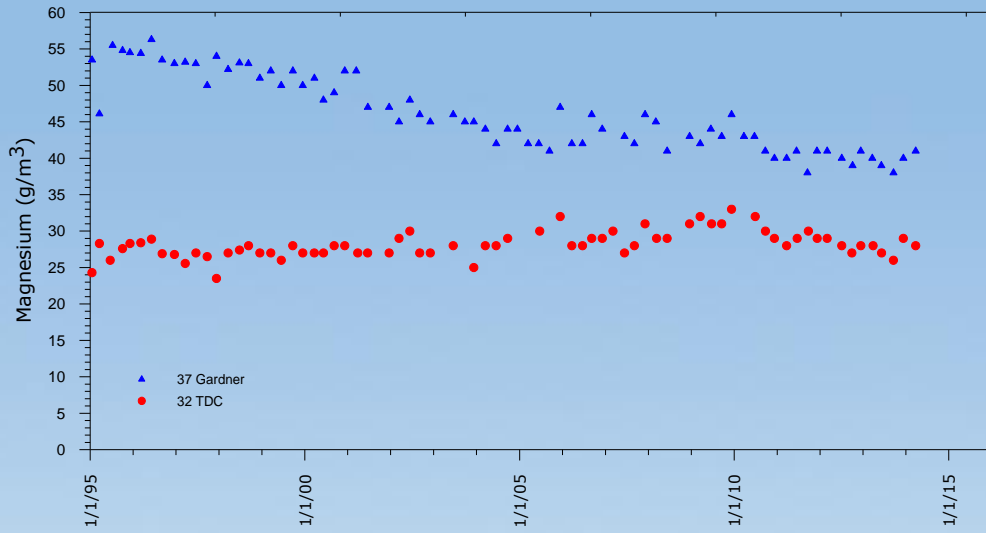
Waimea - confined



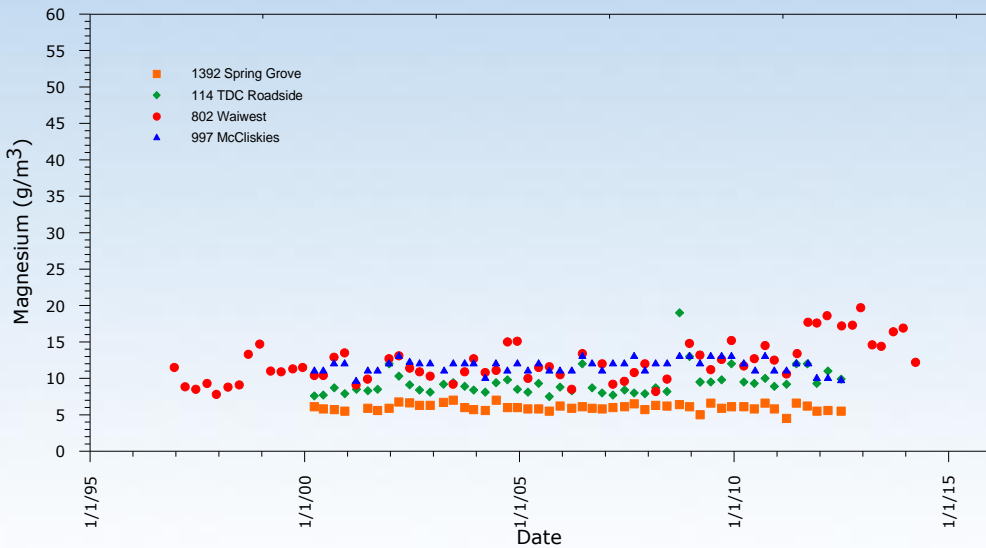
Waimea - unconfined



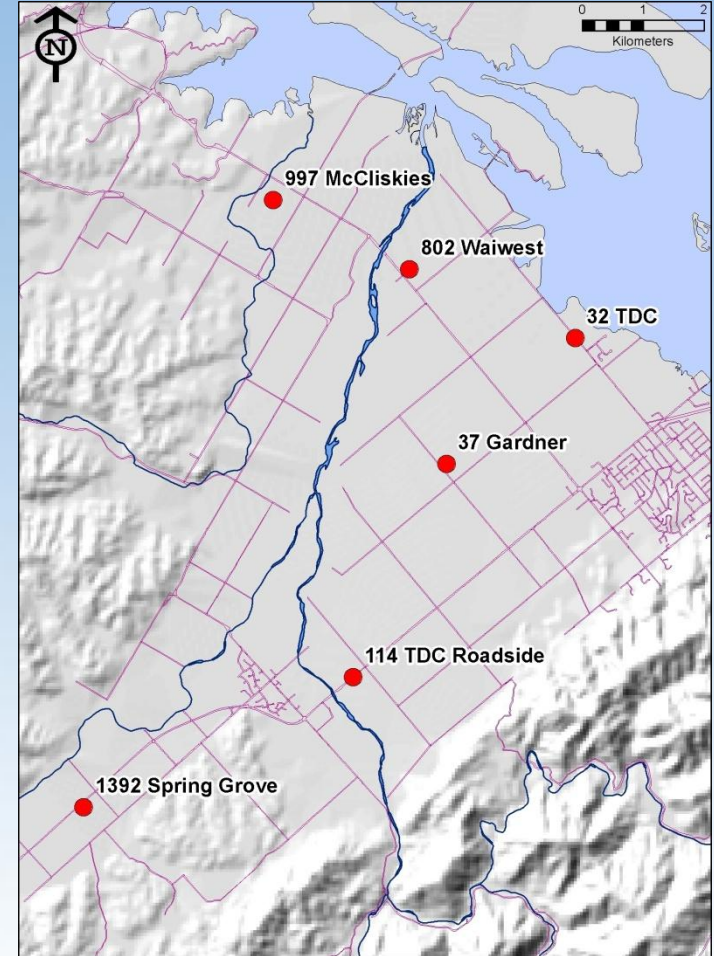
