

Rotorua Geothermal System

Recent monitoring trends in geothermal water levels

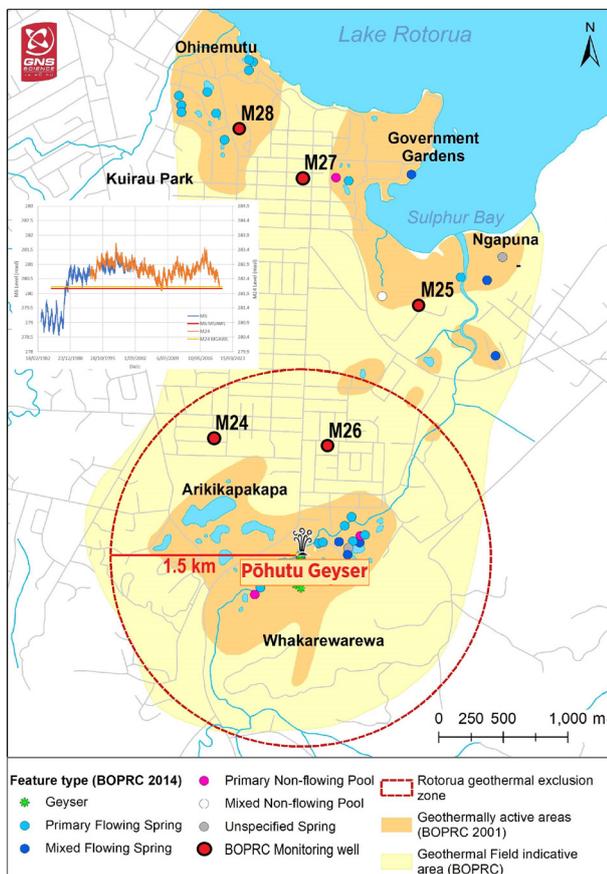
Our geothermal monitoring wells are showing a decline in water levels. We think this is due to an extended dry period, rather than any change in use, but if the dry period lasts and water levels continue to drop, our unique and vulnerable geothermal surface features might be at risk. So what can you do to help?

- **What is the Rotorua Geothermal System and what is a geothermal reservoir?**

The Rotorua geothermal system is a long-lived by-product of volcanism that occurred in the last hundreds of thousand years in the area. Fresh water penetrates through cracks and pores within hot volcanic rock, where it gets heated. This layer of heated water stored underground is called geothermal reservoir.

- **Where is the Rotorua Geothermal System?**

The Rotorua Geothermal System underlies approximately 12 square kilometers of the Rotorua City, from the south-western end of Lake Rotorua to the Whakarewarewa Valley.

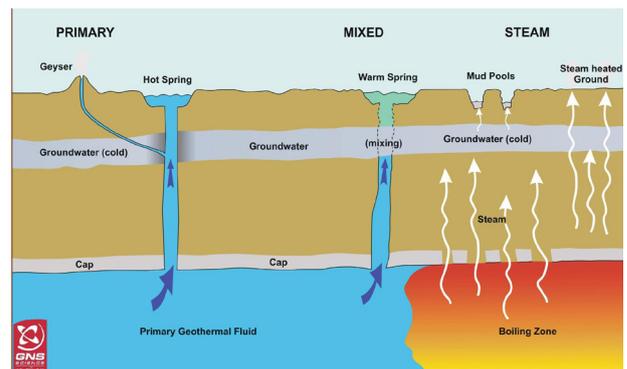


- **What are surface features and why is protecting them important?**

Surface features or Ngāwhā are surface natural discharges of the geothermal water and steam fed by the geothermal reservoir. Surface features include hot springs, pools, steam-fed features and some of New Zealand's last remaining geysers, like the Pōhutu Geyser. The surface features are important to the tourism industry and the science community and are a taonga to Māori.

