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Geothermal features annual monitoring report - January 2023

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REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

Prepared by:
Claire Kotze

For:
Waikato Regional Council
Private Bag 3038
Waikato Mail Centre
HAMILTON 3240

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Katherine Luketina Date July 2023

Approved for release by:
Michelle Begbie Date October 2025

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Acknowledgement

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Table of Contents

Abstract

Annual geothermal monitoring data from 2005 to 2023 are presented for long-term observations of geothermal feature conditions. Field surveys were conducted in May 2022 – February 2023. Nine geothermal fields were visited: Ngā Tamariki, Ōrakei-kōrako, Reporoa, Rotokawa, Tauhara, Te Kopia, Waikite, Waiotapu, and Whangairorohea. Atiamuri was not visited due to illness. Water temperature and pH measurements were taken where possible, and general observations on the feature conditions were also recorded. Images captured from a Fluke infrared thermal imaging camera are included in this report to show the thermal profile of some of the surface features.

The Hydrothermal Eruption Crater at Ngā Tamariki has had various changes since the landslide in 2019. High rainfall levels over the past year may have contributed to the higher levels of some of the features. Some features were not visited in 2021 due to different staff members conducting the monitoring who did not visit all the same sites.

Executive summary

Waikato Regional Council is required by RMA s36 to monitor the state of the regional environment, which includes 70% of the nation's geothermal resource. The existing geothermal resources provide many social, cultural, scientific, and economic benefits. Geothermal features are dynamic and have a natural range of behaviours and activities that need to be understood, so that anthropogenic changes can be identified and addressed in accordingly.

Uses of the regional geothermal resource can adversely affect the natural character of the resource and therefore it is important to undertake regular monitoring to identify changes. Annual monitoring of geothermal surface is conducted in geothermal fields that are most sensitive to changes, to continuously monitor and update the state of environment in these geothermal areas. Most of the features monitored are alkali chloride springs and geysers, which are typically characterised by their near-neutral pH, boiling conditions, chloride-rich chemistry, and in many places sinter deposition. Data of alkali chloride springs and geysers provide the best representation of the deep benign chloride reservoir conditions of a geothermal system.

Included in the annual monitoring is Whangairorohea, a small geothermal system, while Horohoro, Ketetahi, Ohaaki, Tokaanu, and Wairakei are some of the large systems not monitored due to lack of access, a lack of significant surface features, or because large-scale geothermal resource users such as geothermal electricity producers are required to do monitoring.

Since 2005, many features have experienced temperature and pH changes, with some of the conditions returning to initial conditions from 2005. At Ngā Tamariki, a pumiceous sediment apron is forming at the Hydrothermal Eruption Crater due to natural causes.

It is valuable to continue undertaking annual monitoring of geothermal features to increase understanding of the region's geothermal resources, so that long-term feature conditions and changes can be observed, and any threats or damage to the features due to human causes can be mitigated appropriately.

The previous Geothermal Features Annual Monitoring Report (TR2021/17) had errors in the data that was reported, therefore the data in the tables and graphs from that report should be disregarded.

1 Introduction

Monitoring of a selection of geothermal features in the Waikato Region was implemented in 1995. The aim of the monitoring is to observe the natural state of geothermal surface features. Assessments are made on changes that are occurring over time, as well as reporting on any threats or damage to the features. This will allow us to make more informed decisions to protect and enhance the geothermal resources and ecosystems.

1.1 Report Content

Annual geothermal monitoring is conducted once a year and includes quarterly sites and sites only visited annually (Figure 1). This report covers data from May 2022 to February 2023 (and comparing it to previous visits in March 2021). The specific geothermal fields recorded throughout this monitoring period are as follows:

Ngā Tamariki
Ōrakei-kōrako
Reporoa
Rotokawa
Tauhara
Te Kopia
Waikite
Waiotapu
Whangairorohea

1.2 Methodology

Direct water temperature is measured using a Fluke 566 IR Thermometer with a 6 m submersible thermocouple attached. The infrared FLUKE TiS60+ thermal imager is used to as to collect secondary measurements to the submersible thermocouple, and is used to produce infrared spectra images shown for some sites.

GPS co-ordinates gathered during previous site visits have been converted from NZMG to NZTM, which is now the standard coordinate system for WRC. Where existing known co-ordinates have not been available, a Garmin GPSmap 60CSx has been used to record locations, with an accuracy of ± 5 m. Each GPS reading was taken in the same spot as the photograph was taken from.

pH measurements were taken using Whatman® Universal pH 1-11 indicator papers. Samples were cooled before being tested, to comply with the paper's temperate range. Where possible, water flow was estimated. The liquid flow or discharge was estimated when assessed to be realistic, i.e., that the entire flow can be seen, and seepage or flow diversion is not occurring on a large scale.

The water level was recorded for some features; subject to choosing an easily identified and physically long-lived benchmark in the vicinity, or relative to the overflow level. 'Ebullition' and gas discharge are recorded, also water clarity and colour, and the general condition of the sinter is noted.

The gaps in the graphs occur when the site has been visited, but the attribute has not been measured. This may occur for various reasons, such as it was too hazardous to get close enough to the feature to measure it or the equipment malfunctioned.

2 Ngā Tamariki

2.1 3063_1: Hydrothermal Eruption Crater

- There have been a lot of changes to the Hydrothermal Eruption Crater since the April visit in 2021.
- The temperature of the eruption crater showed an increase of 4.1 °C last year from 50.5 °C in May 2022 to 55.1 °C in December 2022.
- The pH has also increased from pH 6 in April 2022 to pH 7 in September and December 2022.
- The colour of the hydrothermal eruption crater has changed dramatically over the last year from murky green to dark brown, as can be seen in the photos below.
- The water level as shown by the ESG (External Staff Gauge) reading has dropped, and it appears that the flow has increased.
- The sediment mounds in the centre of the pool are more apparent than in previous visits.
- There is yellow precipitate around the edges of the pool which can be seen in Figure 14 below.
- There were yellow algae floating on the surface of the pool near the outflow, where previously the algae had been green.
- There was a large weather event in December 2019 which caused a landslip into the pool. This changed the pool considerably, with sediment being deposited at the base of the hillside where the steaming area used to be.
- We visited the site on 27th February 2023, however we could not access the pool due to the effects of the recent Cyclone Gabrielle. There were several trees down which were across the path and made the track unpassable.

Location: -38.533395, 176.172105

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/04/30	6.0	51.0	40.9	0.3	<10.0	Cloudy	Green - Murky	Constant low ebullience at multiple areas
Comments	Increased water level from last visit. Most mud pools on proximal side are now submerged. Sediment apron has become more permanent. Pool extended on the south side and has an effervescent sheen on surface.							
2022/05/13	6.0	50.5	48.9	0.1	<6.0	Cloudy	Grey - Light	Small bubbles all over pool. Strongest next to front edge.
Comments	A lot more steam than usual.							
2022/09/23	7.0	51.3	46.5	0.1	<10.0	Murky	Brown - Light	Constant small bubbles near edges. Steam all over pool.
Comments	Pool very steamy brown and murky. Sediment mounds near outflow and in centre of pool.							
2022/12/05	7.0	55.1	51.0	0.09	<20.0	Murky	Brown - Dark	Small bubbles all over pool.
Comments	Sediment mounds are more apparent. Flow and water level have changed. Pool is steaming. Yellow algae on surface.							

[Hydrothermal Eruption Crater]: Temperature and pH for entire record

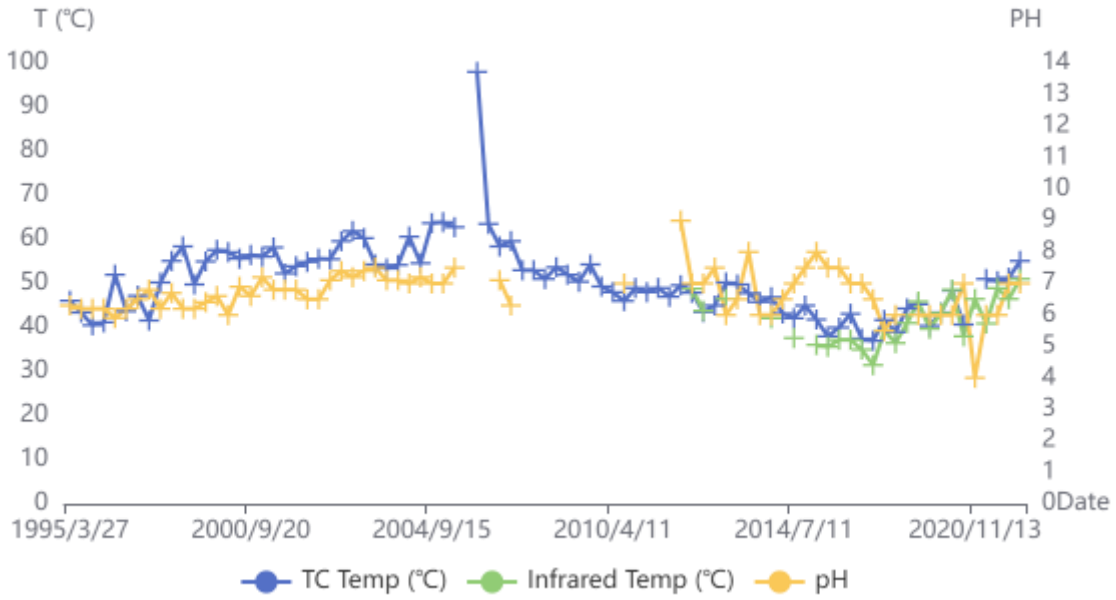


Fig.1 - taken on 2021-04-30 12:43:42"

Fig.2 - taken on 2021-04-30 12:43:50"

Fig.3 - taken on 2021-04-30 12:43:56"

Fig.4 - taken on 2021-04-30 12:55:51"

Fig.5 - taken on 2022-05-13 12:10:34"

Fig.6 - taken on 2022-05-13 12:11:06"

Fig.7 - taken on 2022-05-13 12:11:11" *Fig.8 - taken on 2022-05-13 12:11:21"* *Fig.9 - taken on 2022-09-23 15:39:42"*

Fig.10 - taken on 2022-09-23 15:39:48"

Fig.11 - taken on 2022-09-23 15:39:53"

Fig.12 - taken on 2022-09-23 15:58:22"

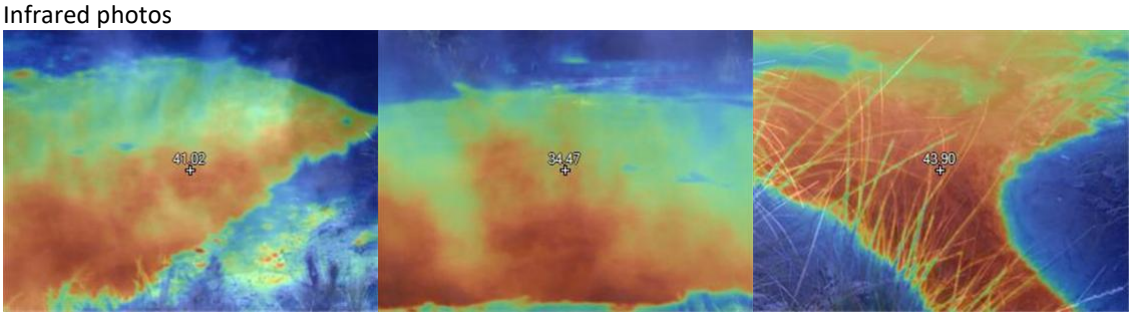
Fig.13 - taken on 2022-12-05 14:41:41"

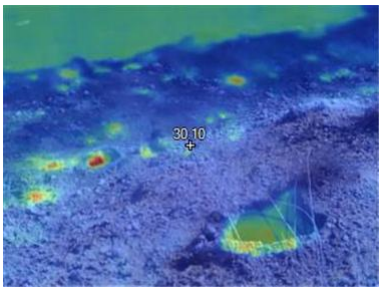
Fig.14 - taken on 2022-12-05 14:42:17"

Fig.15 - taken on 2022-12-05 14:42:21"

Fig.16 - taken on 2022-12-05 14:42:52"

Infrared photos





HER crater 13/05/2022

2.2 3063_4: Southern Spring aka Biodiversity Pool

- We were not able to get close to the pool in 2022 as a pine tree had fallen across the path and we have been unable to find a better path to sample from.

Location: -38.534198, 176.172393

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/04/30	7.0	55.0		65.0			Clear	Green - Light	Constant low ebullience from main pool. Other pools are more ebullient.
Comments	White mineral precipitates forming on subaqueous objects.								
2022/05/13				37.9			Clear	Colourless	Steam visible
Comments	Couldn't access pool, trees have fallen over path.								

[Southern Spring aka Biodiversity Pool]: Temperature and pH for entire record

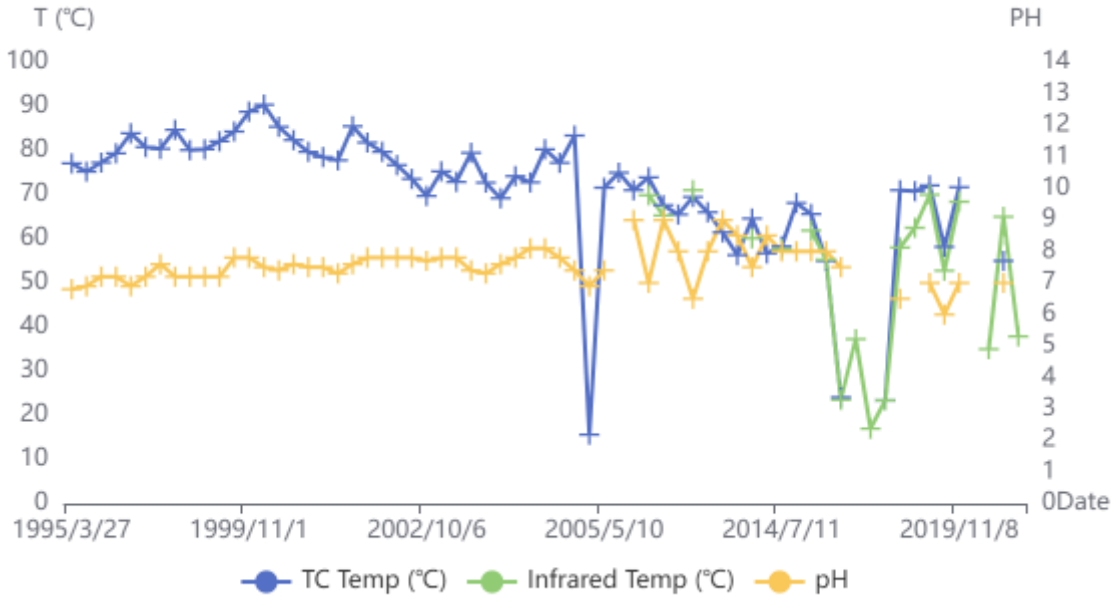
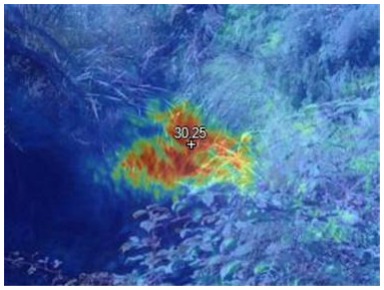


Fig.1 - taken on 2021-04-30 13:24:56"

Fig.2 - taken on 2021-04-30 13:27:55"

Fig.3 - taken on 2022-05-13 12:47:27"

Infrared photos



Biodiversity pool 13/05/2022

2.3 3063_2: Mud pool beside large pool

- pH has increased in the pool from pH 3 to pH 4.
- There was a decrease in temperature from 68.6 °C in May 2022 to 47.5 °C in September 2022. This then increased again to 67.8 °C in December 2022.

Location: -38.533395, 176.172105

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/05/13	3.0	68.6		54.0	1.0		Muddy	Grey - Light	Constant discharge
Comments	New hole 2 m to right of mud pool. Very active, too dangerous to get a reading.								
2022/09/23	4.0	47.5		46.2	0.5		Muddy	Grey	Constant small bubbles
Comments	Small tree in pool.								
2022/12/05	4.0	67.8		55.0	0.6		Muddy	Brown - Light	Constant small bubbles
Comments									

[Mud pool beside large pool]: Temperature and pH for entire record

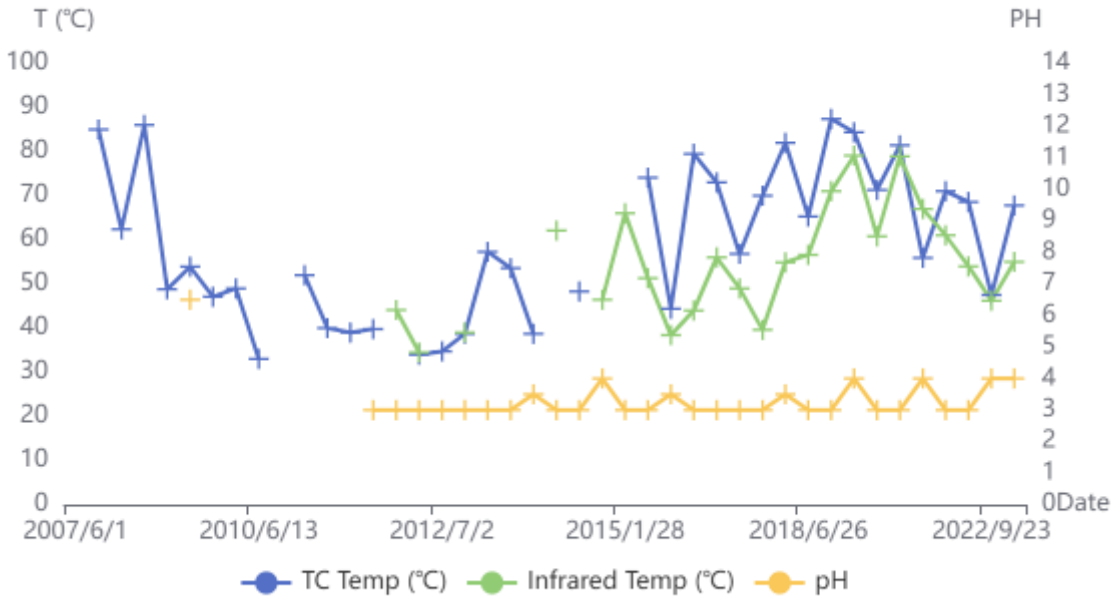


Fig.1 - taken on 2022-05-13 12:24:20"

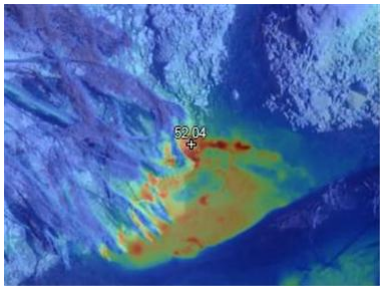
Fig.2 - taken on 2022-05-13 12:24:41"

Fig.3 - taken on 2022-09-23 15:55:41"

Fig.4 - taken on 2022-12-05 14:22:46"

Fig.5 - taken on 2022-12-05 14:24:47"

Infrared photos:



Mud pool beside HER 13/05/2022

3 Ōrakei-kōrako

3.1 3065_451: Waihunuhunu Inlet 1

- The temperature has decreased in 2022 from the previous visit in 2021.
- The pH has increased from pH 5 to pH 6.
- The flow appears to have decreased.

Location: -38.452977, 176.156227

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	5.0	51.9		50.4		>25.0	Clear	Colourless	N/a
Comments									
2022/08/25	6.0	32.0		33.0	0.5	<20.0	Clear	Colourless	No
Comments									

[Waihunuhunu Inlet 1]: Temperature and pH for entire record

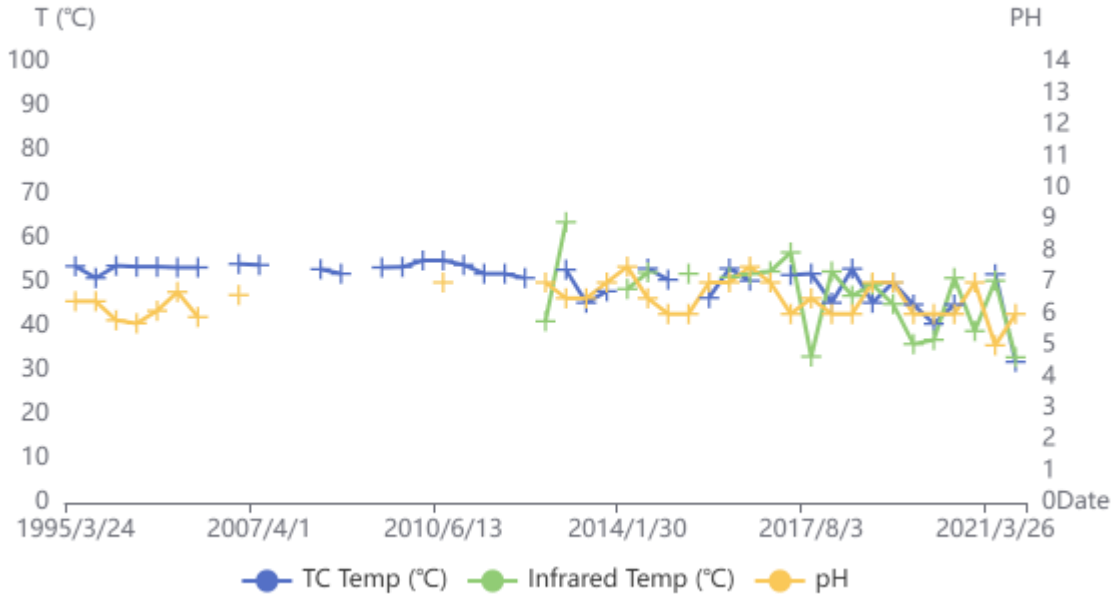


Fig.1 - taken on 2021-03-26 14:11:39"

Fig.2 - taken on 2022-08-25 14:33:27"

3.2 3065_1: Map of Australia

- The temperature has fluctuated over the period, with the lowest temperate recorded in March 2021 at 77.8 °C and the highest at 84.0 °C in November 2022. It has since decreased again by 3.5 °C.
- The colour of the pool has changed from blue to green in November 2022 and the pH had dropped to pH 5 from pH 7. It was also murky when it is usually clear. However, the clarity, colour and pH had returned to normal by the March visit.
- A probe had been installed when we visited in September 2022 and had been removed by the November 2022 visit.