Waimea - confined



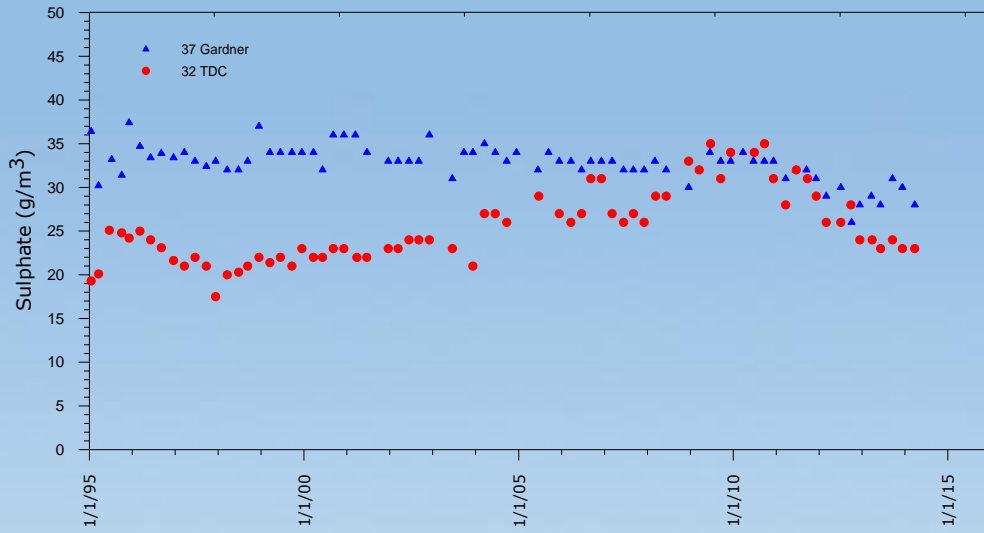
Waimea - unconfined



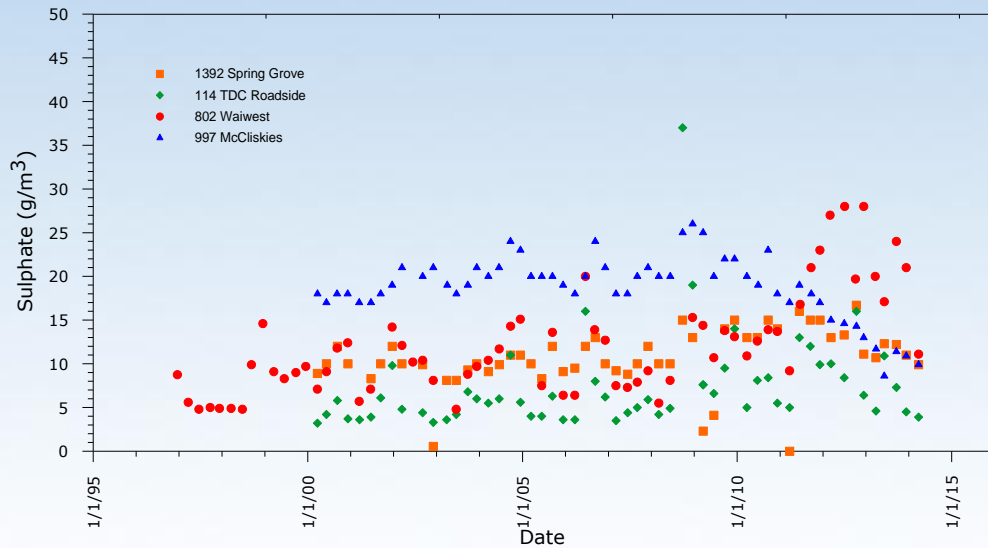
Magnesium (g/m³)



