GROUNDWATER

Northland Regional Council Groundwater and Monitoring Officer Sandrine le Gars sampling groundwater.

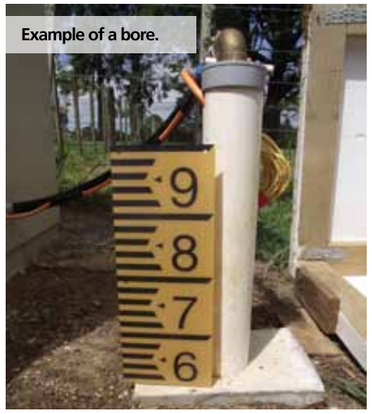
Groundwater performance targets:

Continue to implement and improve a prioritised State of the Environment monitoring programme and monitor compliance with, and the effects of, the exercise of resource consents and regional plans by:

- Carrying out investigations into the water resources of 'at risk' aquifers – **ACHIEVED.**
- Operating a region-wide water quality network for the measurement, recording and reporting of groundwater quality trends – **ACHIEVED.**
- Report the results from the SOE monitoring programmes in the annual monitoring report and make available on the council's website at **www.nrc.govt.nz/soe** by 31 October each year – **NOT ACHIEVED (loaded 4 weeks late).**

Key points 2010-2011

- In general, groundwater in Northland is of a high enough quality that it can be consumed without treatment.
- Groundwater quality was monitored at 39 sites (wells or bores) throughout Northland; seven of them as part of the National Groundwater Monitoring Programme and 32 as part of the Regional Groundwater Quality SOE Programme.
- Five specific groundwater investigations were carried out on aquifers – Ruāwai, Russell, Taipā, Whatitiri and Maungakaramea, where a total of 14 sites were monitored.
- Groundwater levels were monitored at 73 sites.
- Six sites were age tested to determine the average age of the groundwater in certain aquifers in the region.



Example of a bore.

Groundwater is water that exists beneath the earth's surface. The quantity and quality of groundwater largely depends on the underground rock formation within which it is contained, e.g. sand, gravel, fractured volcanic rock.

In Northland, the main aquifer systems are contained in basalt rock, like Whāngārei and Kaikohe, or in the Aupōuri sands. Rainfall is the main groundwater recharge source for these aquifers.

The council monitors groundwater in Northland using three main methods:

- State of the Environment (SOE) monitoring to record the general state of groundwater quality and quantity, and change over time (trends);
- Monitoring of activities that may affect groundwater to prevent or minimise any adverse effects caused by these activities; and
- Investigating individual aquifers where specific problems have been identified.

Groundwater quantity

Monitoring groundwater levels provides information on the effects of climate, land use and abstraction on groundwater resources, and it can tell us how much groundwater is available for use.

Levels are currently recorded continuously at nine sites, monthly at 25 sites and quarterly at 29 sites. Water level information is also collected at 10 sites as part of specific aquifer investigations. The location of monitoring sites was shown in the 2009-2010 Annual Monitoring Report, for a map of sites visit **www.nrc.govt.nz/amr**

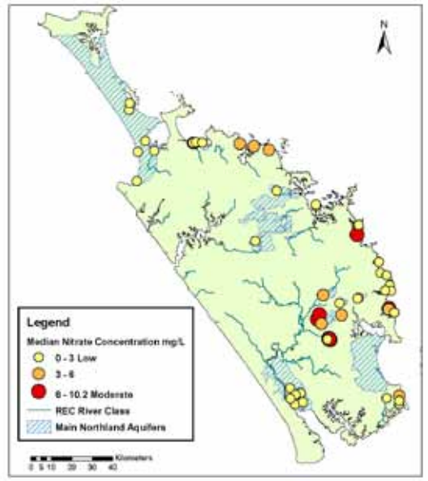
In 2010-11, groundwater levels for most aquifers in Northland were found to be near long-term monthly mean levels in autumn and winter months despite the 2009-2010 drought. The levels dropped slightly to below monthly mean during early summer due to near drought conditions during spring and early summer. The levels recovered in late summer and are now above monthly mean.

Groundwater quality

Monitoring groundwater quality provides information on the effects of climate, land use and abstraction on groundwater quality. The majority of groundwater samples collected in 2010-2011complied with the New Zealand drinking water standards. However, some sites were found to have elevated levels of iron, manganese, bacteria and nitrate.

Elevated concentrations of iron and manganese found in different aquifers are commonly the result of natural processes, e.g. interaction with iron-rich sediments.