Location: -38.473425, 176.1426

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	7.0	77.8		70.0			Clear	Colourless	Constant weak ebullition from single part of the pool
Comments	Pool no longer overflowing as observed on Dec 2020. Recent sinter deposits damaged and algal communities are gone. Areas of increased temperatures around pool now cool.								
2022/05/13	7.0	79.0		78.0	0.83	<1.0	Clear	Blue	Constant upwelling on right side of pool.
Comments									
2022/09/23	7.0	79.7		77.0	0.21	<0.5	Clear	Blue - Green	Constant upwelling on right side of pool. Lots of steam.
Comments	Probe installed in pool.								
2022/11/25	5.0	84.0		75.0		<0.5	Murky	Green	Constant upwelling
Comments	Colour has changed to a murky green.								
2023/02/27	7.0	80.5		72.9	0.22	<0.5	Clear	Blue	Constant upwelling on right side of pool
Comments									

[Map of Australia]: Temperature and pH for entire record

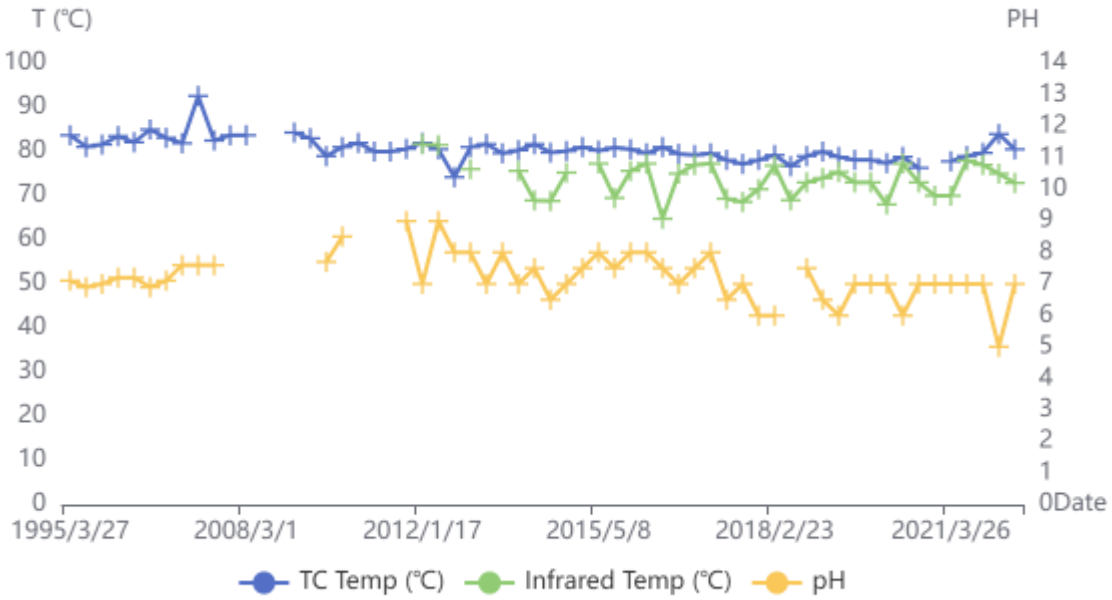


Fig.1 - taken on 2021-03-26 09:57:54"

Fig.2 - taken on 2022-05-13 14:03:00"

Fig.3 - taken on 2022-05-13 14:09:04"

Fig.4 - taken on 2022-05-13 14:09:39"

Fig.5 - taken on 2022-05-13 14:09:59"

Fig.6 - taken on 2022-09-23 11:47:15"

Fig.7 - taken on 2022-09-23 11:47:50"

Fig.8 - taken on 2022-11-25 13:11:40"

Fig.9 - taken on 2022-11-25 13:11:56"

Fig.10 - taken on 2023-02-27 15:54:11"

Fig.11 - taken on 2023-02-27 15:54:30"

Fig.12 - taken on 2023-02-27 15:54:35"

Fig.13 - taken on 2023-02-27 15:54:45"

Fig.6 - taken on 2021-03-26 09:57:50"

3.3 3065_6: Diamond Geyser

- The temperature and pH of Diamond Geyser has fluctuated over the period from March 2021 to March 2023.
- Overall during the period, the pH fluctuated from pH 6 to pH 7.
- The temperature was highest in March 2023 with a reading of 88.9 °C. The lowest temperature was in September 2022 with a reading of 83.5 °C. It has since risen again up to 87.3 °C.
- It is getting increasingly difficult to get to the feature due to the vegetation growth and the fumarole expanding to the left of the feature.

Location: -38.473622, 176.146676

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	6.0	88.9	71.3			Cloudy	Grey	Constant ebullition at 2 points
Comments	New but minor nodular sinter deposits							
2022/05/13	6.0	84.7	78.2			Clear	Colourless	Constant upwelling at outlet
Comments								
2022/09/23	7.0	83.5	76.1			Clear	Blue - Grey	Constant upwelling at outlet
Comments	Oily sheen on surface of pool.							
2022/11/25	6.0	83.7	79.0		<0.05	Clear	Colourless	Constant upwelling at outlet.
Comments	Pool is steaming. Some sticks floating on surface. Oily sheen on surface.							
2023/02/27	7.0	87.3	76.0		<0.1	Clear	Blue - Dark	Constant

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
									upwelling at the outlet
Comments	Some foam has formed on the surface.								

[Diamond Geyser]: Temperature and pH for entire record

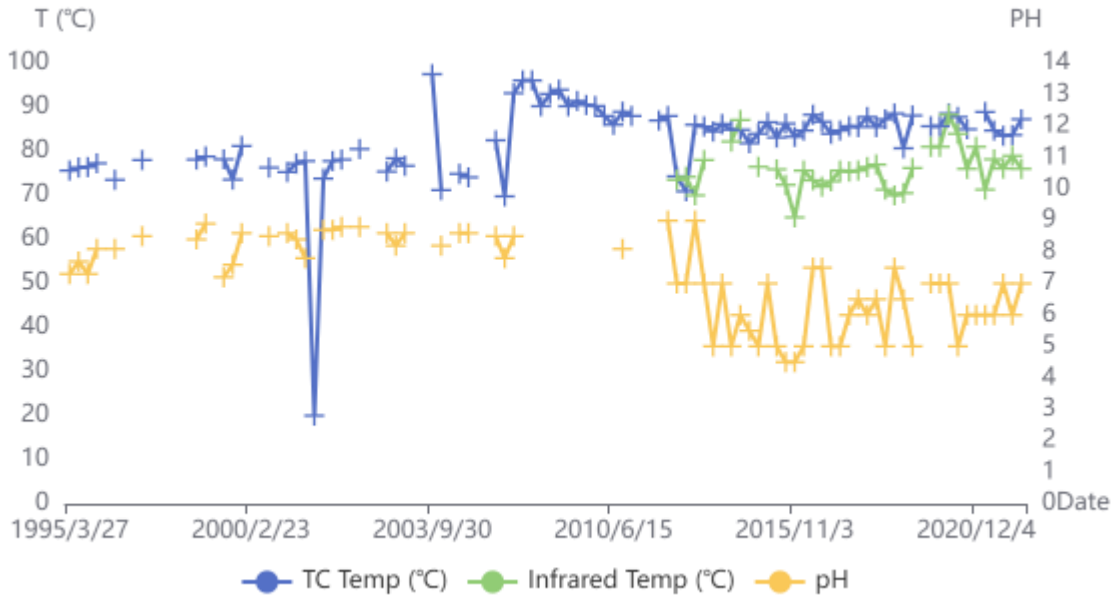


Fig.1 - taken on 2021-03-26 10:41:11"

Fig.2 - taken on 2022-05-13 14:30:03"

Fig.3 - taken on 2022-09-23 12:15:03"

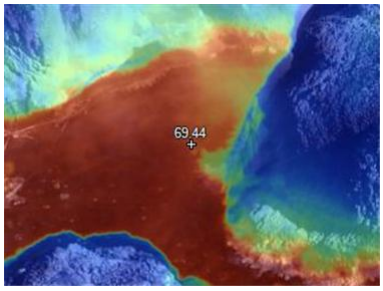
Fig.4 - taken on 2022-11-25 10:58:14"

Fig.5 - taken on 2022-11-25 11:04:44"

Fig.6 - taken on 2022-11-25 11:04:52"

Fig.7 - taken on 2023-02-27 13:31:25"

Infrared photos:



Diamond geyser 13/05/2022

3.4 3065_7: Bush Geyser

- The temperature in the Bush Geyser has remained relatively constant throughout the period from March 2021 to March 2023.
- The highest temperature was recorded in March 2021 with a reading of 91.3 °C and the lowest in May 2022 with a reading of 88.8 °C.
- The pH has decreased from pH 8 in September 2022 to pH 7 in November 2022. The pH was unable to be determined in March 2021 and May 2022.

Location: -38.47351, 176.146821

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26		91.3		50.2					
Comments	Features around this geyser have expanded. Not currently erupting.								
2022/05/13		88.8		68.7	1.1				Steam no audible bubbling
Comments	Could not get pH sample as sinter build up too much to get a bottle in. Did not erupt.								
2022/09/23	8.0	90.3		56.1	0.92		Clear	Colourless	Steaming and erupting
Comments									
2022/11/25	7.0	89.2		76.5	1.1		Clear	Colourless	Calm steaming. Occasional audible bubbling.
Comments									
2023/02/27	7.0	89.0		72.4	1.1		Clear	Colourless	Calm
Comments									

[Bush Geyser]: Temperature and pH for entire record

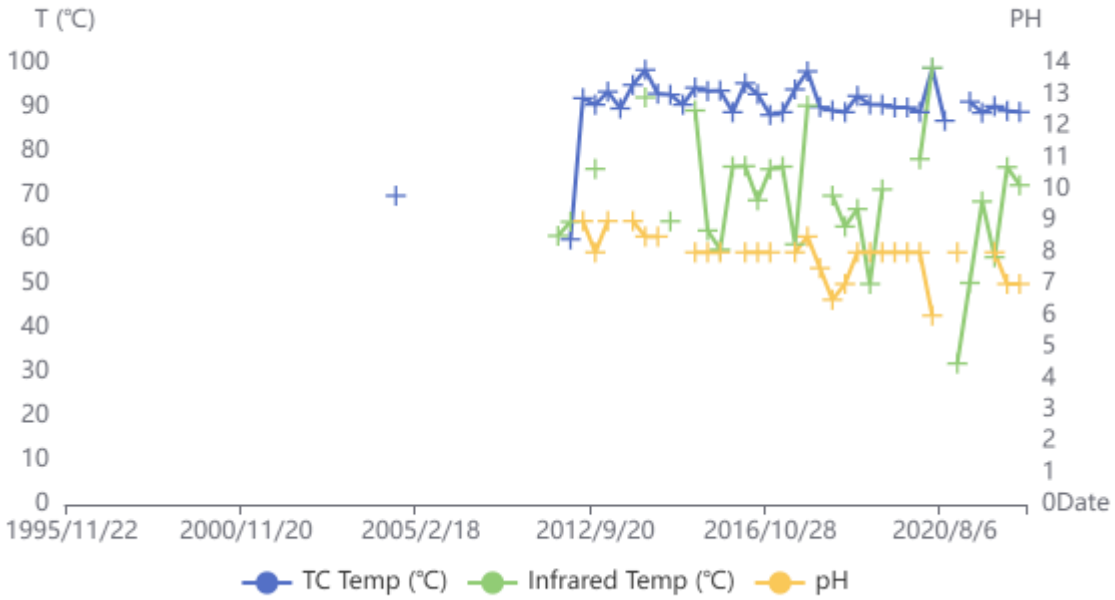


Fig.1 - taken on 2021-03-26 10:53:22"

Fig.2 - taken on 2021-03-26 10:53:30"

Fig.3 - taken on 2022-05-13 14:40:37"

Fig.4 - taken on 2022-05-13 14:40:58"

Fig.5 - taken on 2022-09-23 12:26:30"

Fig.6 - taken on 2022-09-23 12:26:37"

Fig.7 - taken on 2022-11-25 11:14:50"

Fig.8 - taken on 2023-02-27 13:49:16"

Fig.9 - taken on 2023-02-27 13:49:45"

3.5 3065_8: Cascade Geyser

- There were eruptions witnessed on two of the five visits over the period from March 2021 to March 2023.
- All eruptions lasted for 30 seconds.

Location: -38.473594, 176.147031

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26			53.4					Short period of splashing but no eruption.
2022/05/13								Erupting
Comments	Erupted three times for 30 seconds each time.							
2022/09/23								Erupting
Comments	Erupted twice for 30 seconds each time.							
2022/11/25								Steaming
Comments	Steaming, recent signs of eruption. No eruption while we were present.							
2023/03/27								No eruption
Comments	Erupted at 12:49 after we had left the feature.							

[Cascade Geyser]: Temperature and pH for entire record

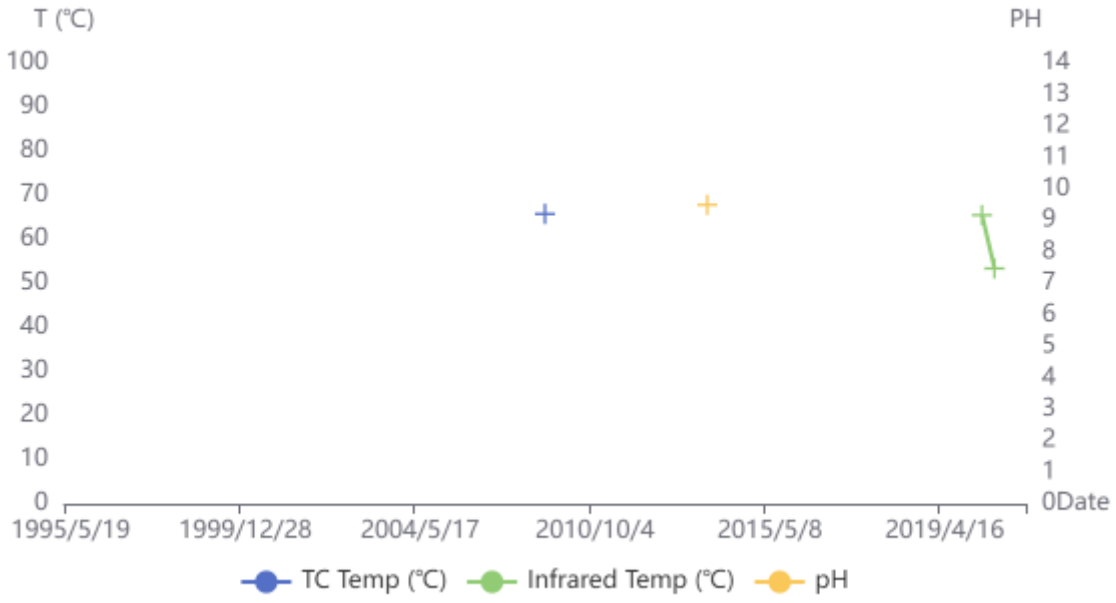


Fig.1 - taken on 2021-03-26 11:10:52"

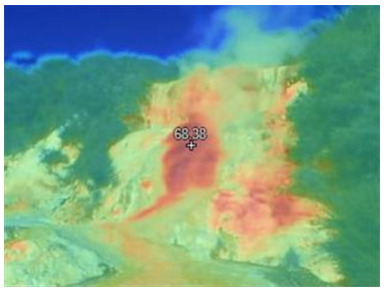
Fig.2 - taken on 2022-05-13 14:47:42"

Fig.3 - taken on 2022-09-23 12:34:44"

Fig.4 - taken on 2022-11-25 11:19:09"

Fig.5 - taken on 2023-02-27 13:55:25"

Infrared photos:



Cascade Geyser 13/05/2022

3.6 3065_18: Sapphire Geyser

- The Sapphire geyser erupted during the visits in September 2022 and February 2023.
- The eruption in September was quite large, with the water reaching 1.5 m high.

Location: -38.473503, 176.147084

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	7.0	99.4		64.0	4.0		Clear	Colourless	Constant ebullition below geyser mouth
Comments									
2022/09/23									Constant boiling, erupted
Comments	Erupted up to 1.5 m high.								
2022/11/25									Steaming
Comments	Steaming, no eruption.								
2023/03/27									
Comments	Erupted for 3 minutes.								

[Sapphire Geyser]: Temperature and pH for entire record

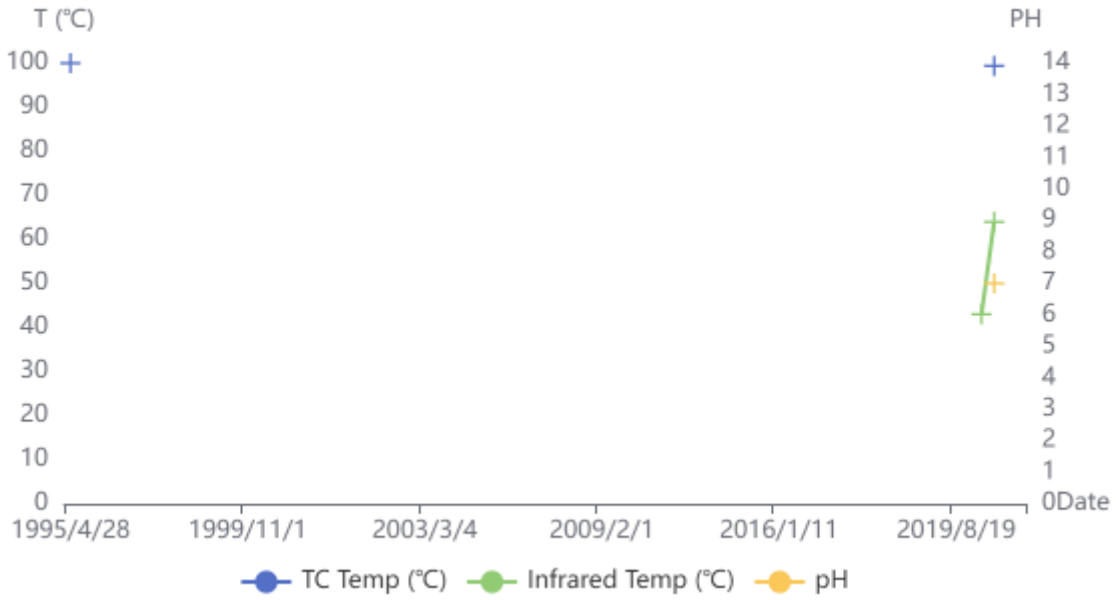


Fig.1 - taken on 2021-03-26 10:58:32"

Fig.2 - taken on 2022-05-13 14:48:24"

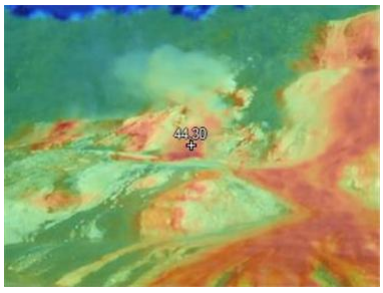
Fig.3 - taken on 2022-09-23 12:30:20"

Fig.4 - taken on 2022-09-23 12:30:32"

Fig.5 - taken on 2022-11-25 11:17:59"

Fig.6 - taken on 2023-02-27 13:59:52"

Infrared photos:



Sapphire geyser 13/05/2022

3.7 3065_11: Map of Africa

- The Map of Africa is no longer accessible due to the increased flow from Devils throat and the Manganese Pool.
- There is no longer algae growing on the surface of the Map of Africa.
- The temperature of the pool has fluctuated over the period. The lowest temperature was 24 °C in September 2022 and the highest was 39.3 °C in November 2022.
- Temperature is measured from the boardwalk with the Infrared gun.

Location: -38.473485, 176.147393

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour
2022/05/13			34.8			Clear	Green
Comments	Could not get close to pool						
2022/09/23			24.0	0.1		Clear	Brown - Dark
Comments	Could not get close to feature to measure pH and temperature due to increase flow from Devils throat						
2022/11/25			39.3	0.01		Clear	Brown - Light
Comments	Algal mats have disappeared from surface of pool.						
2023/02/27			36.0	0.3		Clear	Black
Comments	Water level has dropped.						

[Map of Africa]: Temperature and pH for entire record

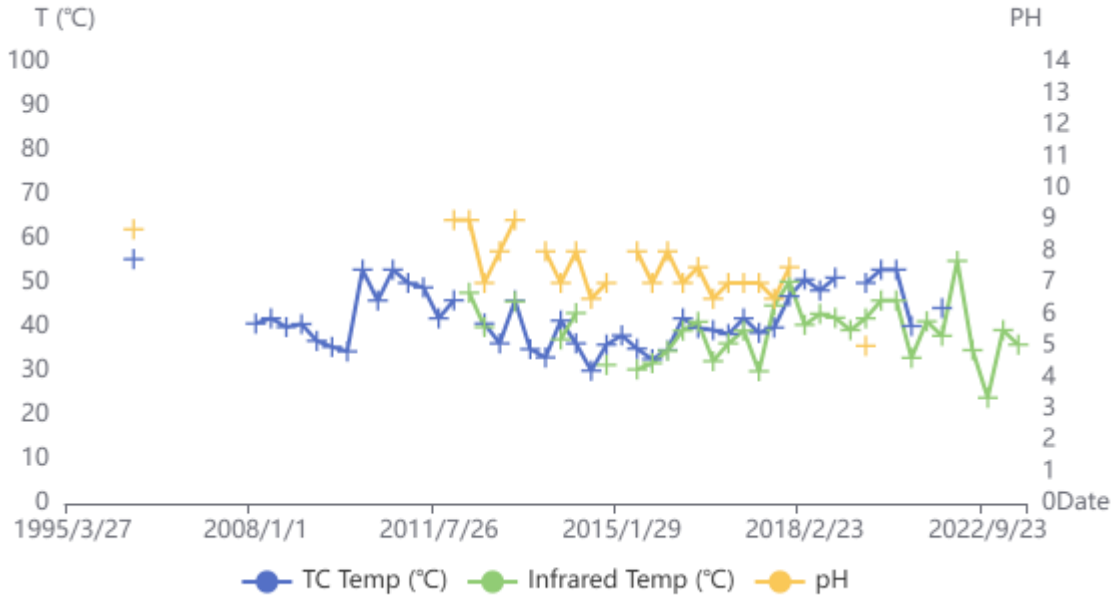


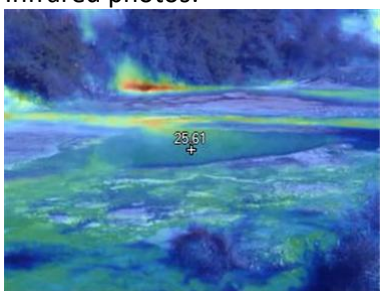
Fig.2 - taken on 2022-05-13 14:53:16"

Fig.3 - taken on 2022-09-23 12:43:04"

Fig.4 - taken on 2022-11-25 11:28:23"

Fig.5 - taken on 2023-02-27 14:08:41"

Infrared photos:



Map of Africa 13/05/2022

3.8 3065_29: Devil's Throat

- The small pool in front of Devil's throat is the feature that we monitor.
- Another small pool had opened up behind the feature in November 2022. The two features may be linked as the front pool is now calm with the features behind it bubbling vigorously.
- The temperature decreased slightly from 96.6 °C in September 2022 to 93.0 °C in November after the new feature opened. However, the temperature has since increased again to 97.5 °C in February 2023.
- The pH of the feature has alternated between pH 6 and pH 7 over the period from March 2021 to February 2023.

Location: -38.473101, 176.147616

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	7.0	81.3	76.0		>8.0	Clear	Colourless	Not visible sporadically audible
Comments	Not erupting. Flowing as 2 streams.							
2022/05/13	6.0	99.0	86.4		<0.5	Clear	Colourless	Constant bubbling
Comments								
2022/09/23	7.0	96.6	75.1		<0.5	Clear	Colourless	Calm
Comments	Water coming from terrace above Devils throat as well as from Fred and Maggie's pool.							
2022/11/25	6.0	93.0	86.5		<0.5	Clear	Colourless	Vigorous bubbling with water spitting 0.5 m from pool.
Comments	A hole has opened up above the feature and the ebullition has moved to that hole which it seems to be connected to.							
2023/02/27	7.0	97.5	88.8		<0.5	Clear	Colourless	Calm
Comments	Feature behind is vigorously bubbling.							