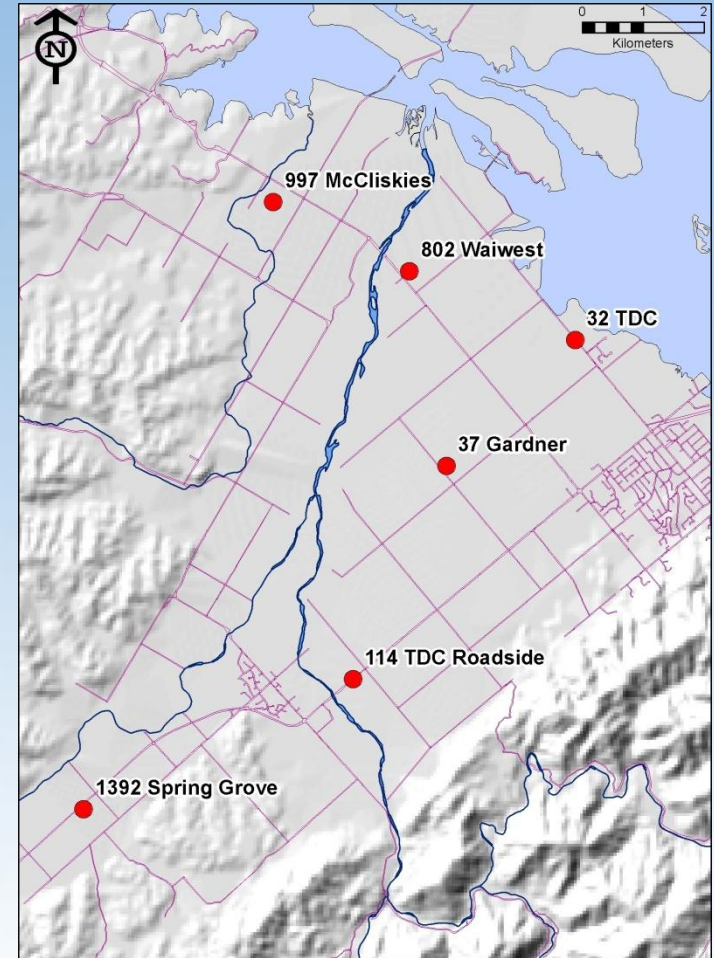
Waimea - confined



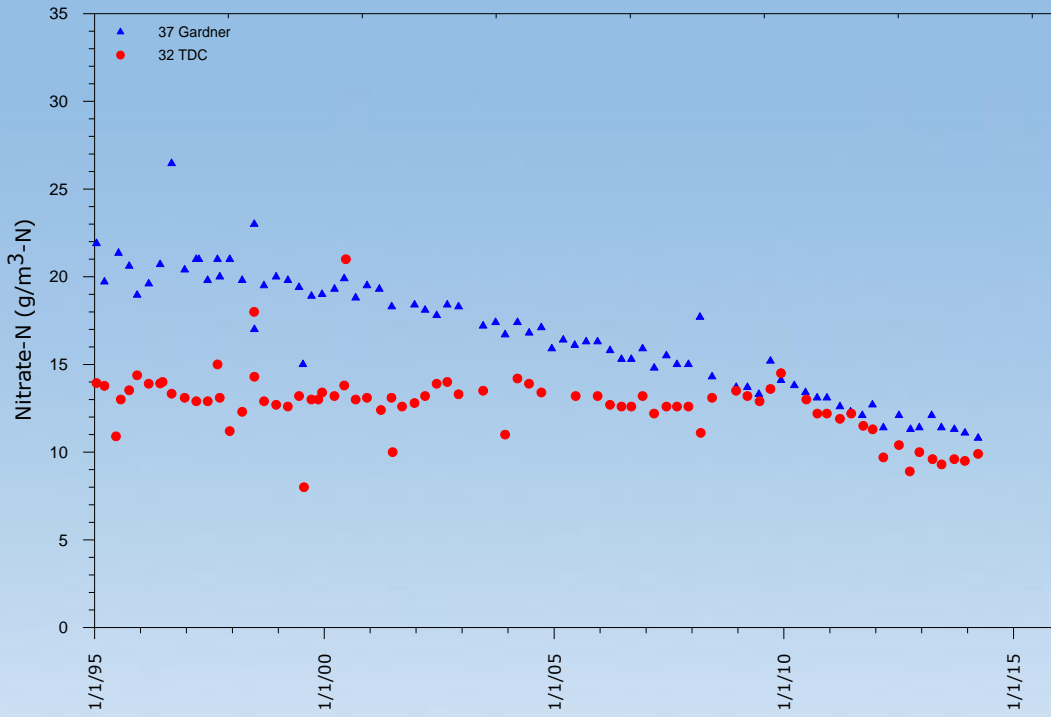
Waimea - unconfined



