Section 4: Priority Waikato ecosystems

Geothermal ecosystems

Geothermal features include steaming ground, boiling mud pools, fumaroles and hot springs. Not all geothermal features are hot. Some contain cooled geothermal water with a high mineral content. Geothermal features support rare ecosystems with high soil, water or air temperatures, unusual and often extreme chemical environments (such as high acidity or alkalinity, high concentrations of toxic chemicals such as arsenic, mercury, and boron) and a range of unpleasant gases (for example, hydrogen sulphide).

Almost 80 per cent of New Zealand's geothermal resources occur within the Waikato region, yet the region's geothermal vegetation still only covers a total area of 579 hectares. Although the area of geothermal vegetation is low, there are many more hectares of features such as lakes and sinter terraces.

The special types of vegetation or biota that occupy geothermal ecosystems include:

- prostrate kanuka shrubland over a turf of unusual mosses, liverworts, and lichens
- low fertility shrubland of mingimingi, manuka, and monoao
- ferns, fern allies, and orchids rare in New Zealand but more common in the tropics
- thermophilic (heat-loving) microorganisms such as stunningly coloured blue green algae
- subtropical fungi attached to plant roots that assist plant survival
- species of invertebrates and algae that occur only in thermal pools and springs
- coastal plants found around geothermal sites (such as arrow grass and *Triglochin striata*).

Dicranopteris linearis (tangle fern) is a tropical fern that only survives in warm geothermal areas in New Zealand
Image by Shaun Barnett, Black Robin Photography (Copyright reserved)

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Threats to geothermal ecosystems
The damming of the Waikato River to form Lake Ohakuri in 1961 drowned an extensive area of geothermal features. Geothermal electricity development at Wairakei-Tauhara and Ohaaki has led to the loss of geothermal flowing features with high biodiversity.

Almost all geothermal ecosystems elsewhere have also been degraded to some extent by human-induced factors, including:

- trampling by tourists and other visitors. Both soils and vegetation are easily destroyed by repeated pedestrian traffic with extremely slow recovery times
- weed invasion of areas of low to moderate geothermal influence, particularly by pines and blackberry
- rubbish dumping
- stock grazing and trampling
- clearance of vegetation for land development.

Geothermal habitats occupy only about 0.002 per cent of New Zealand's land surface, so they are naturally rare. The majority of geothermal areas are legally protected within Department of Conservation reserves or other types of conservation covenants, with about 30 per cent by area in various forms of private ownership in the Waikato region.

Which types of geothermal ecosystems are the most threatened in our region?
Because geothermal ecosystems only occupy a very small area naturally, they are all considered important. Many geothermal terrestrial ecosystems have populations of rare ferns, fern allies, orchids or other plants that increase the need for careful management.

Geothermal aquatic ecosystems are even more vulnerable to change than terrestrial ecosystems, because large-scale geothermal extraction is more likely to destroy such features, some of which may hold organisms or ecosystems unique to a particular pool with a unique chemical composition.

How do I know what to do, and when?
Use the table overleaf to help you prioritise your management actions. The actions are listed in roughly the priority order, though each site is different and will require its own assessment.

Boiling mud pools are a characteristic feature of geothermal ecosystems
Image by Shaun Barnett, Black Robin Photography (Copyright reserved)

Geothermal ecosystems hot tips

WARNING: Geothermal areas are extremely dangerous and care must be taken at all times. If you have any doubts about the stability of geothermal crusts or the temperature of water or soils, don't expose yourself to the risk. The surface may give the appearance of solid ground but is often a thin layer of weak ground over hot water.

In addition geothermal areas have been known to erupt-either as a steam vent or volcanic material or both. This can happen almost anywhere in a geothermal area. Assume all geothermal areas are unsafe to walk on.

Hydrogen sulphide gas is lethal in high concentrations and being heavier than air, will collect in sheltered hollows and enclosed spaces.

- Visit the Weedbusters website: **www.weedbusters.org.nz**
- Visit the Landcare Research website and read their factsheet on how to prioritise weeds: **www.landcareresearch.co.nz/research/biodiversity/landscapesprog/workshops/Stanley_WeedSheet.pdf**
- Visit Environment Waikato's website for more information on geothermal ecosystems: **www.ew.govt.nz**

Choosing Actions: Geothermal ecosystems

Assess needs/plan
Do this before anything else! Seek professional advice if you need to identify the management issues for your site. Write up a plan of action.

Seek funding
Complete this table to determine what actions are needed. Geothermal sites can be extremely dangerous because of extreme heat, boiling waters and toxic fumes!

Action and Priority	Comments
Fence 1st Keep to tracks 2nd Control stock	• Preventing or controlling public access will reduce degradation of geothermal areas by trampling and limit the possibility of accidents. Keep to tracks and boardwalks. • If grazing animals can enter your site they will trample and eat the plants and damage fragile sinter terraces. Heavier animals such as adult cattle and horses are generally more damaging than lightweight stock such as sheep and calves. Even a hot wire will be a good start to keep cattle out. Geothermal areas are also extremely dangerous for stock. Fencing will protect them and fragile ecosystems.
Reduce rubbish 1st Don't dump 2nd Remove unsightly/ dangerous rubbish	• Don't use geothermal areas for dumping rubbish, including offal. • Allow geothermal ecosystems to thrive by removing unsightly and dangerous rubbish left in fumaroles. Be extremely careful, you may need to use specialist contractors.
Control weeds 1st Remove plant pests 2nd Deal with pines and blackberry	• Deal with weeds you are legally obliged to. See the plant and animal pests section in Environment Waikato's website. • Remove shallow-rooting pines near warm ground if they are likely to fall into geothermal features. Otherwise, poisoning pines is better then cutting them down, although sometimes leaving them is best depending on the site. After cutting pines down the open site is a perfect place for new seedlings to establish but if there is a dense scrub canopy pines are less likely to re-establish. • Poison blackberry, but make sure there are no rare ferns mixed in with a blackberry thicket.
Planting Buffer	Plant in the cool ground around geothermal areas to enhance their natural character and protect them from runoff. Geothermal ecosystems are dangerous and highly specialised areas where plants must cope with rapid changes in soil heat and chemistry over very short distances. It will be difficult to plant successfully into such areas, so leave nature to 'plant' into hot areas or seek expert advice.
Monitoring Assess changes in the entire site and/or focal plant populations	Take photos of your site. Count the number or cover of rare plants you see and follow their progress.
Legal protection Seek protection	If a site is not legally protected as a reserve or private covenant, it's generally best to seek legal protection when the site is in good condition. However, if you are planning to protect the site and you need to fence it, it pays to contact QEII National Trust first, as they usually pay a share of the fencing costs.