[Devil's Throat]: Temperature and pH for entire record

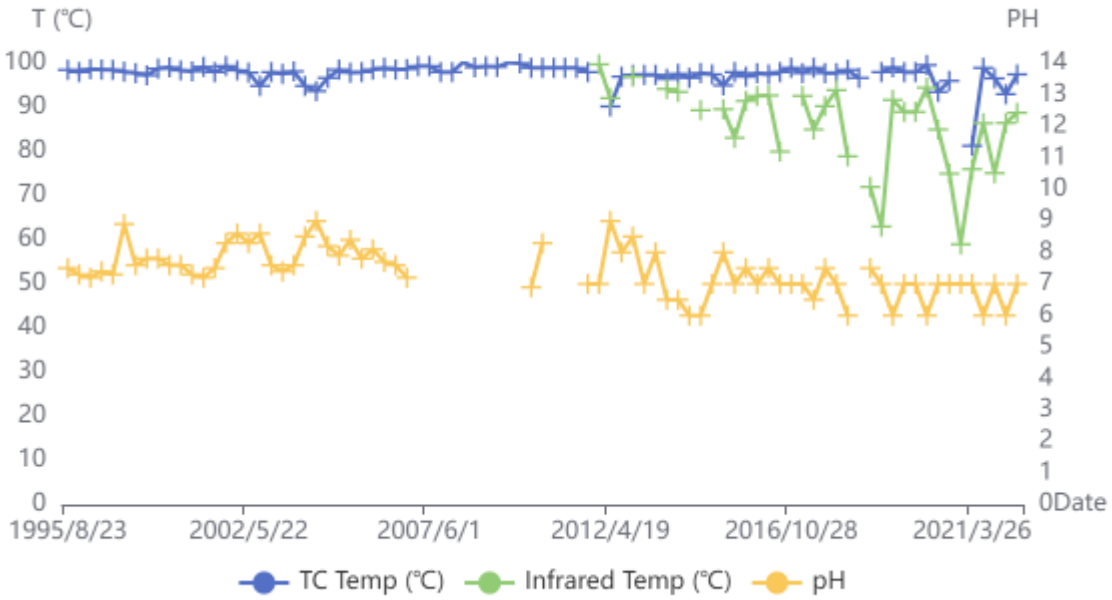


Fig.1 - taken on 2021-03-26 11:39:00"

Fig.2 - taken on 2022-05-13 15:02:28"

Fig.3 - taken on 2022-09-23 12:52:42"

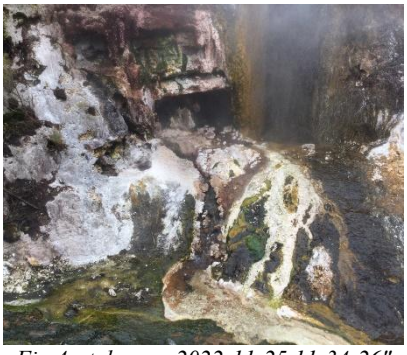
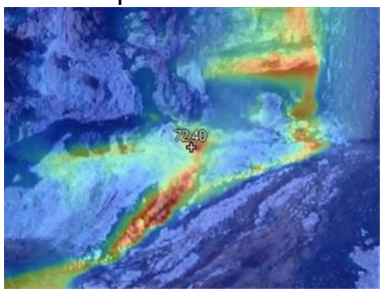


Fig.4 - taken on 2022-11-25 11:34:26"

Fig.5 - taken on 2022-11-25 11:41:17"

Fig.6 - taken on 2023-02-27 14:14:39"

Infrared photos:



Devils throat 13/05/2022

3.9 3065_30: Fred and Maggie's Pool

- The temperature of the pool has increased over the period from 91.2 °C in March 2021 to 98.4 °C in March 2023.
- There has been inflow from the terrace, mainly due to the increased activity of the Manganese Pool. The inflow ceased in November 2022, however it resumed in March 2023.

Location: -38.473221, 176.148183

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	7.0	91.2	76.0			Clear	Colourless	Constantly ebullient
Comments	Overflow of Wairiri geyser now flows into Fred and Maggie.							
2022/05/13	6.0	94.3	90.6		<0.5	Clear	Colourless	Constant boiling at outlet
Comments								
2022/09/23	6.0	98.6	79.0			Clear	Colourless	Constant boiling at outlet
Comments	Very steamy. Small seep into pool from terrace.							
2022/11/25	6.0	97.0	90.9	0.01	<0.5	Clear	Blue - Light	Constant boiling at outlet.
Comments	Two outlets. No inflow from scarp.							
2023/02/27	7.0	98.4	87.8		<0.5	Clear	Grey - Light	Vigorous boiling at outlet.
Comments	Some inflow from Manganese pool.							

[Fred & Maggie Pool]: Temperature and pH for entire record

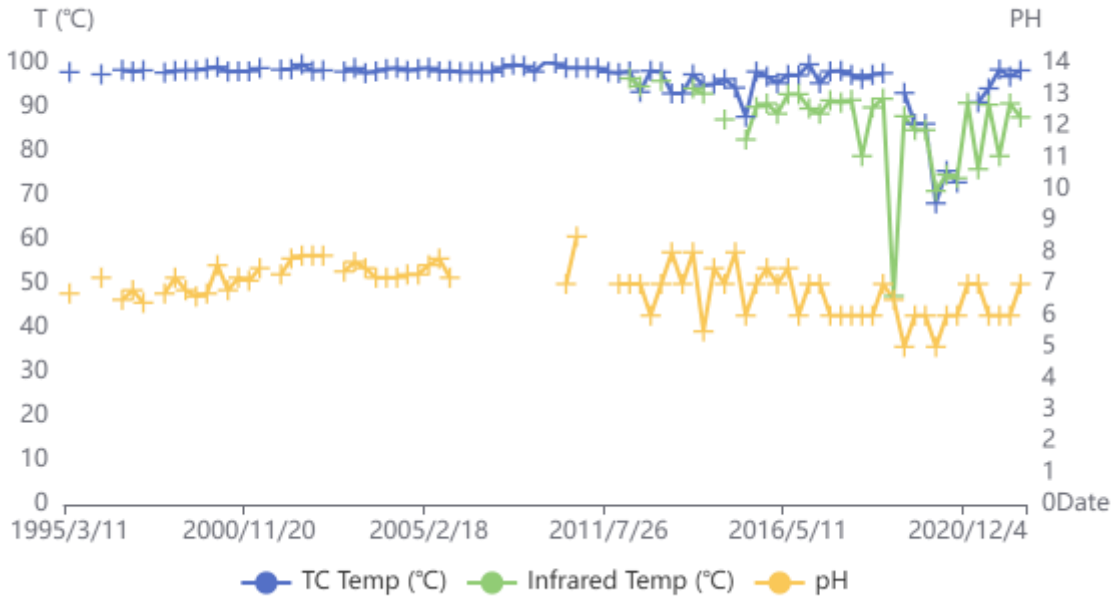


Fig.1 - taken on 2021-03-26 11:51:59"

Fig.2 - taken on 2022-05-13 15:11:00"

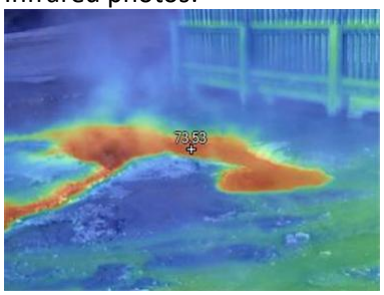
Fig.3 - taken on 2022-09-23 12:58:16"

Fig.4 - taken on 2022-11-25 11:47:01"

Fig.5 - taken on 2023-02-27 14:30:47"

Fig.6 - taken on 2023-02-27 14:31:23"

Infrared photos:



Fred and Maggie's Pool 13/05/2022

3.10 3065_31: Manganese Pool

- Activity in the Manganese Pool has increased. It is now overflowing, with the outflow flowing across the terrace. A portion of the increased water is flowing into Fred and Maggie's pool. The rest is flowing over the terrace and down into the lower terrace past the Devil's Throat. There is water running underneath the boardwalk near Devil's Throat and Map of Africa that is originating from Manganese Pool.
- The temperature of the pool was taken with Infrared in March 2021 and May 2022 as the pool could not be reached. The results from this show that the temperature increased by 36 °C in this period. Since then we have measured in the pool with a thermocouple. The temperature in September 2022 showed a reading of 92.3 °C. This has since increased to 99.0 °C.
- The ebullition has changed over the period, from being calm in March 2021 to eruptive boiling up to 1 m high.
- The pH has remained constant at pH 7. We have been unable to reach the pool to get the sample due to the increased flow, so the pH results are taken from the outflow.

Location: -38.473464, 176.148171

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26				57.0			Cloudy	Colourless	N/a
Comments	Spring reduced in size by ~1/3. All conophyton spires inactive. Overflow from Wairiri geyser enters Manganese, now diluted.								
2022/05/13	7.0			93.0		<1.0	Clear	Colourless	Constant vigorous upwelling in centre of pool up to 0.5 m. Surging.
Comments	Pool is overflowing and bubbling vigorously in cycles.								
2022/09/23	7.0	92.3		87.2		>2.0	Clear	Colourless	Constant vigorous eruption up to 0.5 m high
Comments	Sampled in the outflow as we could not access the pool due to overflowing water. Very active.								
2022/11/25	7.0	98.8		76.0		<1.0	Clear	Colourless	Vigorous eruptive boiling up to 1 m high.
Comments	Water from pool flowing under boardwalk. Rest of the scarp is quite dry.								
2023/02/27	7.0	99.0		88.8		<2.0	Clear	Colourless	Continuous erupting up to 1 m high
Comments	Very active.								

[Manganese Pool]: Temperature and pH for entire record

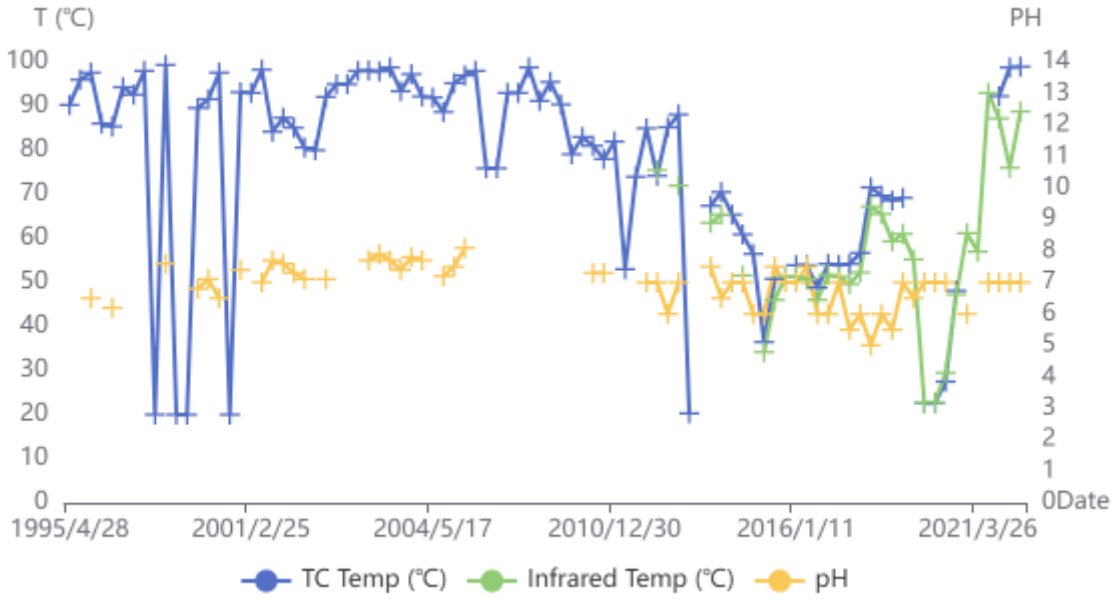


Fig.1 - taken on 2021-03-26 11:58:03"

Fig.2 - taken on 2021-03-26 11:58:20"

Fig.3 - taken on 2022-05-13 15:16:08"

Fig.4 - taken on 2022-05-13 15:16:52"

Fig.5 - taken on 2022-05-13 15:22:55"

Fig.6 - taken on 2022-09-23 13:17:43"

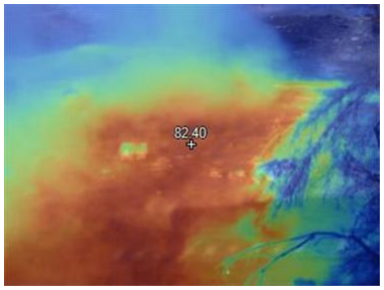
Fig.7 - taken on 2022-11-25 11:59:00"

Fig.8 - taken on 2022-11-25 11:59:13"

Fig.9 - taken on 2022-11-25 11:59:24"

Fig.10 - taken on 2023-02-27 14:35:47"

Infrared photos:



Manganese pool 13/05/2022

3.11 3065_178: South Pool by Boardwalk

- The colour and clarity of the pool has changed over the period from May 2022 to February 2023.
- The level of the pool has risen.
- The trees surrounding the pool had died when we visited in November 2022, enabling the pool to be viewed easily from the boardwalk.
- A new hole opened up next to the boardwalk about 5 m from the pool which is boiling.
- We were told that the pool had recently overflowed over the boardwalk when we visited in February 2023.

Location: -38.474375, 176.148474

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/05/13	6.0		73.3	1.0		Clear	Blue - Grey	Constant upwelling
Comments								
2022/09/23	6.0	75.3	67.2	0.5		Murky	Brown - Light	Constant bubbles all over pool.
Comments	Water level higher than usual.							
2022/11/25	5.0	77.0	67.0	0.5		Murky	Grey - Light	Small constant bubbles all over pool.
Comments	Trees have died around the pool, we can now see the pool from the boardwalk. Water level is higher than normal and colour and clarity have changed. There is a new hole 5 m above the pool that is boiling.							
2023/02/27	7.0	75.8	68.8	0.7		Cloudy	Grey - Light	Constant bubbling all over pool
Comments	Pool is grey, with what looks like grey mud on the sides. It recently overflowed over the boardwalk.							

[South Pool by Boardwalk]: Temperature and pH for entire record

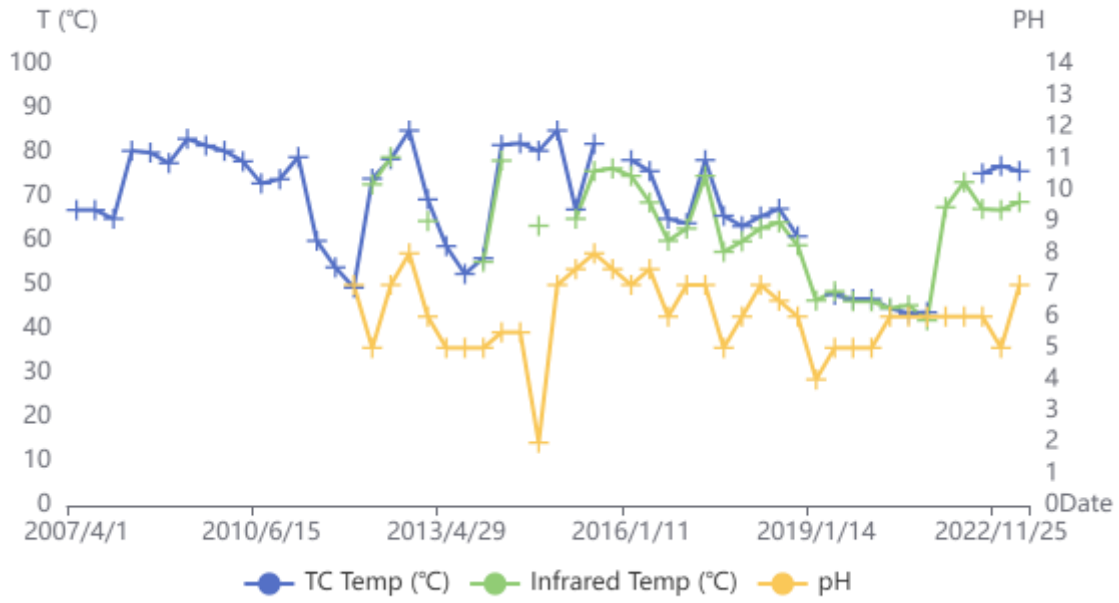


Fig.1 - taken on 2022-05-13 15:36:45"

Fig.2 - taken on 2022-05-13 15:38:08"

Fig.3 - taken on 2022-09-23 14:05:39"

Fig.4 - taken on 2022-11-25 12:08:29"

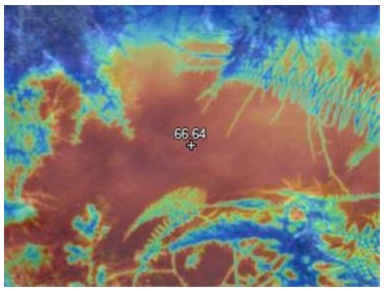
Fig.5 - taken on 2022-11-25 12:08:53"

Fig.6 - taken on 2022-11-25 12:08:59"

Fig.7 - taken on 2022-11-25 12:09:07"

Fig.8 - taken on 2023-02-27 14:53:24"

Infrared photos



South Pool 13/05/2022

3.12 3065_177: North Pool by Boardwalk

- The area is overgrown, it is therefore difficult to get the readings. We were unable to get the thermocouple readings in May 2022 and November 2022.
- The temperature decreased by 6.1 °C from September 2022 to February 2022.
- In May 2022 the level reference was the lower rim, which it was level with (approximately 2 m below ground level). In November 2022 the level had risen above the lower rim to 1 m below ground level. In February 2023 it had risen again and was at ground level.

Location: -38.474339, 176.148461

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/05/13	6.0			60.4	0		Clear	Grey - Light	Constant upwelling
Comments									
2022/09/23	7.0	67.3		67.2	1.0		Cloudy	Grey	Constant small bubbles in centre.
Comments	Water level higher than normal.								
2022/11/25	6.0			54.7	1.0		Murky	Grey - Light	Calm occasional bubbles.
Comments									
2023/02/27	6.0	61.2		40.0	0		Cloudy	Grey - Light	Continuous bubbling
Comments									

[North Pool by Boardwalk]: Temperature and pH for entire record

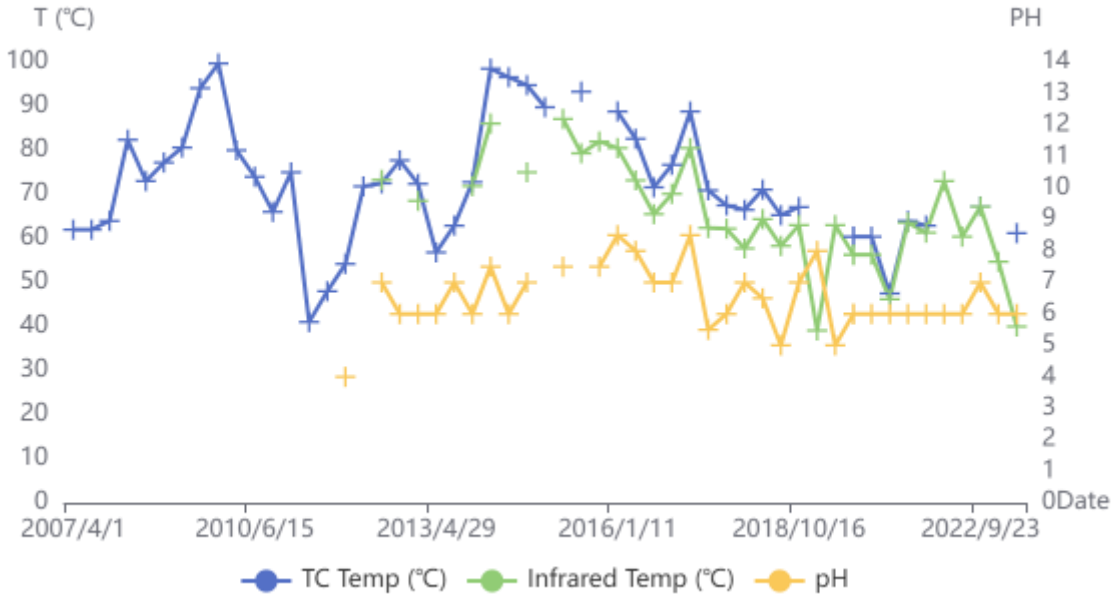


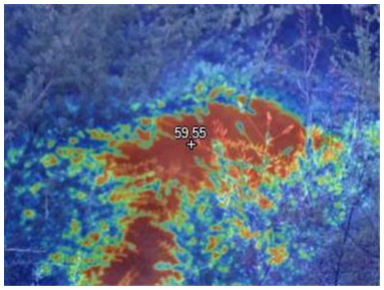
Fig.1 - taken on 2022-05-13 15:39:39"

Fig.2 - taken on 2022-09-23 13:33:54"

Fig.3 - taken on 2022-11-25 12:19:14"

Fig.4 - taken on 2023-02-27 14:59:55"

Infrared photos:



North Pool 13/05/2022

3.13 Artist's Palette

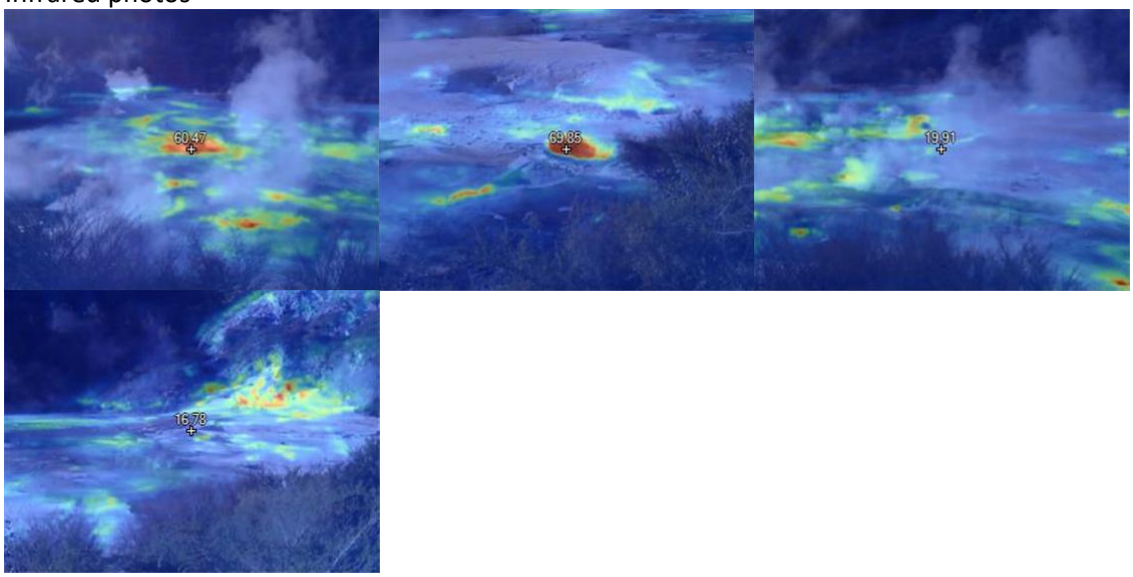
13 May 2022

23 September 2022

25 November 2022

27 February 2023

Infrared photos



Artist's palette 13/05/2022

3.14 3065_185: Ruatapu Cave main pool

- The temperature of the pool is taken using the Infrared gun from the platform.
- The temperature has fluctuated slightly over the period from March 2021 to February 2023 with the lowest reading in September 2022 of 34.6 °C and the highest in May 2022 of 37.0 °C.