- **How are surface features affected by geothermal aquifer levels?**

Each type of surface feature relies on a delicate balance of reservoir pressure (reported as water levels) and temperature. Changes to water levels affect how and if geysers and other surface features will 'play' in the longer term. In the picture below you can see how the geothermal reservoir and some of the surface features that occur in Rotorua are connected.



- **How does the Bay of Plenty Regional Council monitor the geothermal water levels?**

The Bay of Plenty Regional Council has five geothermal monitoring wells across the Rotorua Geothermal System. Two of those wells are just north of Whakarewarewa (M24 and M26), one in Ngāpuna (M25), one west of Government Gardens (M27) and one east of Kuirau Park (M28). Water levels in those wells are collected continuously. The map to the left shows the location of the monitoring wells as well as a graph of the water level for one of them.

- **How do we know when the water levels are getting low?**

Three of our monitoring wells (M24, M26 and M28) have minimum geothermal aquifer water levels (MGAWLs) set to ensure that surface activity is maintained and to give Council early warning of dropping aquifer water levels. Levels were set in the Rotorua Geothermal Regional Plan based on the minimum level recorded during the system recovery phase after bore closures.

- **What affects geothermal water levels and are they getting low?**

Water levels are affected by rainfall and by how much water and heat is taken from the reservoir. While our take of geothermal water and heat has not changed much in the last few years, the rainfall has. Our geothermal reservoir is replenished by the rain that infiltrates into the ground and geothermal water levels respond quickly to rainfall changes. Since 2017 annual rainfall levels have dropped as well as our geothermal water level. This dry period may continue.

- **Why do people take water from geothermal aquifers and how it is used?**

Geothermal water is extracted from the aquifer and the heat taken is used for domestic, commercial and municipal space and water heating. Geothermal water is also extracted for customary uses like bathing, cooking and healing, and in health spas for treatment.

- **How is geothermal water and heat extracted?**

Geothermal water is extracted from the reservoir through geothermal wells. The heat is taken from the hot geothermal water using a heat exchanger and the used (cooled) water is injected back into the reservoir. When reinjection is not possible, like for the geothermal water that has been bathed in, the fluid is discharged to waste. Downhole heat exchangers extract heat from the reservoir without bringing fluid to surface.

- **Does taking geothermal heat affect our aquifer levels, or only taking geothermal water?**

Taking heat from the geothermal system causes cooling of the reservoir. A reservoir temperature drop changes the geothermal fluid properties and pressure thus the water levels locally and across the field.

- **Do we have a problem now?**

One of our three monitoring wells has now reached its MGAWL. We are monitoring the situation closely and hope the levels will recover. Temporary fluctuations in

water levels have happened before, so at this stage we only want to give people early warning so they can do their part to reduce risks of future temporary reductions on consent holder takes.

- **What can we do NOW to help reduce the risk of water levels dropping further?**

While we cannot control the climate, we can control how much water and heat we are taking. Where possible, we are asking you to limit your geothermal water use and to think of ways to reduce waste. Check out how you can use the geothermal resource more efficiently on the next page.

- **What happens if this dry period continues?**

If the dry period continues water levels may continue to drop. Under the Rotorua Geothermal Regional Plan all resource consent holders have conditions to protect our surface features when water levels drop below a sustainable level. At the moment only one well has reached its MGAWL. If the MGAWL in other wells is triggered for more than 20 days Council will formally ask resource consent holders to voluntarily reduce their takes. If water levels don't recover, Council can require a staged reduction in take for a set period of time.