In 2010-11, 23 percent and 33 percent of the sites had median levels of iron and manganese above their aesthetic guidelines for human consumption, and one site at Whananaki North had median manganese levels above the health-related standard. There are no specific increasing trends in iron and manganese at the sites for the past 12 months.



Median nitrate levels in groundwater, 2010-2011.

Results of bacterial analysis indicate that 12 groundwater sites have bacteria present above the drinking water guideline value of <1/100mL. Four sites, located at Matapōuri Bay, Tauranga Bay, Te Ngaire Bay and Waipapakauri showed repeated bacterial contamination and the council is currently investigating different types of aquifers, i.e. sand and greywacke. Possible causes include on-site effluent disposal and bore construction.

Median nitrate concentrations at all sites were below the drinking water limit of 11.3mg/L-N, the highest nitrate level being measured at Whatitiri. The map below shows median levels of nitrate concentration at all groundwater quality monitoring sites.

Specific groundwater investigations

Aquifer systems

The council undertakes a specific groundwater investigation where a potential issue has been identified, e.g. elevated nitrate or increased risk of saltwater intrusion in coastal areas. There are currently five aquifers in Northland that are subject to further investigation – Ruāwai, Taipā, Maungakaramea, Russell and Whatitiri.

Aquifer and use	Issue	Comments and Compliance with New Zealand drinking water standards (NZS).
Taipā Domestic	Salt water intrusion and nitrate	Nitrate is still elevated but has not exceeded NZS in the past 12 months. Saline indicators are well below NZS.
Ruāwai Domestic, stock, public drinking water	Salt water intrusion and iron	Chloride, sodium and iron concentrations remain elevated. Median chloride and sodium concentrations have exceeded the NZS at two sites and the median iron concentrations at all six sites exceed the NZS. The high iron is a result of natural processes. Sampling will be reduced.
Russell Domestic	Salt water intrusion and bacterial	Saline indicators are well below NZS. The NZS for *E.coli* was not exceeded repeatedly – this is likely to be a result of the sewage reticulation system.
Whatitiri Domestic, horticultural, irrigation, stock drinking	Nitrate	Nitrate is still elevated but has not exceeded NZS in the past 12 months. There appears to be a slight increasing trend and potential sources are being investigated.
Maungakaramea Domestic, horticultural, irrigation, stock drinking	Nitrate	Nitrate is still elevated and has exceeded NZS on one occasion in the past 12 months. Seasonal trends are evident and potential sources are being investigated.

The preliminary assessment report for Matarau/Ruatangata aqufiers was finalised in January 2011. The key findings of this report are:

- Rainfall is the source of recharge;
- The potential water available for allocation is around 7600 cubic metres per day; and
- Irrespective of the estimated water available for allocation, any future groundwater take application needs to be carefully considered based on the localised effects on springs and existing users.

CASE STUDY: a unique response to earthquakes

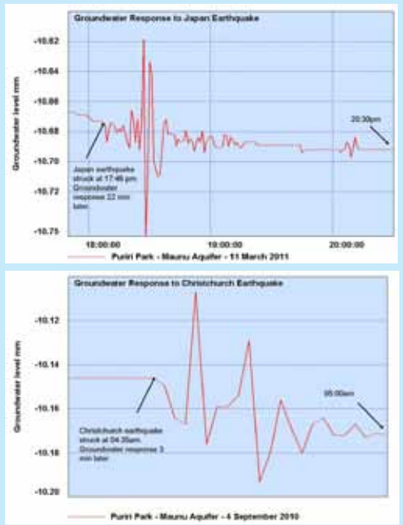
The groundwater level station located at Maunu responds to significant earthquakes that occur in the Pacific region. This appears to be unique in New Zealand and probably at a larger scale.

Examples of groundwater level fluctuations are shown in the graphs below for the Christchurch (4 September 2010) and Japan (11 March 2011) earthquakes. Water level fluctuations were also recorded following the Chile, Sumatra, Vanuatu and Kermadec Islands' earthquakes.

In most cases the groundwater levels settled about 2-3cm lower than prior to the earthquakes. This is a unique response which raises a number of questions:

- Is this a response of the water in the bore hole or the whole basalt aquifer?
- What is the volume of water moved?
- Where does the water go?

The groundwater level data has been provided to specialists in the hope of gaining a better understanding of the changes caused by the earthquakes in the aquifer. It may also help explain the large-scale movements of Earth's lithosphere.



Puriri Park (Maunu, Whāngārei) groundwater level station is a unique seismograph. These graphs show the groundwater level fluctuations after Christchurch and Japan earthquakes.