Location: -38.475027, 176.149694

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition

Date	pH	TC (°C)	TempInfrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26			36.0				Grey	
Comments	Steam observed at far end of cave.							
2022/05/13			37.0			Clear	Blue	Calm
Comments								
2022/09/23			34.6			Clear	Blue - Green	Calm
Comments	Steam from vent on left side of cave.							
2022/11/25			36.6			Clear	Blue	Calm
Comments								
2023/02/27			35.1			Clear	Blue	Calm
Comments								

[Ruatapu Cave main pool]: Temperature and pH for entire record

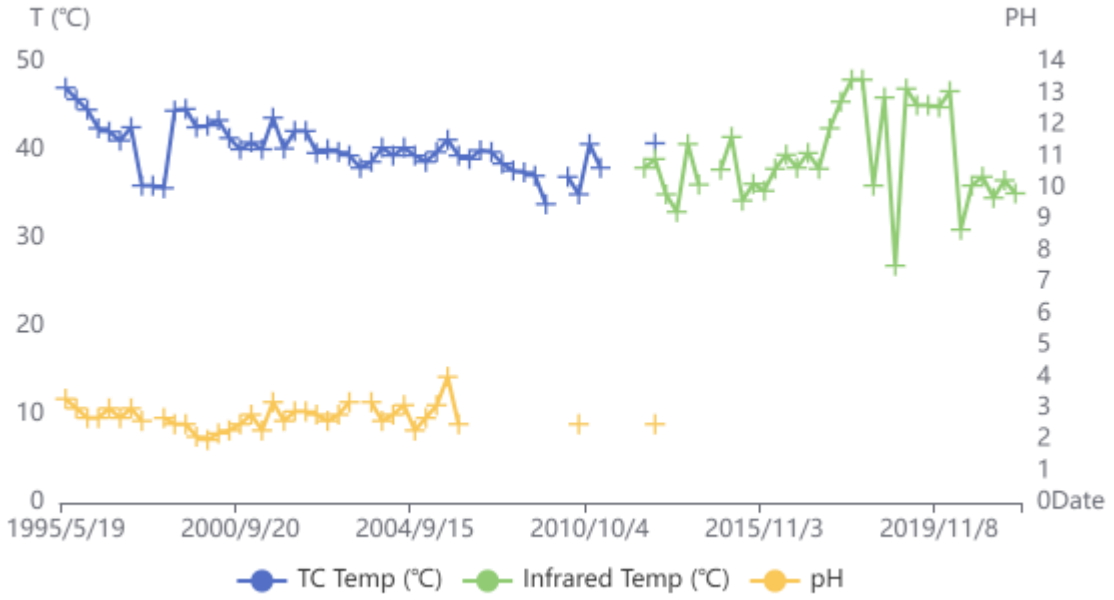


Fig.1 - taken on 2021-03-26 12:19:51"

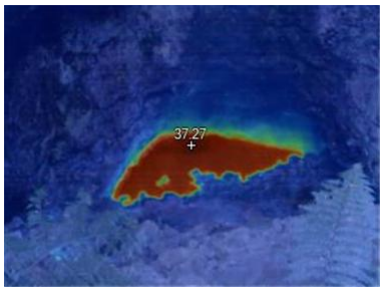
Fig.2 - taken on 2022-05-13 15:55:09"

Fig.3 - taken on 2022-09-23 13:59:44"

Fig.4 - taken on 2022-11-25 12:38:42"

Fig.5 - taken on 2023-02-27 15:18:00"

Infrared photos



Ruatapu Cave 13/05/2022

3.15 3065_22: Soda Fountain

- In March 2021 and May 2022, the Soda Fountain pool had emptied and had a small amount of water in it, however it has since refilled and remained filled for subsequent visits.
- Apart from when it was empty in March 2021 and May 2022, the pool has remained around boiling temperature.

Location: -38.473762, 176.147141

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26									Steaming
Comments	Currently empty. Steam up to 56 °C.								
2022/05/13	7.0	61.9		55.7	2.0		Clear	Colourless	Steaming
Comments	Pool empty. Inflow on right side of pool.								
2022/09/23	7.0	99.8		72.3		<0.5	Clear	Blue - Light	Constant vigorous boiling far side of pool up to 0.5 m high.
Comments									
2022/11/25	6.0	100.5		80.8		<0.5	Clear	Blue	Constant vigorous upwelling on far side of pool up to 0.5 m high.
Comments									
2023/02/27	7.0	98.5		69.9		<0.5	Clear	Blue - Light	Continuous vigorous boiling at back of pool
Comments									

[Soda Fountain]: Temperature and pH for entire record

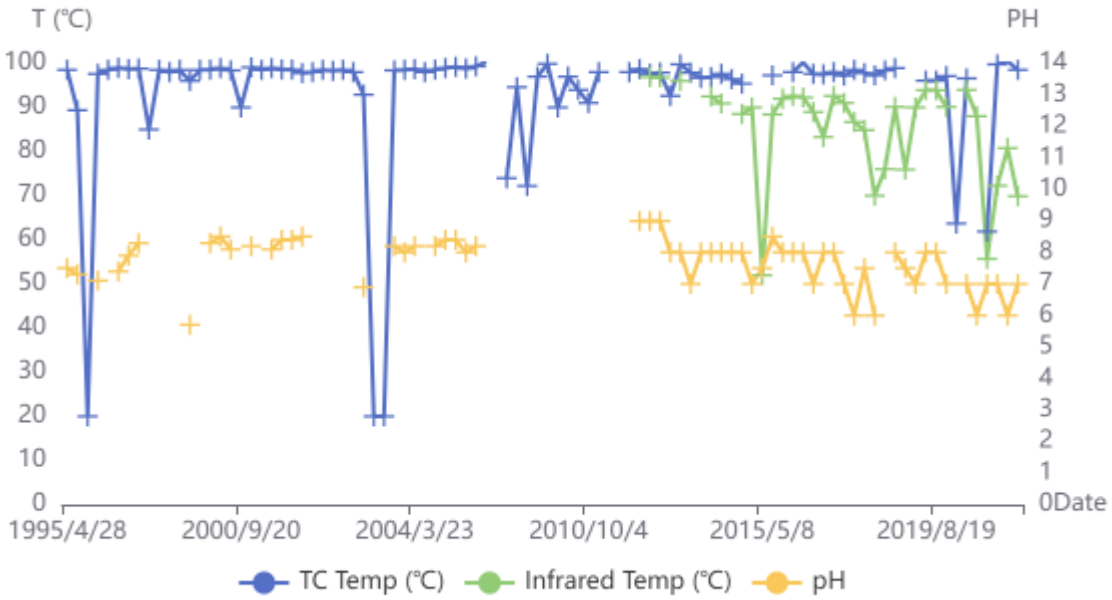


Fig.1 - taken on 2021-03-26 12:32:59"

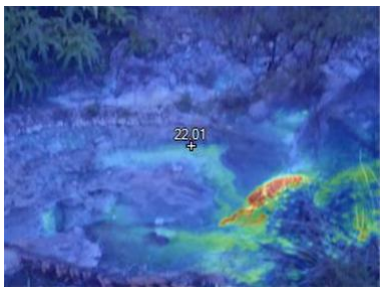
Fig.2 - taken on 2022-05-13 16:05:54"

Fig.3 - taken on 2022-09-23 14:12:42"

Fig.4 - taken on 2022-11-25 12:50:30"

Fig.5 - taken on 2023-02-27 15:30:28"

Infrared photos:



Soda fountain 13/05/2022

4 Reporoa

4.1 3066_1: Butcher's Pool

- Temperature has decreased slightly over the period from March 2021 to May 2022, with a decrease of 1.6 °C
- pH has dropped from pH 7 to pH 6.
- The level has dropped.
- The colour and clarity of the pool have changed.

Location: -38.453451, 176.34291

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	7.0	41.9	40.5	0.5		Clear	Colourless	Constant small bubbles effervescent
Comments	Water surface has scum and oily sheen							
2022/08/25	6.0	40.3	38.5	1.22		Cloudy	Blue - Grey	Yes
Comments								

[Butcher's Pool]: Temperature and pH for entire record

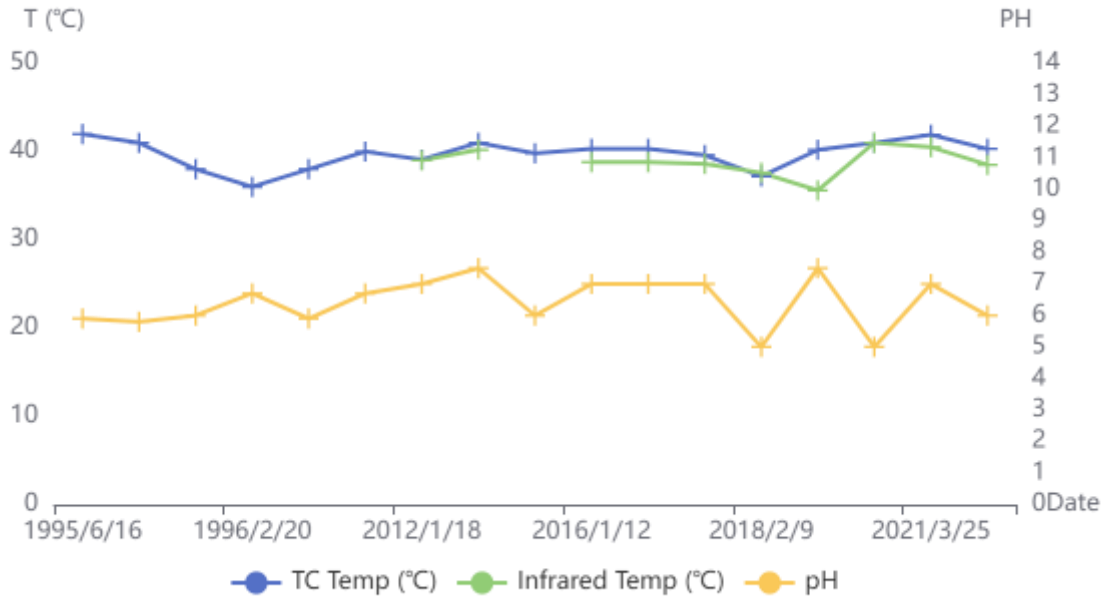


Fig.1 - taken on 2021-03-25 17:08:21"

Fig.2 - taken on 2021-03-25 17:08:25"

Fig.3 - taken on 2022-08-25 13:18:21"

4.2 3066_24: Wharepapa Rd: Fumarole 1

- The temperature has decreased by 41 °C over the period from February 2020 to December 2022.
- The temperature reading was taken using the infrared gun. Due to the grass growing over the fumarole it was difficult to get an accurate reading.

Location: -38.416027, 176.330671

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2020/02/26				75.0					Steaming
Comments	Ground collapsing in vent.								
2022/12/05		53.1		34.0	1.0		Muddy	Brown - Dark	Constant audible bubbling
Comments	Could not get pH as it was mud.								

[Wharepapa Rd: Fumaroles]: Temperature and pH for entire record

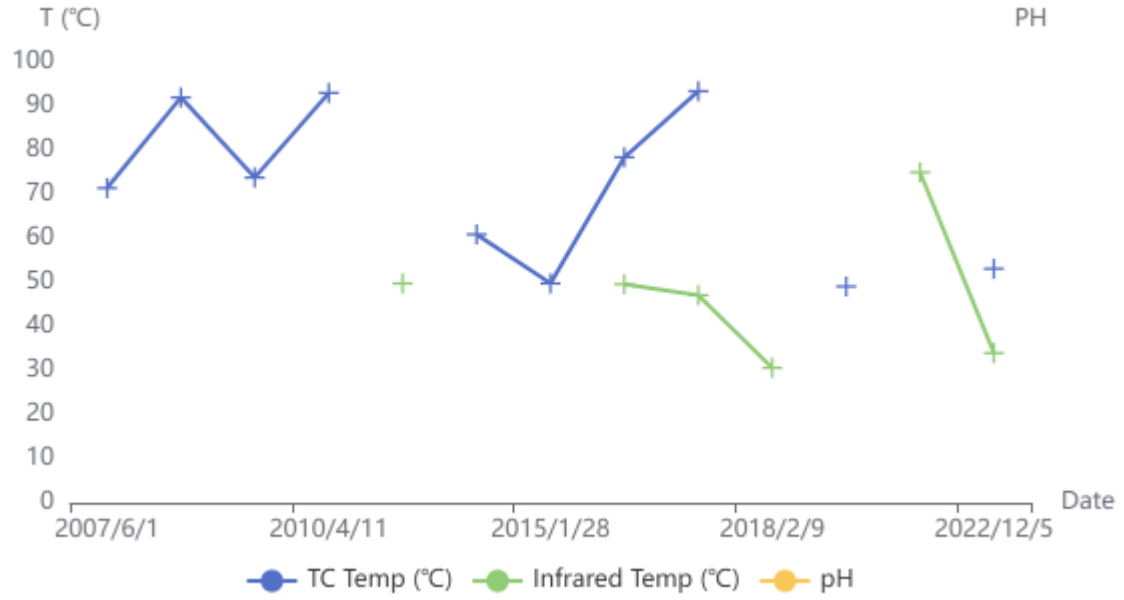


Fig.1 - taken on 2020-02-26 13:32:56"

Fig.2 - taken on 2020-02-26 13:33:03"

Fig.3 - taken on 2020-02-26 13:33:25"

Fig.4 - taken on 2022-12-05 11:24:59"

Fig.5 - taken on 2022-12-05 11:25:04"

Fig.6 - taken on 2022-12-05 11:25:10"

4.3 3066_29: Wharepapa Rd: Fumarole 3

- The infrared gun is showing a decrease in temperature of 13.7 °C over the period from February 2020 to December 2022. However, the Thermocouple is showing a temperature of 73.5 °C in December 2022 (we could not test with the thermocouple in February 2020). The infrared gun can be difficult to use on underground fumaroles.

Location: -38.415931, 176.330553

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2020/02/26				69.0					Steaming
Comments									
2022/12/05		73.5		55.3	1.0		Muddy	Brown - Dark	Constant audible bubbling
Comments	There is a fence around the fumaroles.								

[Wharepapa Rd: Fumarole 3]: Temperature and pH for entire record

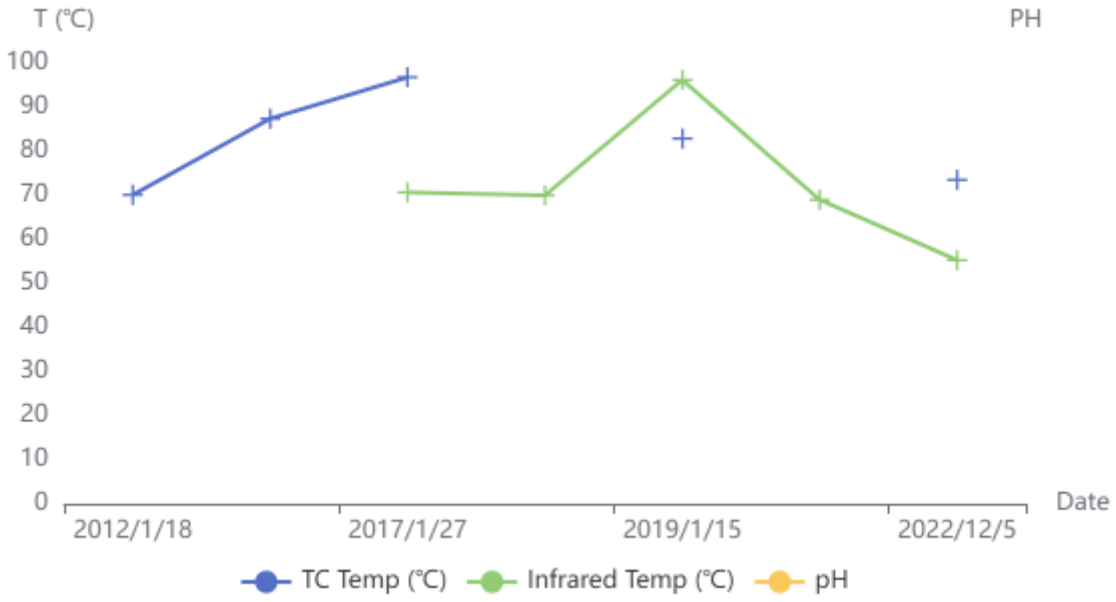


Fig.1 - taken on 2020-02-26 13:36:22"

Fig.2 - taken on 2022-12-05 11:29:16"

4.4 3066_30: Wharepapa Rd: Fumarole 4

- The temperature in the fumarole has decreased by 3.6 °C over the period from February 2020 to December 2022 (using the infrared gun).
- The thermocouple reading is most likely not accurate as it may not have reached the water due to the angle of the fumarole.

Location: -38.415904, 176.330563

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2020/02/26				57.0					Audible bubbling and steaming
Comments	New fence around fumaroles. Ground collapsing into it.								
2022/12/05		38.1		53.4	1.6		Muddy	Brown - Dark	Constant audible bubbling
Comments									

[Wharepapa Rd: Fumarole 4]: Temperature and pH for entire record

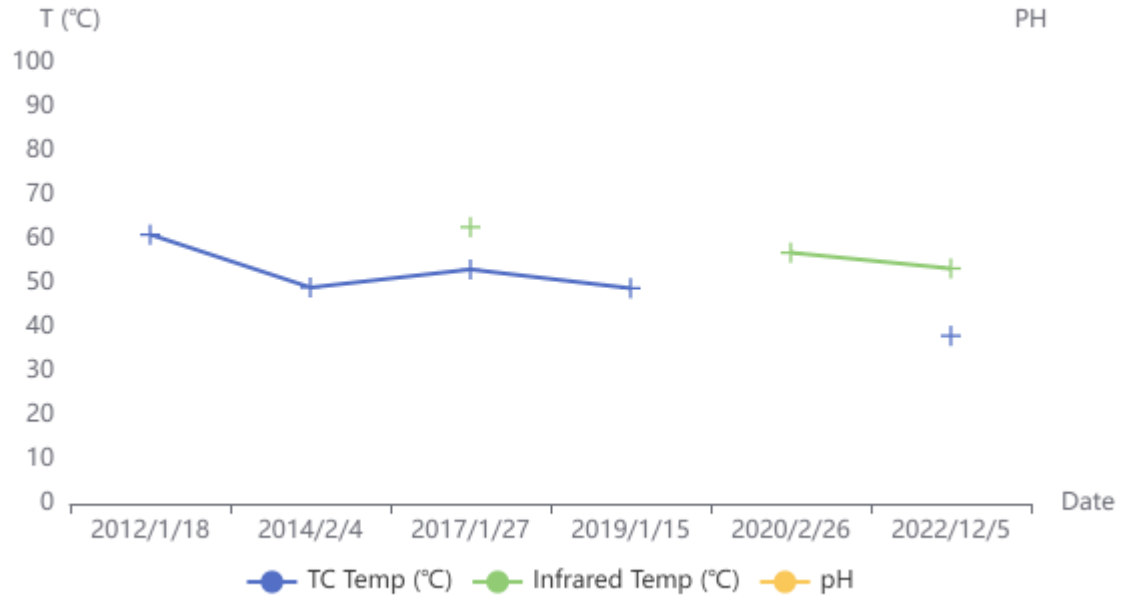


Fig.1 - taken on 2020-02-26 13:39:27"

Fig.2 - taken on 2022-12-05 11:33:14"

4.5 3066_9: Hot Pool 3 at Reporoa

- The temperature and pH of the pool have remained consistent over the period from March 2021 to December 2022.

Location: -38.415908, 176.331342

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	7.0	93.2		87.1	0.5		Clear	Blue	Constant ebullience near point of outflow
Comments	Oily sheen on water surface around pool margins								
2022/12/05	7.0	93.3		73.4		<6.0	Clear	Blue - Dark	Constant upwelling 2 m left of outlet.
Comments	The ground in the paddock at the end of the pool is muddy, possible seepage from the pool.								

[Hot Pool 3 at Reporoa]: Temperature and pH for entire record

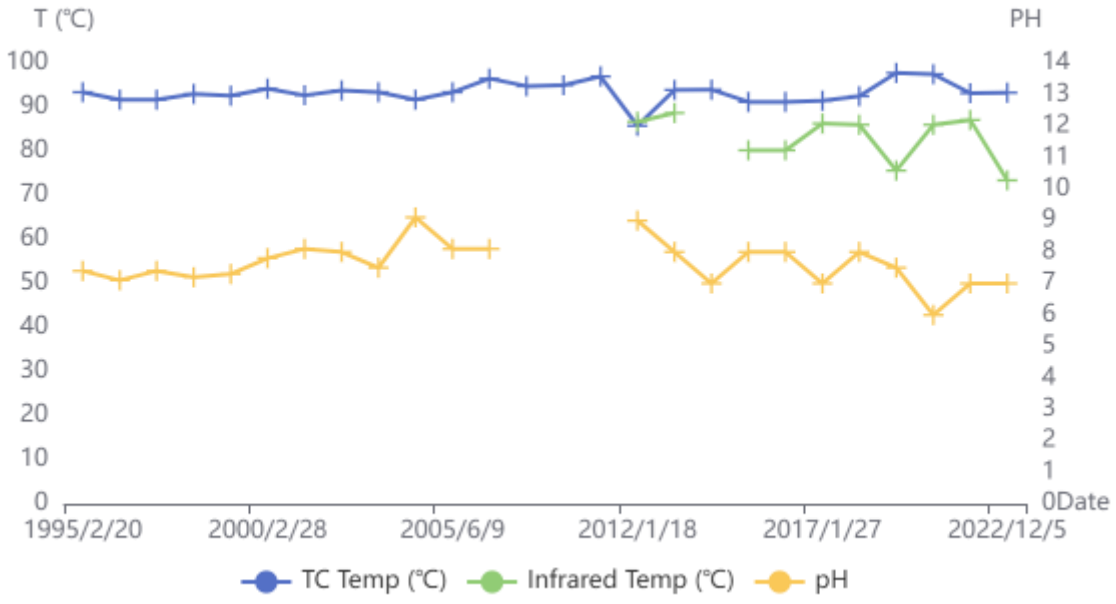


Fig.1 - taken on 2021-03-25 13:30:42"

Fig.2 - taken on 2021-03-25 13:34:22"

Fig.3 - taken on 2022-12-05 10:47:45"

Fig.4 - taken on 2022-12-05 10:48:40"

Fig.5 - taken on 2022-12-05 10:49:08"

4.6 3066_8: Figure 8 shaped hot pool – large pool

- The temperature of the pool has decreased by 6.1 °C since the previous visit in March 2021.
- In the weeks prior to the visit in December 2022, there had been high rainfall.
- There was inflow from the paddock which may have contributed to the lower temperature.

Location: -38.415366, 176.330458

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	7.0	92.4	82.1			Clear	Colourless	Constant low ebullience
Comments	All nearby fumaroles covered with soil.							
2022/12/05	7.0	86.3	80.2	0.01		Clear	Colourless	Constant upwelling
Comments	Water level is high, most likely from high rainfall the past few weeks. There is inflow from the paddock.							