*Prince of Wales Feathers and Pōhutu geysers
@Duncan Graham*

For more information

For further information on the Rotorua Geothermal System in the Bay of Plenty, contact Penny Doorman, Geothermal Programme Leader on **0800 884 880** or visit www.boprc.govt.nz/environment/geothermal/rotorua

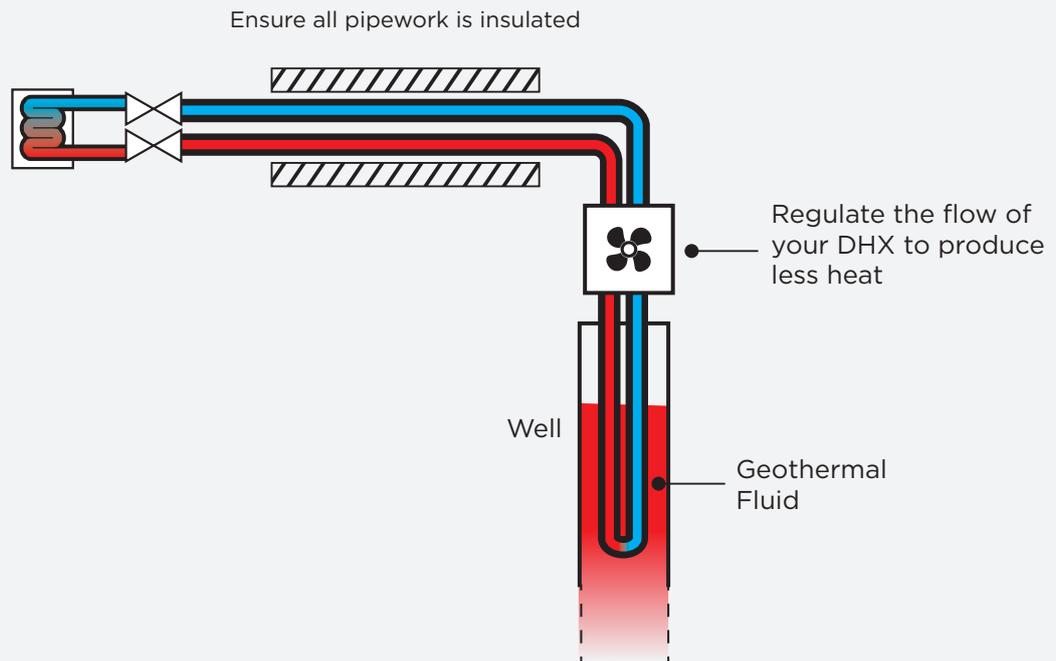


- ✓ **ALWAYS** seek advice from a **Suitably Qualified Expert** to maintain and adjust your equipment as per the **geothermal regulations**.

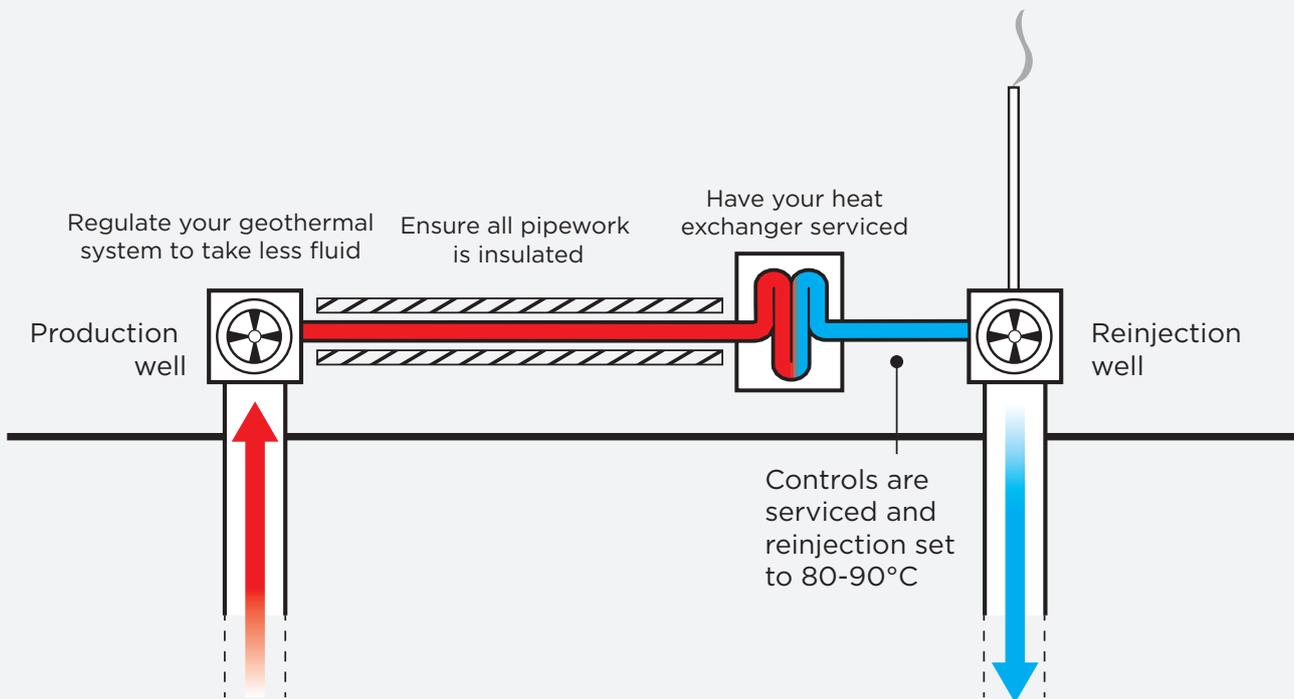
WAYS TO REDUCE YOUR TAKE AND GET EFFICIENT