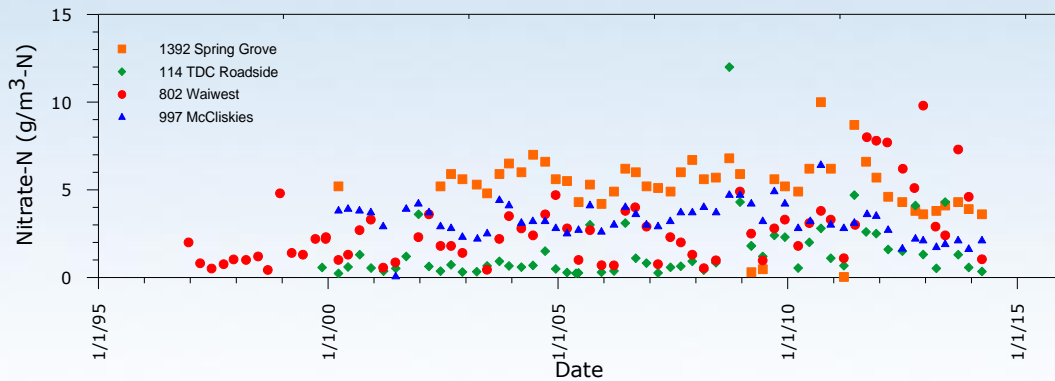
Sulphate (g/m³)



Waimea - confined



Waimea - unconfined



Nitrate-N (g/m³-N)