[Figure 8 shaped hot pool]: Temperature and pH for entire record

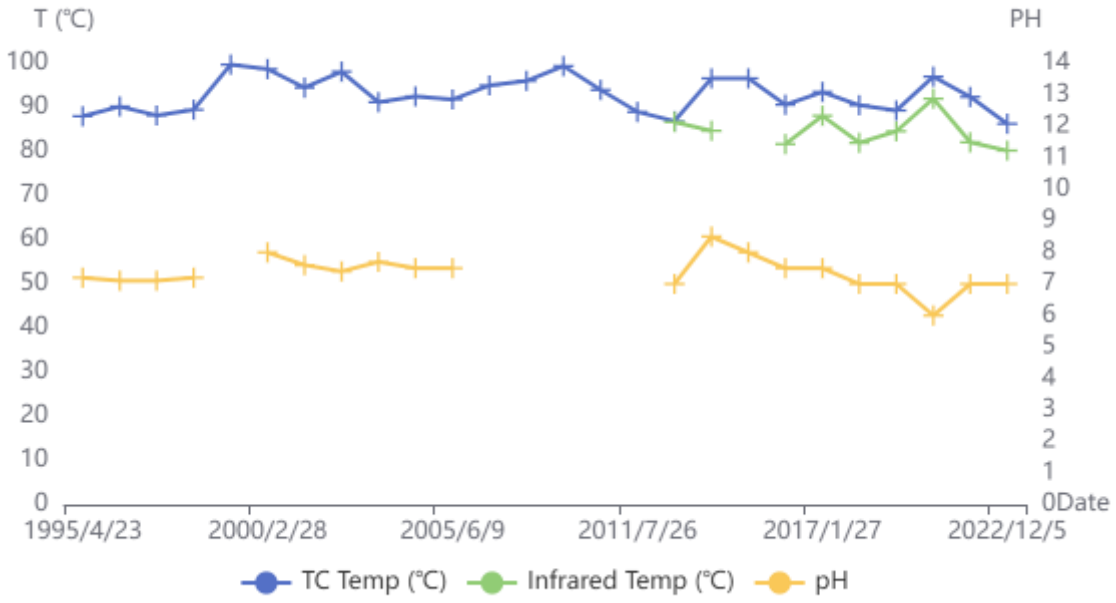


Fig.1 - taken on 2021-03-25 13:19:40"

Fig.2 - taken on 2022-12-05 11:08:21"

4.7 3066_27: Figure 8 shaped hot pool – small pool

- The temperature has decreased by 8.4 °C since the previous visit in February 2020.
- The pH has increased from pH 5 to pH 7 over the period.
- The change in pH and temperature may be due to the recent rainfall and due to the large pool overflowing into the small pool.

Location: -38.415341, 176.330388

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2020/02/26	5.0	93.0	89.0	0.5		Clear	Colourless	Occasional bubbles
Comments								
2022/12/06	7.0	84.6	76.0	0.01		Clear	Colourless	Calm steaming
Comments	Water is flowing into the pool from the large Figure 8 pool.							

[Figure 8 shaped hot pool -small pool]: Temperature and pH for entire record

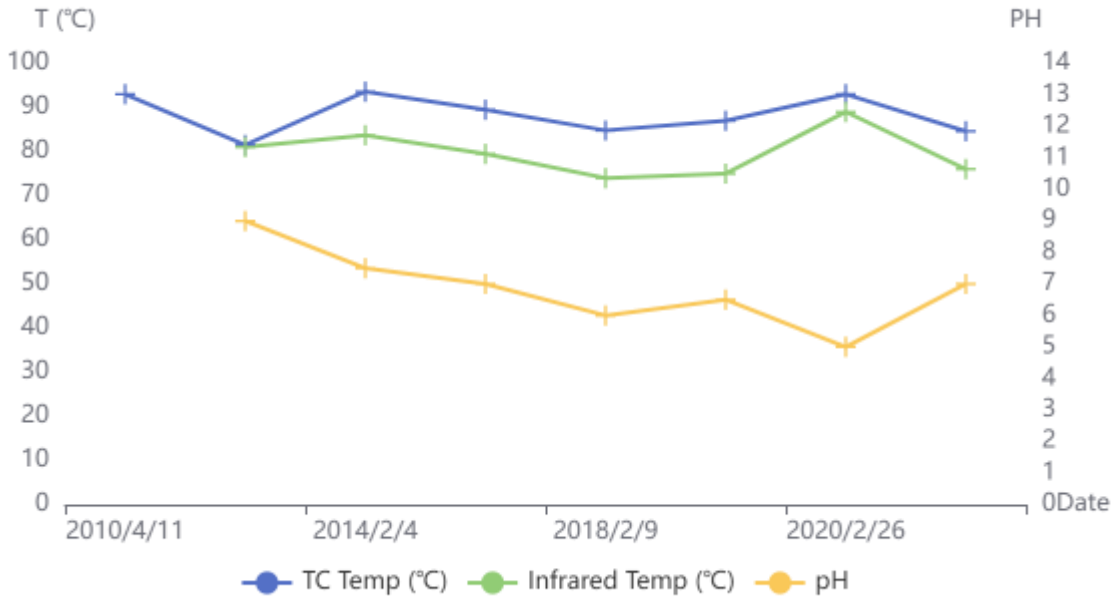


Fig.1 - taken on 2020-02-26 13:46:24"

Fig.2 - taken on 2020-02-26 13:46:35"

Fig.3 - taken on 2022-12-05 11:02:22"

4.8 3066_26: Longview Road Mud Pools

- The temperature of the pool is 6.7 °C lower than it was on the previous visit in 2020.
- We could not access the lake due to the overflowing mud pools.

Location: -38.413257, 176.361379

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2020/02/26		27.4		28.0	0.5		Muddy	Brown	Constant discharge all over.
Comments	Lots of new holes opened up, sulphur deposits around some vents. Ground too soft to walk around to get to pool. Could not get close to get pH.								
2022/10/17	3.0	20.7		20.8			Murky	Brown - Light	Constant small bubbles all over pool. Can see it coming through holes in the mud.
Comments	Pool has a large amount of water. Cannot access the lake.								

[Longview Road Mud Pools]: Temperature and pH for entire record

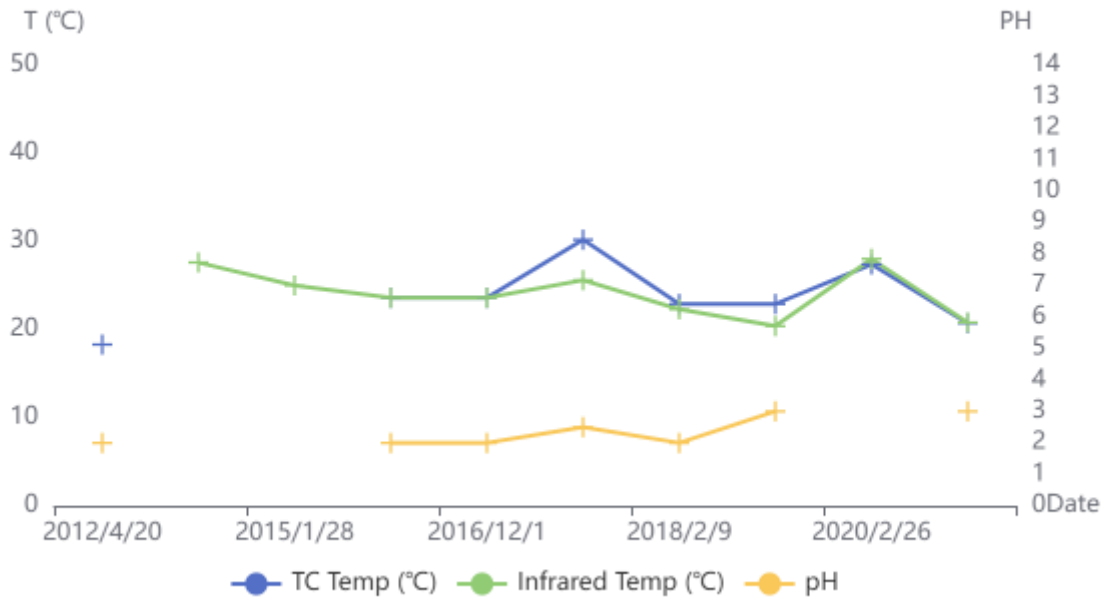


Fig.1 - taken on 2020-02-26 14:51:15"

Fig.2 - taken on 2020-02-26 14:51:21"

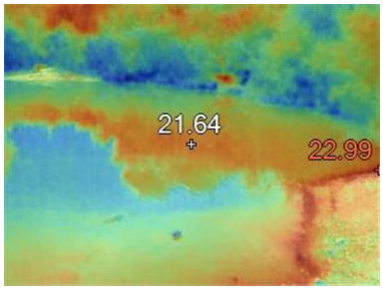
Fig.3 - taken on 2020-02-26 14:51:26"

Fig.4 - taken on 2022-10-17 11:26:33"

Fig.5 - taken on 2022-10-17 11:26:39"

Fig.6 - taken on 2022-10-17 11:26:55"

Infrared photos:



Longview road mud pools 05/10/2022

4.9 3066_11: Golden Springs Motel; North Pool

- The temperature of the pool has decreased by 6.1 °C.
- The flow has reduced significantly.
- The colour and clarity of the pool has changed.
- According to the residents in the Motel, there are blockages upstream which is causing the reduction in flow.

Location: -38.46875, 176.30955

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	7.0	39.4		37.6		<20.0	Cloudy	Grey - Light	N/a
Comments									
2022/10/12	7.0	33.3		32.3	0.6	<2.0	Murky	Brown	Calm
Comments	According to residents, upstream is blocked up with sticks causing limited flow downstream.								

[Golden Springs Motel; North Pool]: Temperature and pH for entire record

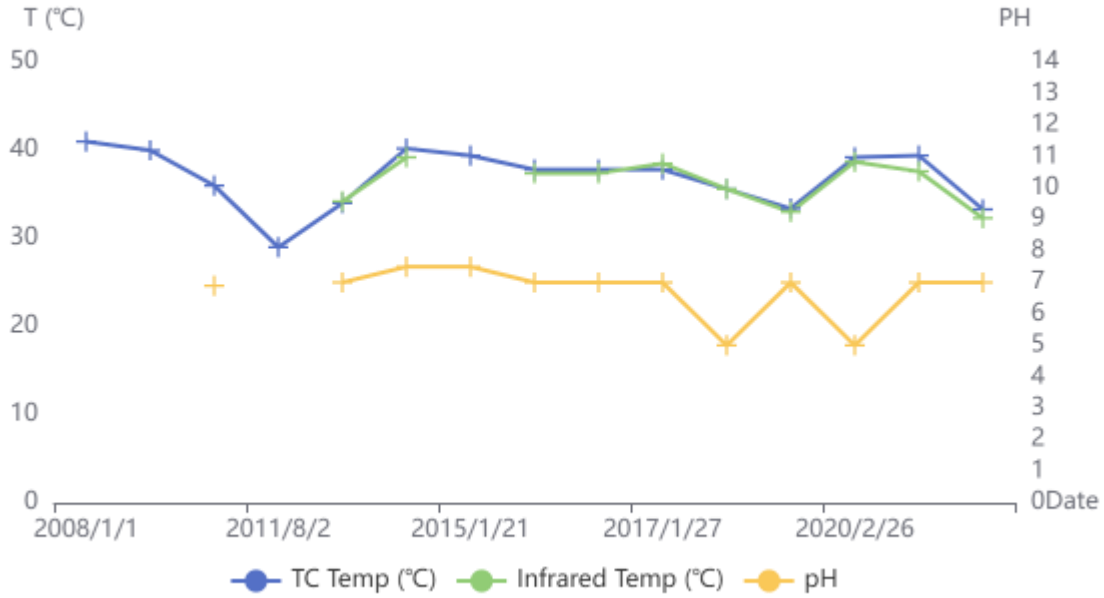
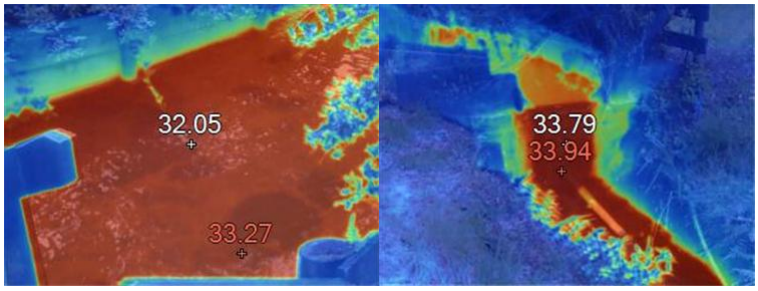


Fig.1 - taken on 2022-10-12 12:22:49"

Fig.2 - taken on 2022-10-12 12:23:23"

Fig.3 - taken on 2022-10-12 12:23:39"



North Pool 05/10/2022

4.10 3066_12: Golden Springs Motel; South Pool

- The pH of the pool has decreased from pH7 to pH6.
- The temperature of the pool has decreased by 10 °C.
- The colour and clarity of the pool has changed.
- The flow was not visible, however there was water downstream of the pool.
- The pool is in disrepair and appears to be blocked up downstream by vegetation.
- According to the residents in the Motel, there are blockages upstream of the Motel which is causing the reduction in flow.

Location: -38.470031, 176.308852

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	7.0	37.5		36.5		<5.0	Cloudy	Grey	N/a
Comments									
2022/10/12	6.0	27.5		27.8	0.6		Murky	Brown	Calm
Comments	Pool is in disrepair, downstream looks blocked up.								

[Golden Springs Motel; South Pool]: Temperature and pH for entire record

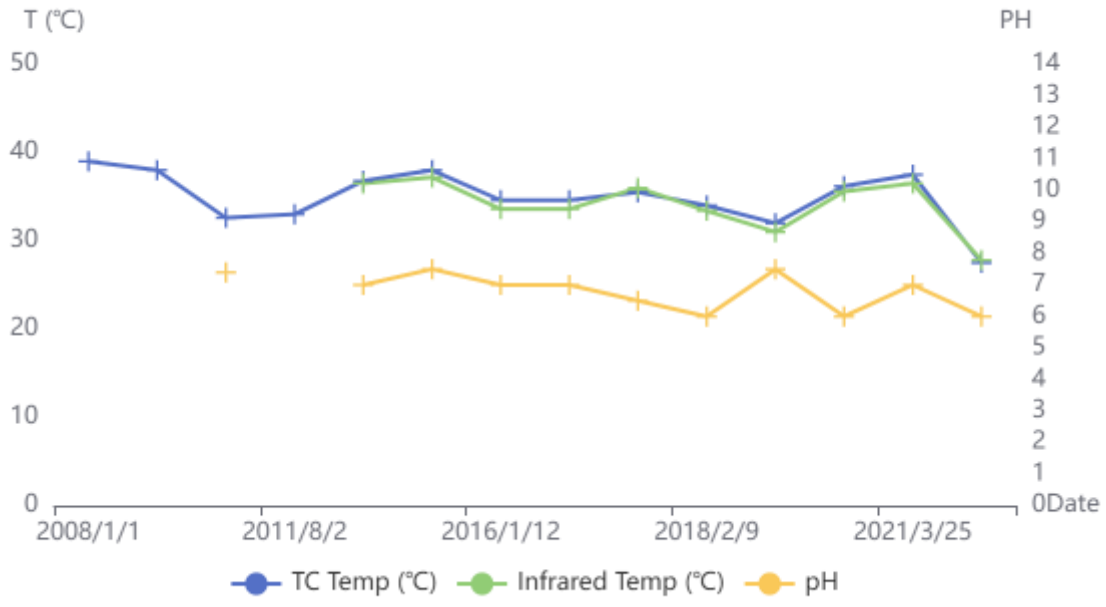


Fig.1 - taken on 2022-10-12 12:09:59"

Fig.2 - taken on 2022-10-12 12:10:26"

4.11 3066_13: No 3 across Golden Springs Motel

- The pool has decreased by 0.9 °C over the period from March 2021 to October 2022.
- Some of the willows around the pool have been removed.
- There are algal mats covering a large area of the pool.

Location: -38.465192, 176.310522

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	7.0	42.9		40.0			Cloudy	Green - Murky	Constant
Comments	Surface covered in organic debris.								
2022/10/12	7.0	41.8		40.2	0.2		Murky	Green - Murky	Constant Effervescing in centre of pool.
Comments	Some of the willows have been removed. Pool appears lower than usual. Could not tell how much flow there was.								

[No 3 across Golden Spring Hotel]: Temperature and pH for entire record

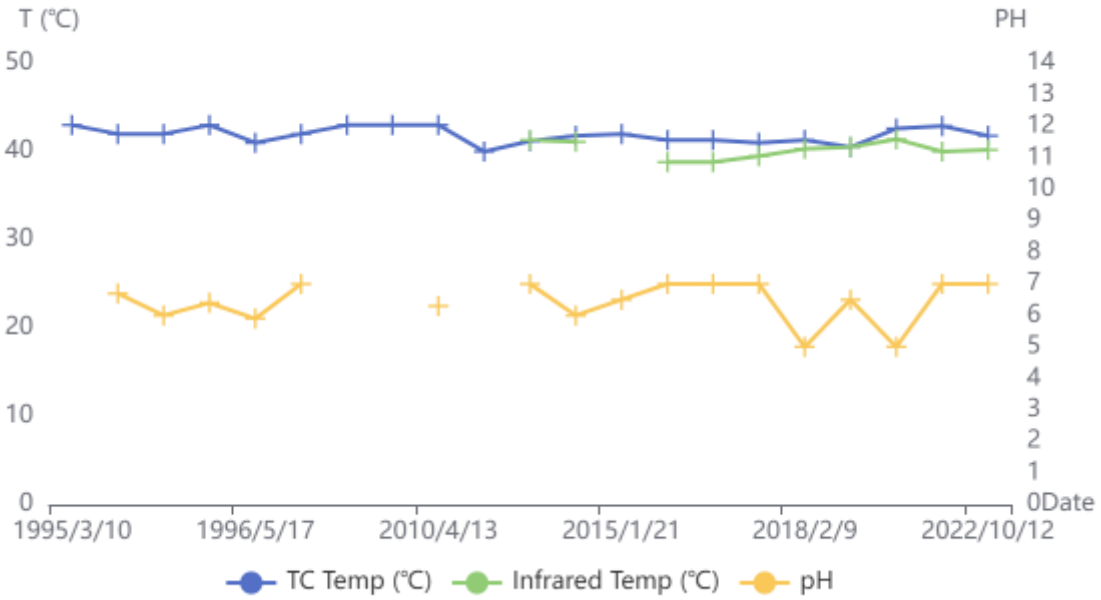


Fig.1 - taken on 2021-03-25 16:41:12"

Fig.2 - taken on 2022-10-12 12:37:30"

Fig.3 - taken on 2022-10-12 12:42:29"

4.12 3066_14: No 4 across the Golden Springs Motel

- The temperature of the pool has increased by 5.3 °C over the period from March 2021 to October 2022.
- Most of the pool is covered in algal mats.
- Trees have fallen into the pool.

Location: -38.464388, 176.310267

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	7.0	44.0		46.7			Cloudy	Grey	N/a
Comments	Algae covered on the surface								
2022/10/12	7.0	49.3		48.4			Clear	Colourless	Calm
Comments	Pool mostly covered in algal mats. Could not tell what flow was. Some trees have fallen into the pool.								

[No 4 across the Golden Springs Hotel]: Temperature and pH for entire record

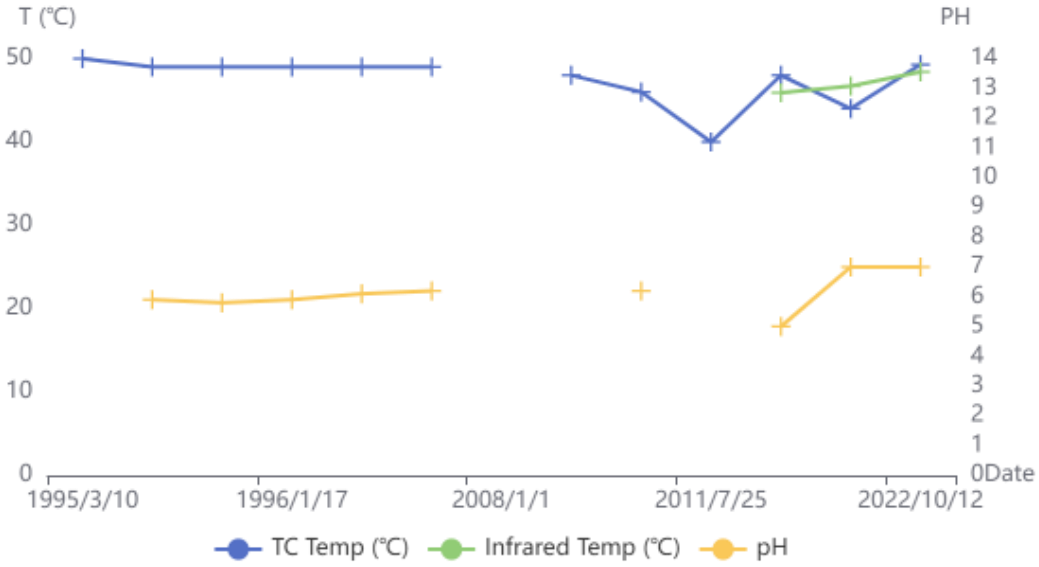
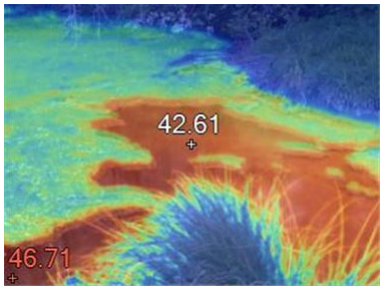


Fig.1 - taken on 2021-03-25 16:49:29"

Fig.2 - taken on 2022-10-12 12:49:55"

Fig.3 - taken on 2022-10-12 12:56:38"

Infrared photos:



Feature 4 05/10/2022

5 Rotokawa

5.1 3067_3: RKF3

- The temperature has decreased from 55.8 °C to 28.4 °C from May 2021 to October 2022.
- pH has decreased from pH4 to pH3.