IN YOUR PRODUCTION SYSTEM	PRODUCTION WELL OR WELL WITH DOWNHOLE HEAT EXCHANGER	<ul style="list-style-type: none"> ✓ Regulate your geothermal heating system to produce less geothermal fluid. ✓ Regulate the flow of your DHX to produce less heat.
	PIPELINES AND HEAT EXCHANGER	<ul style="list-style-type: none"> ✓ Fix all leaking pipes and valves. Change them if they cannot be fixed. ✓ Fix any leaking heat exchanger gasket and replace any damaged plates. ✓ Clean your heat exchanger pipes. ✓ Install insulation on all hot and warm pipes.
	YOUR REINJECTION WELL	<ul style="list-style-type: none"> ✓ If you are reinjecting water at more than 90 °C, chances are you are wasting precious water as steam. Upgrade your geothermal heating system to reinject between 80 °C and 90 °C. If you cannot do that, shut off your well until the end of March.
IN YOUR MINERAL POOL	<ul style="list-style-type: none"> ✓ Only fill your mineral pool when you plan to use it. ✓ Reduce the pool temperature by 3 °C or more. 	
IN YOUR INDOOR SPACE	<ul style="list-style-type: none"> ✓ Only use the heat you need to be comfortable. Regulate your radiators. ✓ Keep your door and windows closed, apart from the middle of the day. This is to remove moisture. ✓ Heat only in mornings and evenings, unless occupied during the day too. ✓ If it is gets too hot, shut off your well until the end of March and use an electric heater for the cooler times of the day. 	
IN YOUR HOT WATER SYSTEM	<ul style="list-style-type: none"> ✓ Think about ways to reduce hot water use. Use cold water to wash your hands, dishes and clothes when practical. ✓ Shower instead of bathing. Take showers 2-3 minutes shorter than you're used to. ✓ Reduce hot water waste. Turn off the hot tap when not using and fix dripping taps. ✓ Install insulation around the hot water equipment. ✓ Reduce the temperature of the hot water cylinder to 60 °C. 	
IN YOUR HEATED POOL	<ul style="list-style-type: none"> ✓ Turn the pool heating off if you are not using it frequently. ✓ Cover your pool and keep it covered as much as possible. ✓ Reduce the pool temperature by 2 °C or more. 	

DOWN HOLE HEAT EXCHANGER



PRODUCTION-REINJECTION SYSTEM



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