Location: -38.62713, 176.190395

Date	pH	TC (°C)	TempInfrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/04/30	4.0	55.8	39.6	0.3		Milky	Blue - Light	None
Comments								
2022/10/12	3.0	28.4	27.0	0.2		Cloudy	Green - Light	Constant bubbling in centre of pool
Comments								

[RKF3]: Temperature and pH for entire record

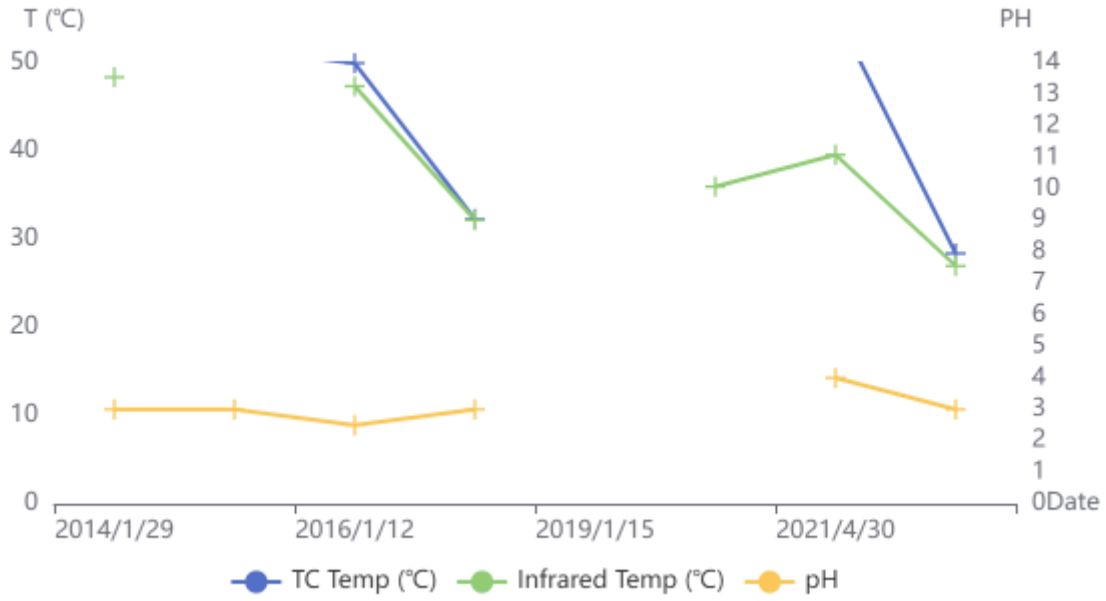


Fig.1 - taken on 2021-04-30 10:03:44"

Fig.2 - taken on 2021-04-30 10:03:48"

Fig.3 - taken on 2022-10-12 10:15:4

6 Tauhara

6.1 3068_101: Otumuheke u/s confluence Kathleen Stream

- The temperature of the pool has decreased by 4.9 °C since the March 2021 visit. The lowest temperature of 40.3 °C was recorded in August 2022. It has since risen slightly to 42.0 °C.
- The pH has fluctuated over the period, with the recording of pH5 in November 2022 and the highest of pH7 in March 2021.
- In June 2022 we noticed that there was dirt built up between the confluence of the streams which appeared to be man-made. There has since been rocks and plastic bags placed in between the streams.

Location: -38.671515, 176.091562

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	7.0	46.9	41.8		<5.0	Clear	Colourless	N/a
Comments								
2022/06/27	6.0	40.9	39.0		<10.0	Clear	Colourless	nd
Comments	Dirt built up between streams							
2022/08/25	6.0	40.3	39.2	0.1		Muddy	Brown - Light	None
Comments								
2022/11/25	5.0	41.0	40.0		<20.0	Clear	Colourless	nd
Comments	There are now rocks between the streams.							
2023/02/24	6.0	42.0	40.2		<15.0	Clear	Colourless	nd
Comments	Yellow and green algae on stream bed. Rocks and plastic bags between the streams to alter flow.							

[Otumuheke u/s confluence Kathleen Stream]: Temperature and pH for entire record

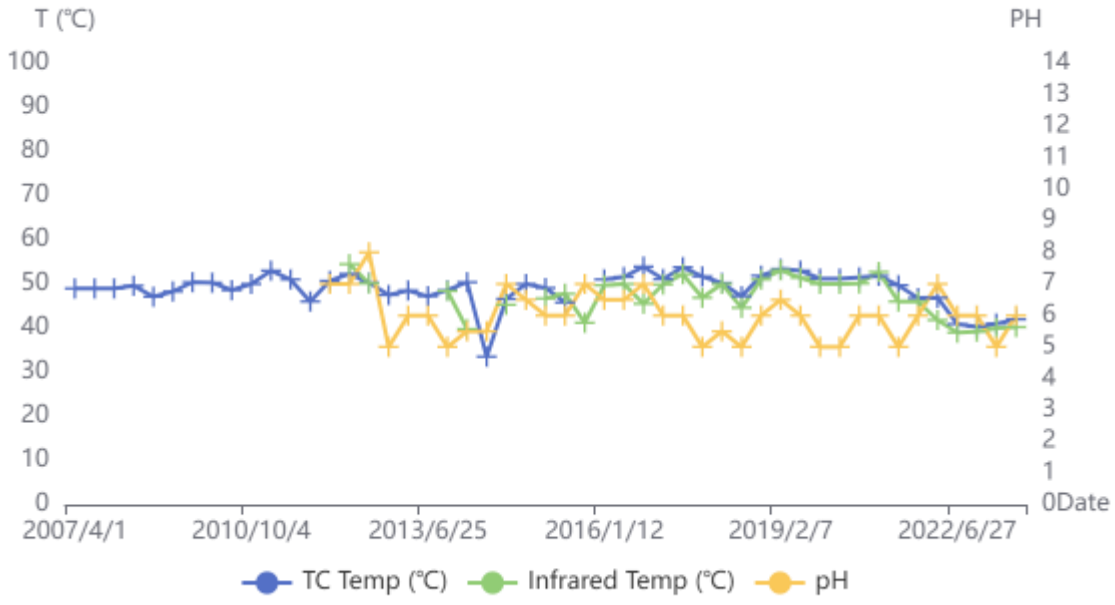


Fig.1 - taken on 2021-03-25 18:38:27"

Fig.2 - taken on 2022-06-27 14:48:09"

Fig.3 - taken on 2022-06-27 14:48:16

Fig.4 - taken on 2022-08-25 12:12:03"

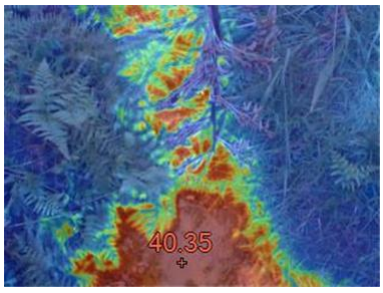
Fig.5 - taken on 2022-11-25 14:05:02"

Fig.6 - taken on 2022-11-25 14:05:22

Fig.7 - taken on 2022-11-25 14:06:49"

Fig.8 - taken on 2023-02-24 14:50:56"

Fig.9 - taken on 2023-02-24 14:51:02



Otumuheke Stream u/s confluence Kathleen Stream 04/05/2023

6.2 3068_119: Kathleen Stream u/s confluence Otumuheke

- The temperature of the Kathleen Stream has fluctuated over the period from March 2021 to February 2023. The temperature had a large decrease from 51.2 °C to 33.2 °C in June 2022. The temperature has since risen again to 44.7 °C in February 2023.
- The pH has fluctuated between pH7 and pH6 over the period.

- In June 2022 we noticed that there was dirt built up between the confluence of the streams which appeared to be man-made. There has since been rocks and plastic bags placed in between the streams.

Location: -38.671534, 176.091551

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	7.0	51.2		46.0			Clear	Colourless	N/a
Comments									
2022/06/27	6.0	33.2		30.4		<5.0	Clear	Colourless	nd
Comments	Dirt has been built up between the streams to separate them.								
2022/08/25	7.0	36.0		35.3	0.1		Clear	Colourless	None
Comments									
2022/11/25	6.0	41.3		41.1		<5.0	Clear	Colourless	nd
Comments	Some bright green algae on stream bed.								
2023/02/24	6.0	44.7		39.7		<5.0	Clear	Colourless	nd
Comments	Rocks and plastic bags in river used to change flow. Yellow and green algae on stream bed.								

[Kathleen Stream u/s confluence Otumuheke]: Temperature and pH for entire record

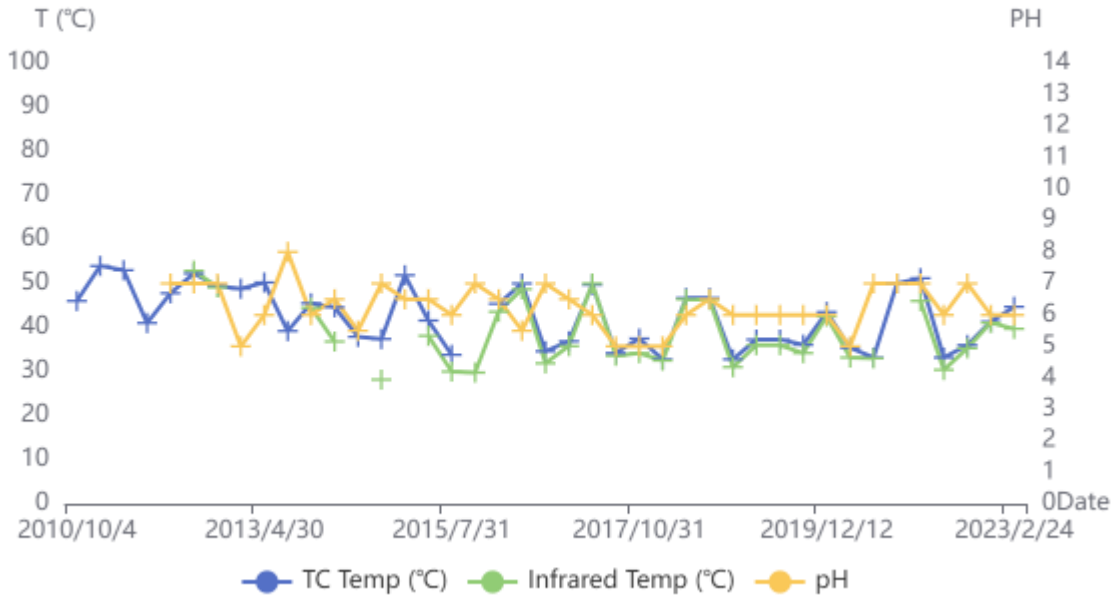


Fig.1 - taken on 2021-03-25 18:35:12"

Fig.2 - taken on 2022-06-27 14:41:00"

Fig.3 - taken on 2022-06-27 14:41:14"

Fig.4 - taken on 2022-08-25 12:06:42"

Fig.5 - taken on 2022-11-25 14:09:02"

Fig.6 - taken on 2022-11-25 14:09:12"

Fig.7 - taken on 2023-02-24 14:47:37"

Fig.8 - taken on 2023-02-24 14:47:50"

Fig.9 - taken on 2023-02-24 14:48:47"

6.3 3068_85: Otumuheke end of Ponga Fence

- The temperature of the feature has decreased over the period, with a temperature of 48.7 °C recorded in March 2021 and a temperature of 44.8 °C in February 2023. The lowest temperature was recorded in November 2022.
- The pH has predominantly stayed at pH6 over the period. However, it had dropped to pH5 in November 2022.

Location: -38.671987, 176.093145

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	6.0	48.7		47.0		<5.0	Clear	Colourless	N/a
Comments									
2022/06/27	6.0			40.8		<10.0	Clear	Colourless	nd
Comments									
2022/08/25	6.0	44.3		43.7	0.1	>3.0	Clear	Colourless	No
Comments									
2022/11/25	5.0	42.3		41.8		<20.0	Clear	Colourless	nd
Comments	Green and brown algae present.								
2023/02/24	6.0	44.8		43.8		<10.0	Clear	Colourless	nd
Comments	Orange and green algae on stream bed								

[Otumuheke end of Ponga Fence]: Temperature and pH for entire record

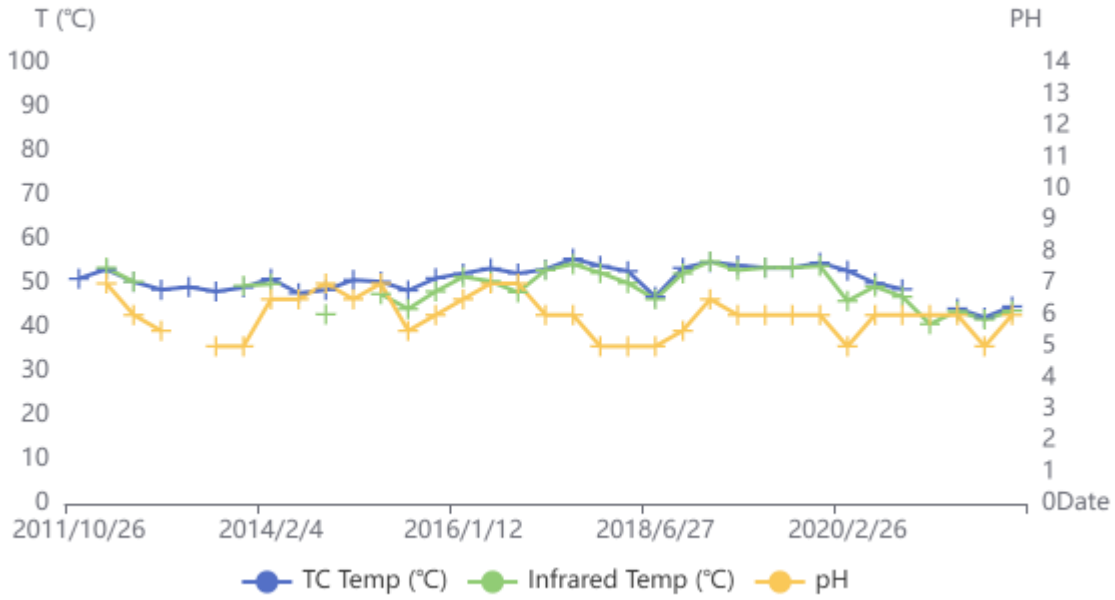


Fig.1 - taken on 2021-03-25 18:47:10"

Fig.2 - taken on 2022-08-25 12:25:06"

Fig.3 - taken on 2022-11-25 14:17:30"

Fig.4 - taken on 2023-02-24 15:01:56"

6.4 3068_112: Waipahihi New Spring

- It is getting increasingly difficult to visit the feature due to the overgrown vegetation.
- The temperature had decreased from 66.9 °C in March 2021 to 62.5 ° in August 2022.
- The pH remained consistent at pH6.

Location: -38.70258, 176.102028

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	6.0	66.9		61.0		>7.0	Clear	Colourless	N/a
Comments									
2022/08/25	6.0	62.5		60.5	0.2	<2.0	Clear	Colourless	No
Comments									

[Waipahihi New Spring]: Temperature and pH for entire record

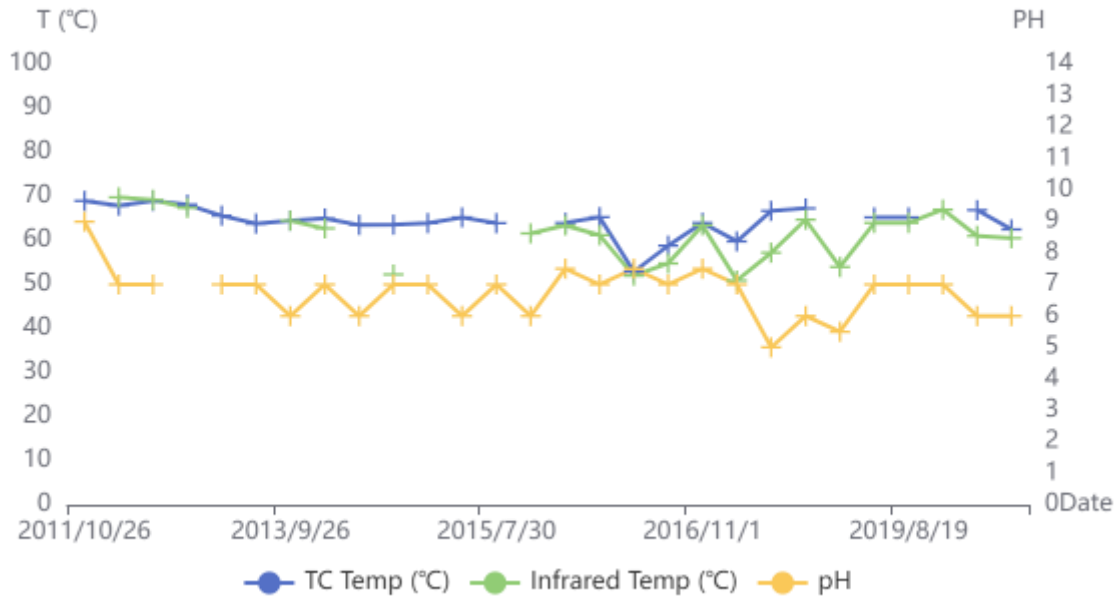


Fig.1 - taken on 2021-03-26 08:21:04"

Fig.2 - taken on 2021-03-26 08:21:08"

Fig.3 - taken on 2022-08-25 10:52:40"

6.5 3068_6: Waipahihi Source Spring

- The temperature of the feature has fluctuated over the period from March 2021 to February 2023. The lowest temperature was recorded in August 2022 with a reading of 61.2 °C and the highest temperature was recorded in February 2023 with a temperature reading of 70.7 °C.
- The feature fluctuated between pH6 and pH7 over the period.
- The feature is overgrown with cutty grass and blackberry, making it difficult to reach.

Location: -38.702477, 176.10253

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	6.0	67.5	65.5			Clear	Colourless	N/a

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
Comments								
2022/06/27	7.0	67.9	65.4		<0.5	Clear	Colourless	Calm
Comments								
2022/08/25	6.0	61.2	63.3	0.2	<1.0	Clear	Colourless	No
Comments								
2022/11/25	7.0	68.7	63.8		<0.5	Clear	Colourless	Calm
Comments	Site access is overgrown with blackberry.							
2023/02/20	6.0	70.7	64.2		<0.5	Clear	Colourless	Calm steaming
Comments	Lots of blackberry and cutty grass blocking access. Need to get it cleared.							

[Waipahihi Source Spring]: Temperature and pH for entire record

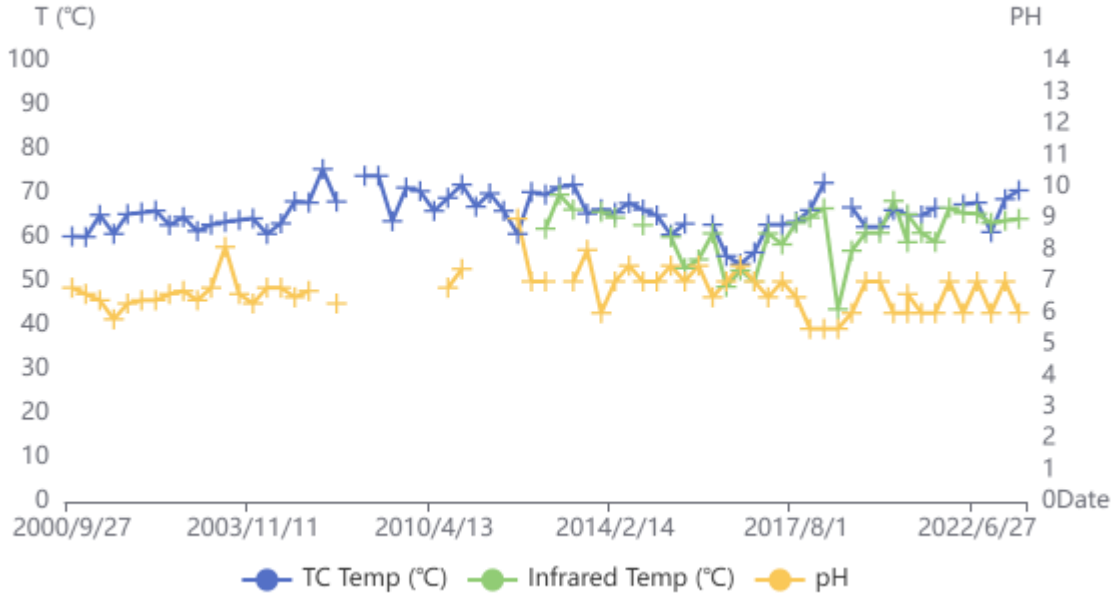


Fig.1 - taken on 2021-03-26 08:00:07"

Fig.2 - taken on 2022-08-25 10:37:36"

Fig.3 - taken on 2022-11-25 15:08:47"

Fig.4 - taken on 2023-02-20 11:47:35"

6.6 3068_16: Taharepa Springs

- The temperature of the spring has increased over the period from 57.0 °C in March 2021 to 64.1 °C in February 2022
- The pH has fluctuated between pH6 and pH7 over the period.
- In June 2022 it was observed that sand has infilled a large area of the pool. This may be due to high lake levels covering the area and depositing sand. In November 2022, the lake level was periodically flooding the spring. When we visited in February 2023 the water was disappearing into the sand and appearing again close to the rocks. There is now a small pool near the rocks.
- Several rocks have been placed on the sand around the small pool.

Location: -38.70023, 176.084303

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	7.0	57.0		54.0			Clear	Colourless	N/a
Comments									
2022/06/27	6.0	63.4		60.0		<0.5	Clear	Colourless	Constant
Comments	Sand has infilled a large area of the pool.								
2022/08/25	7.0			60.2	0.08	<2.0	Clear	Colourless	No
Comments									
2022/11/25	6.0	63.0		61.9		<0.5	Clear	Colourless	nd
Comments	Lake level is very high, sometimes flooding the spring.								
2023/02/24	7.0	64.1		62.0		<0.05	Clear	Colourless	nd
Comments	Spring water disappears into the sand and warms the pools by the rocks. Sand has covered the pool area and rocks have been placed around it.								

[Taharepa Springs]: Temperature and pH for entire record

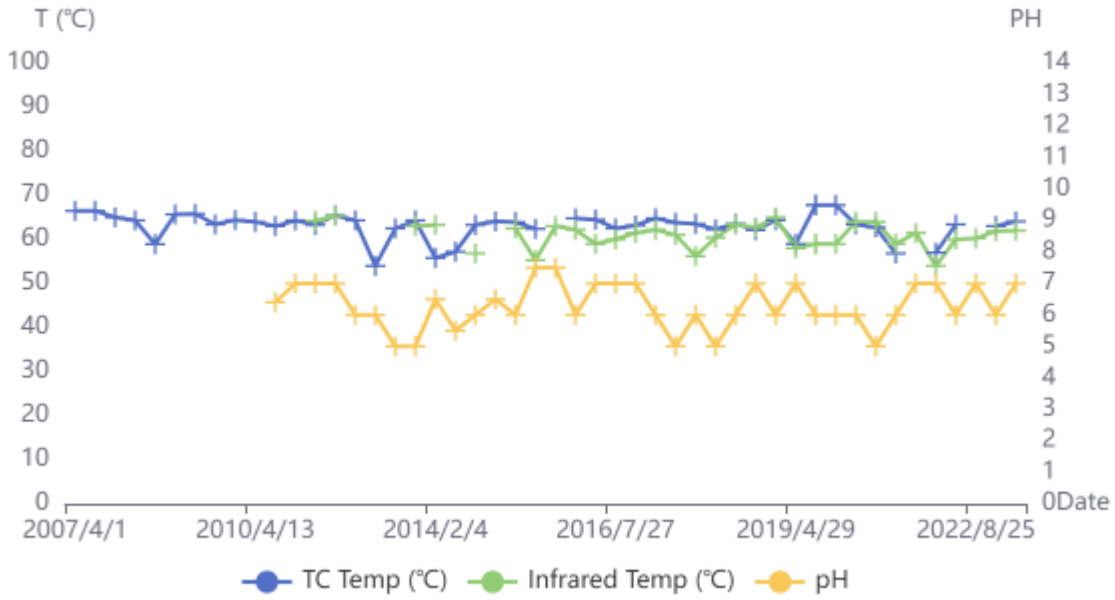


Fig.1 - taken on 2021-03-26 07:14:10"

Fig.2 - taken on 2021-03-26 07:14:20"

Fig.3 - taken on 2022-08-25 11:17:58"

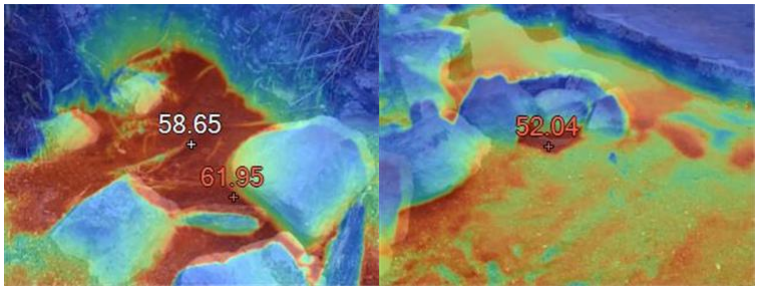
Fig.4 - taken on 2022-11-25 14:46:04"

Fig.5 - taken on 2022-11-25 14:46:26"

Fig.6 - taken on 2023-02-24 15:22:40"

Fig.7 - taken on 2023-02-24 15:22:48"

Fig.8 - taken on 2023-02-24 15:23:02"



Taharepa Springs 24/02/2023

6.7 3068_17: Rocky Point Spring

- The lake was covering the spring in all of the visits in 2022 and in February 2023.

Location: -38.701805, 176.085049

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	7.0	66.0		67.0		<1.0	Clear	Colourless	None only small ripples on the surface
Comments									
2022/08/25	6.0	21.5		33.4	0.3		Clear	Colourless	No
Comments									
2023/02/24				30.3					
Comments	Lake level is high and has flooded the feature.								

[Rocky Point Spring]: Temperature and pH for entire record

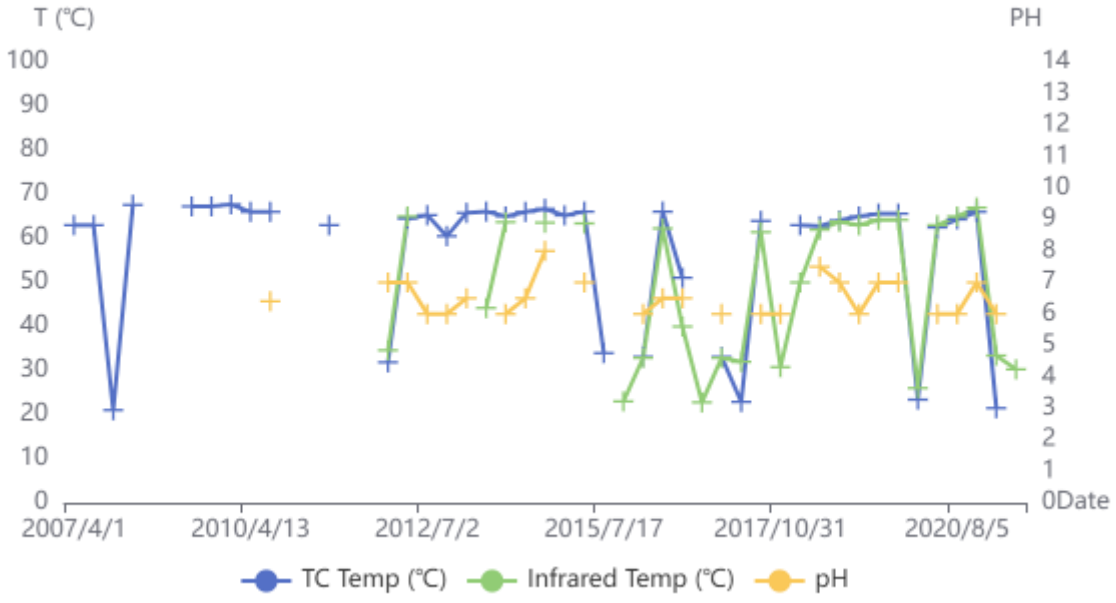


Fig.1 - taken on 2021-03-26 07:29:04"

Fig.2 - taken on 2021-03-26 07:29:19"

Fig.3 - taken on 2022-08-25 11:35:22"

Fig.4 - taken on 2022-08-25 11:35:46"

Fig.5 - taken on 2022-11-25 14:37:55"

Fig.6 - taken on 2023-02-24 15:29:39"

7 Te Kopia

7.1 3069_7: TKF7

- The temperature (using the infrared gun) has decreased by 10 °C since the previous visit in 2020.
- The water level has risen. There is no longer any visible mud around the edges and some of the trees are almost completely submerged.
- The colour has changed from light grey to light blue.

Location: -38.401978, 176.216424

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2020/02/25			45.0			Muddy	Grey - Light	Bubbling all over pool.
Comments								
2022/10/17			35.0			Milky	Blue - Light	Small bubbles all over pool. Steaming on far end. Audible bubbling on left of boardwalk.
Comments	Water level high. Almost covered some trees.							

[TKF7]: Temperature and pH for entire record

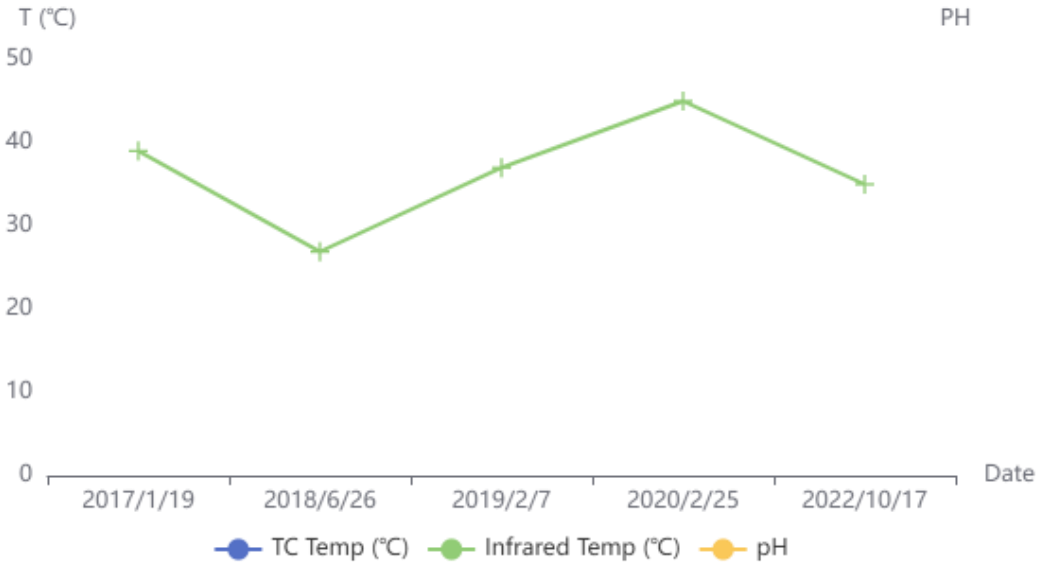
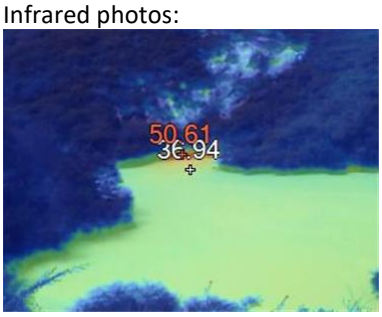
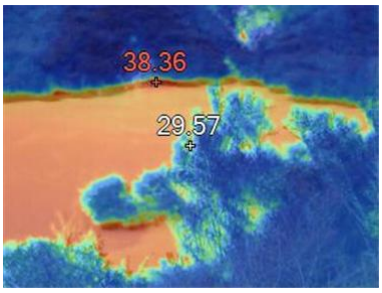


Fig.1 - taken on 2020-02-25 15:48:38"

Fig.3 - taken on 2022-10-17 13:21:53"

Infrared photos:





TKF7 05/10/2022

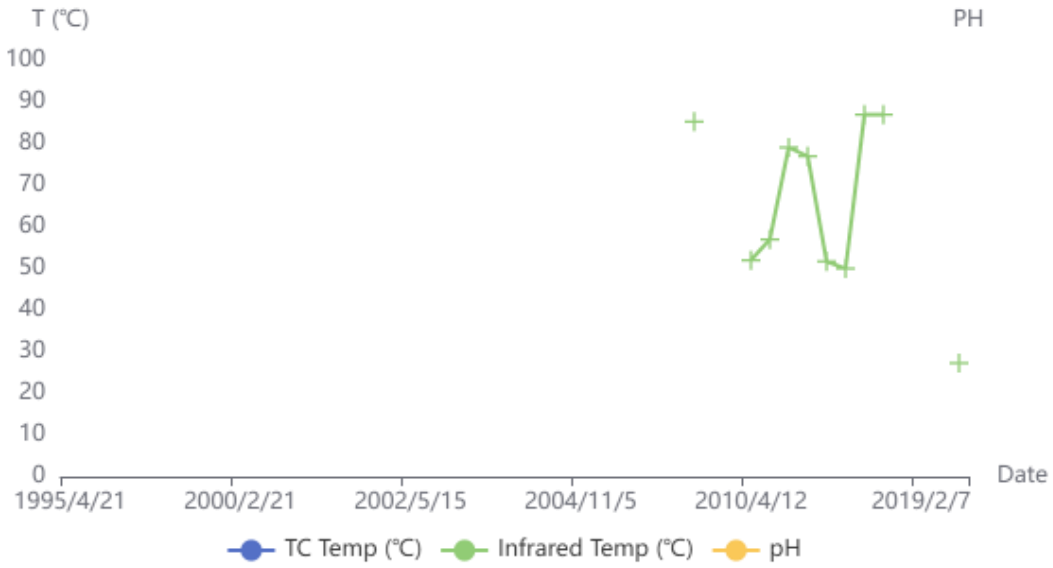
7.2 3069_2: TKF2

- Water level has risen from approximately 4 m below the top of the mound in March 2021 to approximately 2 m below the top of mound in October 2022.
- The mud geyser was close to being completely submerged in the October 2022 visit.
- The colour has changed from light brown to light blue over the period.

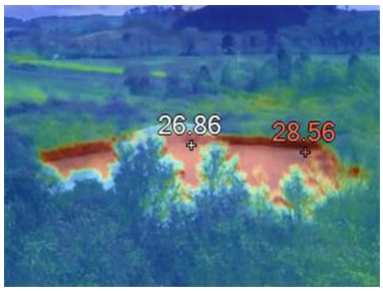
Location: -38.401899, 176.215035

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26					4.0		Muddy	Brown - Light	Constant at multiple points at the pool. No activities observed on mud geyser.
Comments									
2022/10/17				27.3	2.0		Milky	Blue - Light	Small bubbles in several areas on right side of pool and near the mound.
Comments									

[TKF2]: Temperature and pH for entire record



Infrared photos:



TKF2 05/10/2022

7.3 3069_4: TK8

- When we visited the site in October 2022, it appeared from the dead vegetation in the area that the ground surrounding the feature is heating up. Tress have fallen over both around and into the feature. We were unable to get close enough to get measurements.
- According to the landowner the area has been more active in recent times, with the ground heating up in several areas of the farm.

Location: -38.397907, 176.216724

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2020/02/25			83.0	3.5		Muddy	Grey - Light	Constant vigorous discharge in main pool hissing on side vent
Comments	Mud is runny. Sulphur depositions on side of vent. TK8 blown out, hissing. Orange moss on trees above pool. Some branches have fallen into pool.							
2021/03/26			82.0	1.0		Muddy	Brown	Constant ebullition large bubbles 20-30 cm diameter

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/10/17							Muddy	Grey - Light	Constant hissing and steaming.
Comments	Trees have fallen in due to heated ground. Doom no longer active, joined with TK8. Tree fallen across it. Could not get close to get temp readings.								

[Mud pools west of Te Kopia Rd]: Temperature and pH for entire record

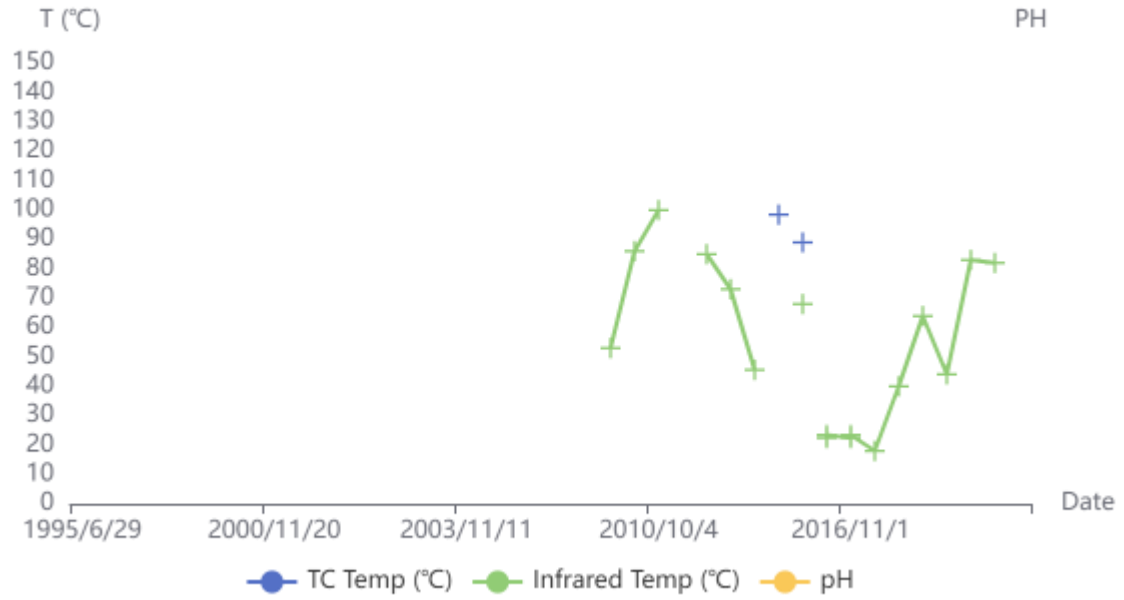


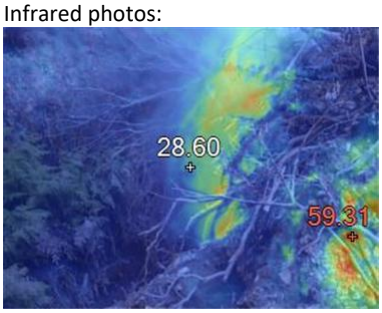
Fig.1 - taken on 2020-02-25 15:06:33"

Fig.1 - taken on 2021-03-26 14:56:50"

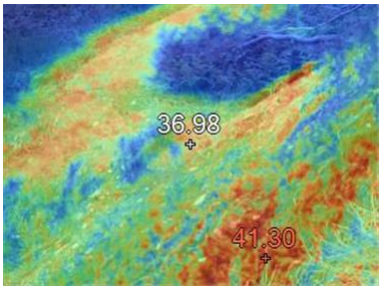
Fig.1 - taken on 2022-10-17 12:58:40"

Fig.2 - taken on 2022-10-17 13:01:39"

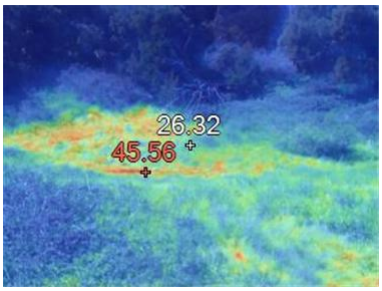
Infrared photos:



TK8 05/10/2022



Doom 05/10/2022



Murphy's hot ground 05/10/2022

7.4 3069_4: Mud pools beside Mangatete Stream trib

- We have not been able to access the stream recently due to fallen branches in February 2020 and then fallen trees in October 2022.
- The landowner mentioned that in the last 15 months the grass in the paddock and the trees have died. This can be seen in the photos below.
- The area at Murphy's hot ground as also been active recently, with the vegetation dying off.

Location: -38.397144, 176.217251

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2020/02/25				65.0			Muddy	Grey - Light	Constant gas discharge
Comments	Couldn't get close to pool due to fallen branches. White splash marks in vegetation on left of pools.								
2022/10/17									Steaming cannot see pool itself.
Comments	Within the last 15 months grass died off in paddock and killed off trees. Receded again apart from a small patch of dead grass. Cannot access pools due to the fallen trees.								

[Mud pools beside Mangatete Stream trib]: Temperature and pH for entire record

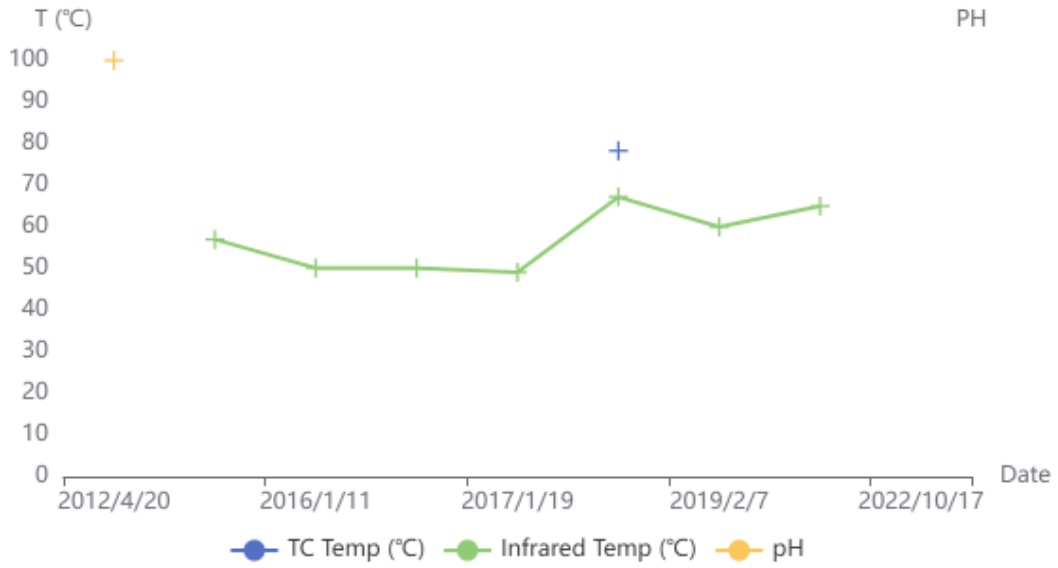


Fig.1 - taken on 2020-02-25 15:25:51"

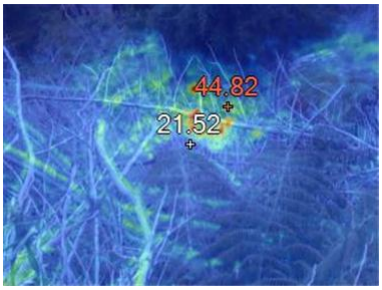
Fig.2 - taken on 2020-02-25 15:27:56"

Fig.3 - taken on 2022-10-17 12:24:58"

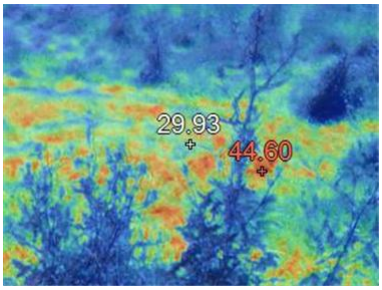
Fig.4 - taken on 2022-10-17 12:32:12"

Fig.5 - taken on 2022-10-17 12:32:20"

Fig.6 - taken on 2022-10-17 12:33:07"



Mud pools at Mangatete Stream trib 05/10/2022



Hot ground in paddock near stream 05/10/2022

8 Waikite

8.1 3073_107: Hot Pools Supply Spring

- When we visited the site in December 2022, we were told that there had been some recent disturbances to the spring after a 5.3 magnitude earthquake south of Taupo on 30 November 2022. The pools had to be cleaned out due to them being soapy. This happened twice. The Supply Spring had a lot of sediment. It cleared after a few days. We did not notice anything unusual when we visited the pools.
- The temperature of the pool had fluctuated within 2.3 °C over the period, close to boiling point.
- The pH has remained consistent at pH7 throughout the period.

Location: -38.327257, 176.304471

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	7.0	94.4		84.4			Clear	Colourless	Erupting up to 30 cm high
Comments	2 m splash zone. Red algal community in splash zone. Now water from another spring is channelled into this feature.								
2022/06/27	7.0	94.0		88.0			Clear	Colourless	Vigorous
2022/10/05	7.0	94.4		88.1			Clear	Colourless	Constant vigorous with spray up to 1 m forward
2022/12/09	7.0	95.1		90.5			Clear	Colourless	Constant vigorous boiling and gushing.
Comments	Manager mentioned that after the earthquakes the pools looked very soapy. They cleaned them out and it happened again. Apparently there was a lot of sediment in the supply spring, possibly due to the aftershocks close by.								
2023/03/01	7.0	92.8		90.5			Clear	Colourless	Vigorous boiling water thrown to 1.5 m forward.

[Hot Pools Supply Spring]: Temperature and pH for entire record

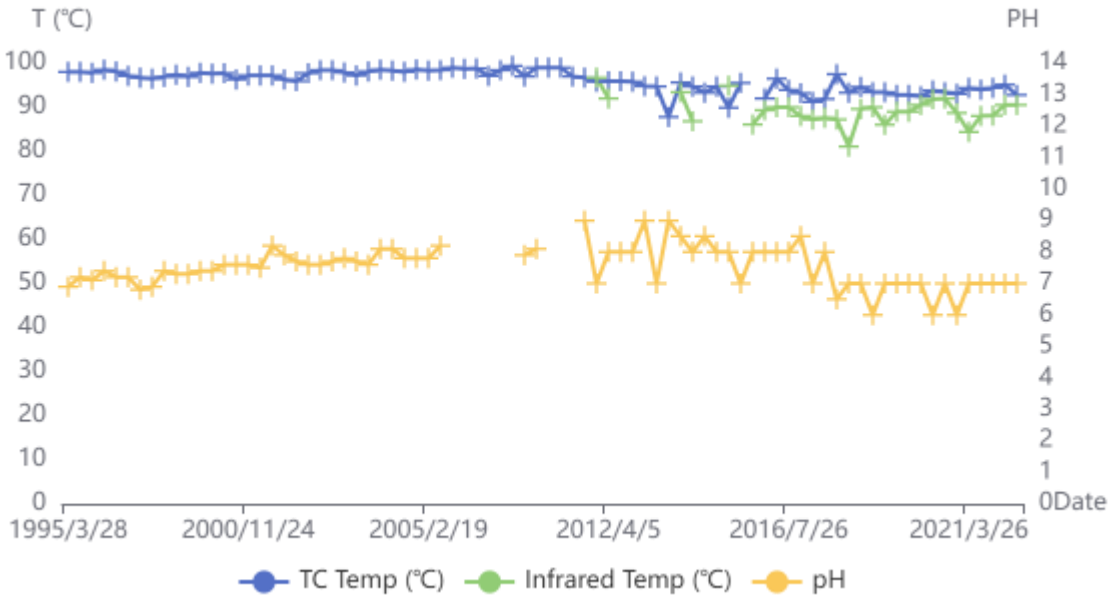


Fig.1 - taken on 2021-03-26 16:28:08"

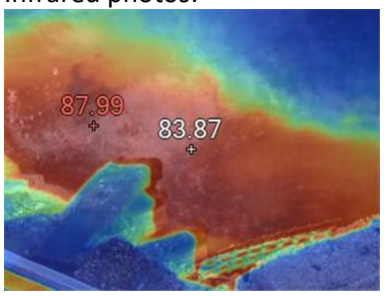
Fig.1 - taken on 2022-06-27 13:03:00"

Fig.3 - taken on 2022-12-09 14:30:41"

Fig.4 - taken on 2023-03-01 14:12:12"

Fig.2 - taken on 2022-10-05 15:45:32"

Infrared photos:



Hot Pools supply spring 05/10/2022

8.2 3073_108: Pool adjacent to Supply Spring

- The temperature of the pool has fluctuated over the period with the lowest temperature recorded in Jun 2022 with a reading of 74.0 °C and the highest temperature recorded in October 2022 with a reading of 84.9 °C.
- The pH has remained reasonably consistent over the period with most visits recording pH7. The October 2022 visit showed a result of pH6.

Location: -38.32703, 176.303568

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	7.0	82.5		80.9			Clear	Colourless	Constant ebullition at multiple points of the pool
Comments	Not flowing out, as water from supply spring is now entering into this feature.								
2022/06/27	7.0	74.0		58.0			Clear	Colourless	Constant upwelling in centre
Comments	Pool has extended closer to the path								
2022/10/05	6.0	84.9		72.8		<1.0	Clear	Blue - Light	Constant upwelling in centre of pool.
Comments									
2022/12/09	7.0	83.3		71.2		<1.0	Clear	Blue	Constant upwelling in centre.
Comments									
2023/03/01	7.0	84.0		83.6		<0.5	Clear	Colourless	Constant bubbling in centre.
Comments									

[Pool adjacent to Supply Spring]: Temperature and pH for entire record

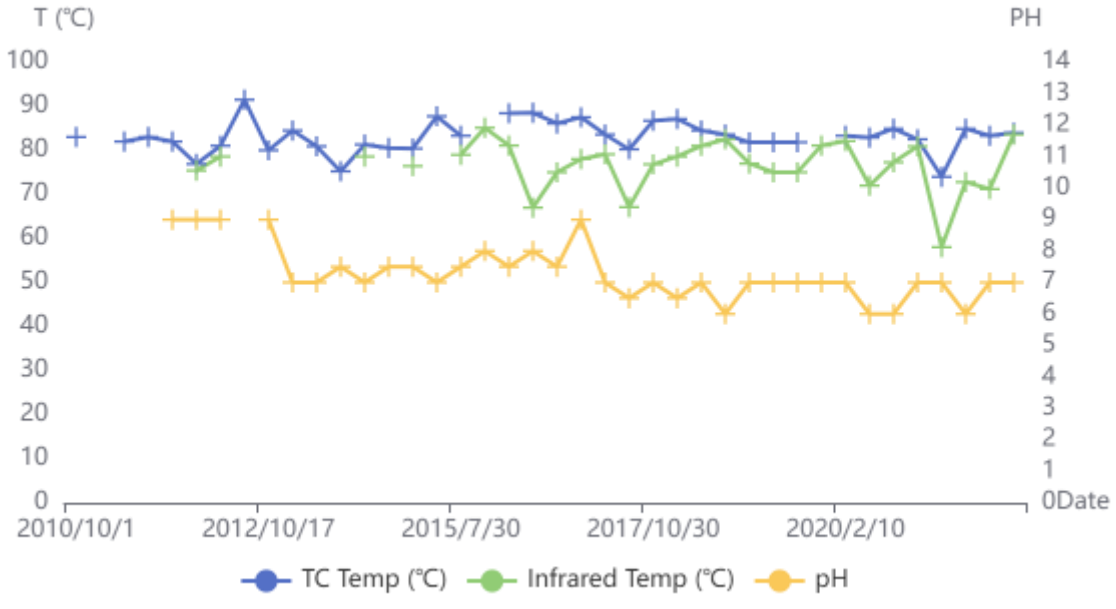


Fig.1 - taken on 2021-03-26 16:33:32"

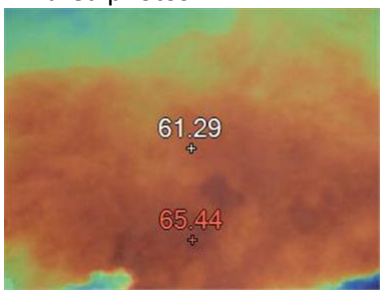
Fig.2 - taken on 2022-06-27 13:15:35"

Fig.3 - taken on 2022-10-05 15:52:23"

Fig.4 - taken on 2022-12-09 14:42:28"

Fig.5 - taken on 2023-03-01 14:14:27"

Infrared photos



Pool beside supply spring 05/10/2022

8.3 3073_109: Scalding Spring

- The temperature of the pool has remained reasonably consistent over the period with a variation of 3.3 °C over the period from April 2021 to March 2023.
- The pH of the pool is generally consistent at pH 7, however it did drop to pH6 in June 2022.
- In April 2021 the flow had increased to >5 l/s. This is unusual for this site, however as we only visit the site quarterly it is possible that the flow can change considerably during periods that we do not visit. The flow had decreased again to <0.5 l/s when we next visited the site in June 2022.

Location: -38.316698, 176.314705

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/04/30	7.0	94.3		79.3		>5.0	Clear	Colourless	Constant ebullition near outlet hottest part of pool.

Comments

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/06/27	6.0	97.3		78.9		<0.5	Clear	Blue	Constant upwelling at outlet
Comments									
2022/10/05	7.0	95.5		89.3		<0.5	Clear	Blue	Constant upwelling at outlet.
Comments									
2023/03/01	7.0	94.0		82.4		<0.5	Clear	Blue	Constant upwelling at outlet
Comments	Some wire in the pool.								

[Scalding Spring]: Temperature and pH for entire record

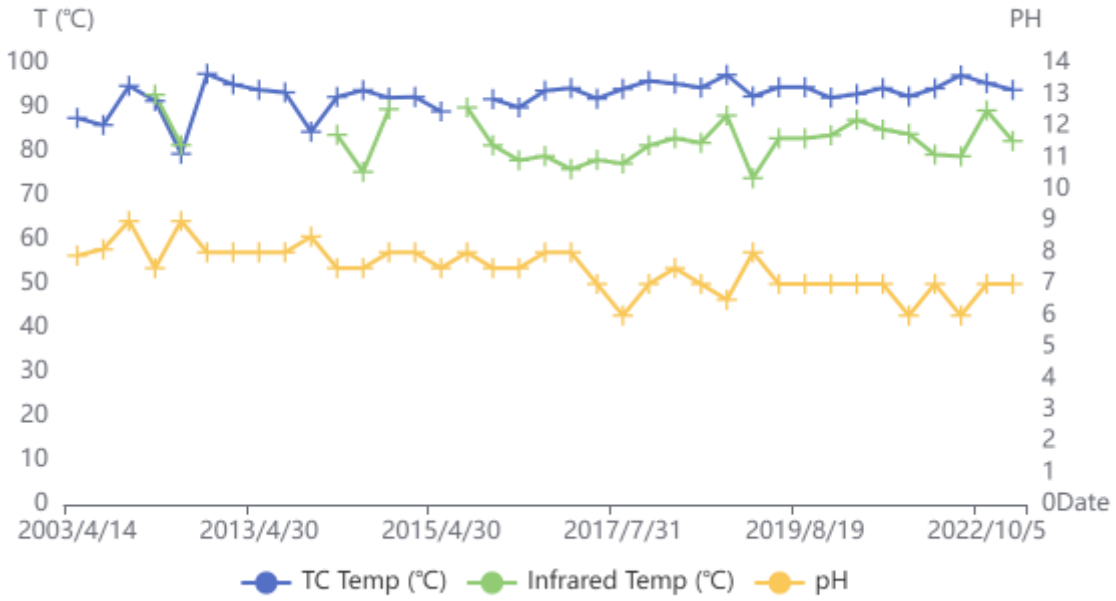


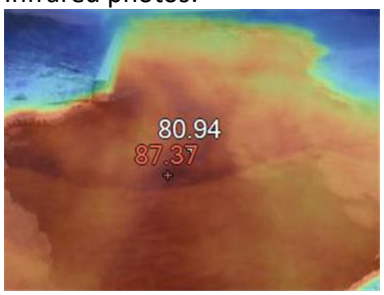
Fig.1 - taken on 2021-04-30 16:31:39"

Fig.2 - taken on 2022-06-27 12:14:36"

Fig.3 - taken on 2022-10-05 15:09:20"

Fig.4 - taken on 2023-03-01 13:36:04"

Infrared photos:



Scalding Spring 05/10/2022

8.4 3073_110: Waikite Scarp and Spring

- The pH has fluctuated between pH 7 and pH 8 over the period from April 2021 to March 2023.
- The temperature has also fluctuated, with the highest temperature reading of 79.1 °C recorded in April 2021, and the lowest temperature of 71.0 °C recorded in June 2022.

Location: -38.32045, 176.312635

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/04/30	8.0	79.1	75.0			Clear	Colourless	
Comments	Microbial mats on stream rims and on vegetation. Animal remains (frog, cricket and bird) observed. Plants fall into stream and do not get calcified/silicified, but become opaque and lose organic matters.							
2022/06/27	8.0	71.0	70.8			Clear	Colourless	nd
2022/10/05	7.0	78.7	71.0		<0.5	Clear	Colourless	Calm steaming
Comments	Overgrown blackberry upstream							
2023/03/01	8.0	73.2	72.1		<0.5	Clear	Colourless	nd
Comments	Blackberry has overgrown a large area around the stream and springs. We may not be able to access it next time as it is growing over the fence.							

[Waikite Scarp and Spring]: Temperature and pH for entire record

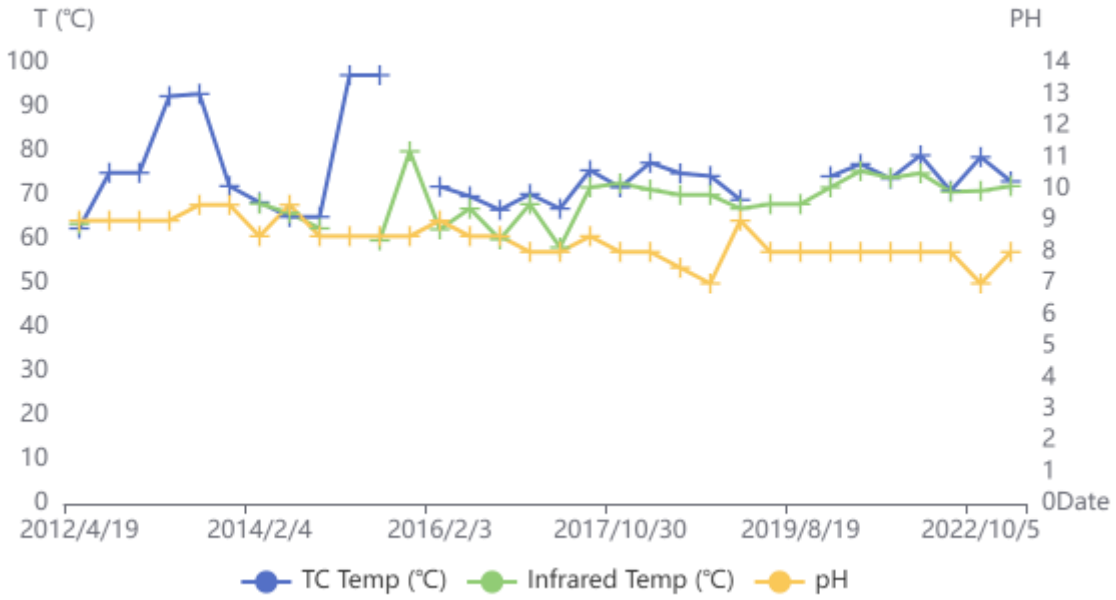
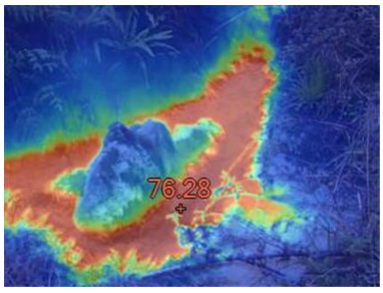


Fig.1 - taken on 2021-04-30 16:00:34"

Fig.1 - taken on 2022-10-05 14:41:19"

Fig.2 - taken on 2023-03-01 13:12:57"



Waikite scarp 05/10/2022

8.5 3073_32: WAF5586 Manaroa Pool

- The temperature of the pool has fluctuated over the period, with the lowest temperature recorded in June 2022 with a reading of 88.0 °C and the highest temperature recorded in March 2023 with a reading of 100.0 °C.
- The temperature is taken using the thermocouple on the side of the pool. The centre of the pool appeared to be boiling in all visits.
- pH7 was recorded at the first three visits from March 2021 to October 2022. This then changed to pH6 in December 2022. We could not test the pH in March 2023 as the sampling pole was malfunctioning.

Location: -38.326956, 176.304926

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/26	7.0	93.2	82.4			Clear	Colourless	Constant eruptive ebullition
Comments	Bigger radius of rupturing centre than usual							
2022/06/27	7.0	88.0	89.0		<50.0	Clear	Blue - Dark	Constant upwelling in centre surging up to 1 m
Comments	Very steamy							
2022/10/05	7.0	98.4	69.6		<50.0	Clear	Blue - Dark	Vigorous upwelling in centre of pool.
Comments								
2022/12/09	6.0	98.8	83.4		<50.0	Clear	Blue - Dark	Constant vigorous boiling in centre of pool up to 1.0 m. Several other smaller areas of upwelling.
Comments								
2023/03/01		100.0			<50.0	Clear	Blue - Dark	Constant vigorous upwelling in centre. Up to 0.5 m high.
Comments	Pole would not extend out so could not get pH reading. Very steamy.							

[WAF5586 Manaroa Pool]: Temperature and pH for entire record

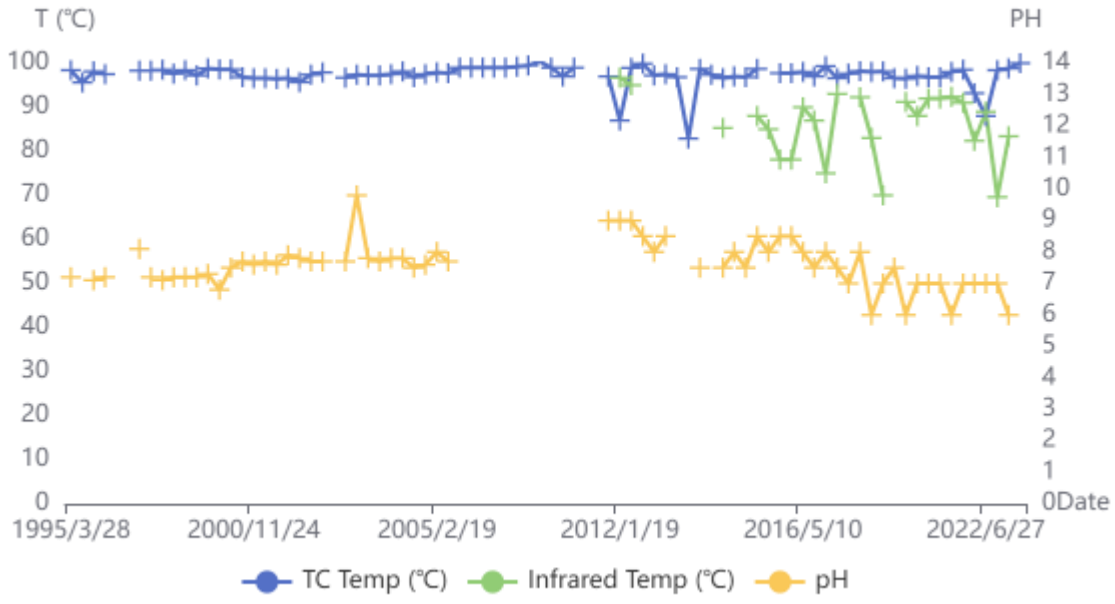


Fig.1 - taken on 2021-03-26 16:56:43"

Fig.2 - taken on 2022-06-27 13:28:22"

Fig.3 - taken on 2022-10-05 16:06:02"

Fig.4 - taken on 2022-12-09 14:52:14"

Fig.5 - taken on 2023-03-01 14:26:07"

9 Waiotapu

9.1 3074_124: Kerosene Creek

- The pH has remained the same over the period from March 2021 to December 2022.
- The temperature has fluctuated over the period, with the lowest temperature of 34.8 °C recorded in August 2022 and the highest temperature of 39.6 °C recorded in May 2022.
- The area on the left of the creek had eroded further, this was especially noticed at the December 2022 visit as a large tree has fallen across the creek, forcing the water to go around the creek and erode the bank.

Location: -38.335113, 176.386481

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition	Bathers
2021/03/25	4.0	38.7	36.9			Clear	Brown - Light	N/a	0
2022/05/09	4.0	39.6	39.8		<170.0	Murky	Brown - Light	nd	8
Comments	Also 10 bathers at large pool. Couldn't take a photo due to people swimming.								
2022/08/25	4.0	34.8	34.5	0.4	<50.0	Cloudy	Brown - Light	No	4
2022/12/09	4.0	39.1	37.7	0.4	<250.0	Murky	Brown	ND	2

[Kerosene Creek]: Temperature and pH for entire record

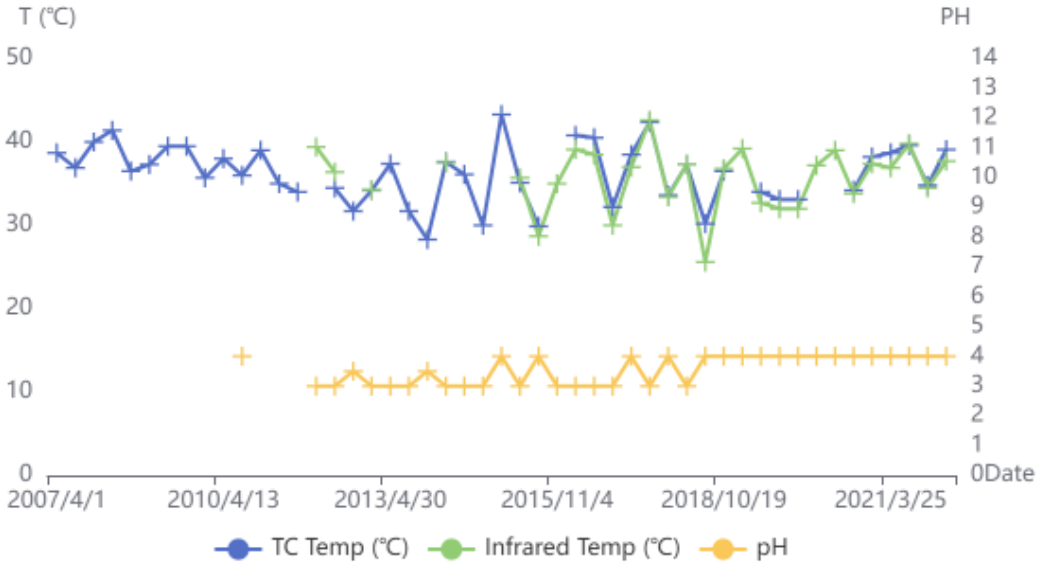


Fig.1 - taken on 2021-03-25 09:34:18"

Fig.2 - taken on 2021-03-25 09:34:26"

Fig.3 - taken on 2022-05-09 15:31:10"

Fig.4 - taken on 2022-08-25 13:49:21"

Fig.5 - taken on 2022-12-09 10:25:41"

Fig.6 - taken on 2022-12-09 10:26:49"

Fig.7 - taken on 2023-03-01 11:49:44"

Fig.8 - taken on 2023-03-01 11:49:55"

Fig.9 - taken on 2023-03-01 11:50:00"

Fig.10 - taken on 2022-12-09 10:25:47"

9.2 3074_292: Kerosene Creek Large Pool

- The number of bathers visiting the pool has varied over the visits from March 2021 to March 2023.

Location: -38.335577, 176.386308

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition	Bathers
2021/03/25	4.0	37.2		37.3		>35.0	Clear	Brown - Light	N/a	4
2022/05/09										10
2022/12/09										4
2023/03/01										31

[Kerosene Creek Large Pool]: Temperature and pH for entire record

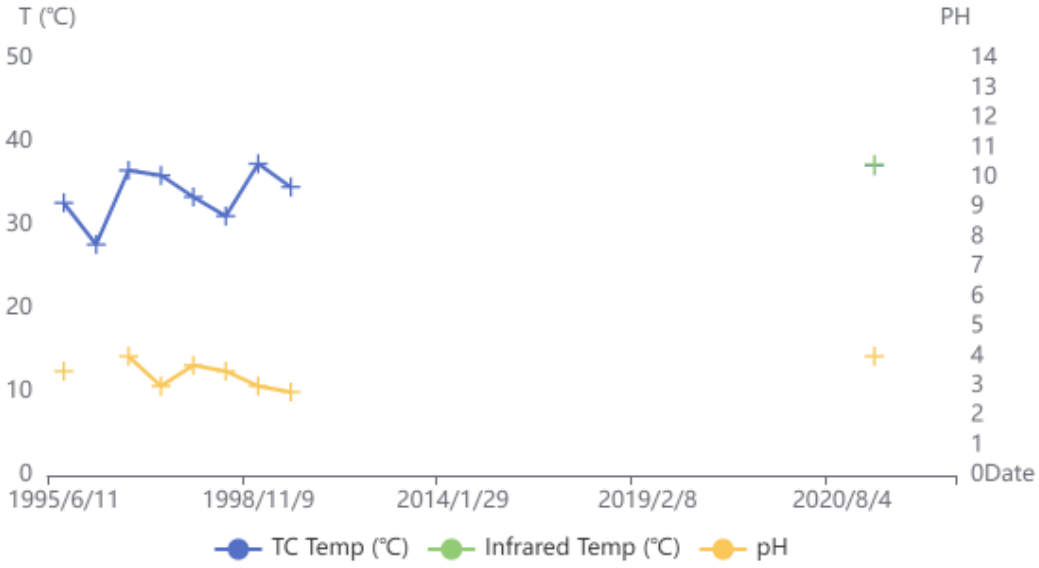


Fig.1 - taken on 2022-12-09 10:28:27"

Fig.2 - taken on 2023-03-01 11:54:57"

9.3 3074_177: WTF1052 Lady Knox Geyser

- Waiotapu has been closed for renovations, therefore the geyser has not been set off while we were there. It has reopened for our visit in December 2022.
- The geyser was erupting at 11am during the December 2022 visit, reaching a height of between 5 m and 10 m.
- When we arrived at the geyser at 10:30am in February, the geyser was no longer erupting (after being set off at 10:15am). Apparently, it had only had short eruptions all week.

Location: -38.350748, 176.37696

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25								Only audible
Comments	Constant audible rumbling noise from vent, constant steam discharge							
2022/05/09			89.3					Constant audible bubbling and steaming
Comments	No recent signs of eruptions, area around geyser is dry. Geyser is steaming and audible bubbling so is still active							
2022/10/05		97.6						Steaming and audible bubbling
Comments	Steaming, did not erupt.							
2022/12/09			84.3			Clear	Colourless	Still erupting at 11 am up to 10 m high. Height changing between 5and 10 m high.
Comments	Geyser still going after being set off.							
2023/02/24		100.0						Audible bubbling no longer erupting.
Comments	Geyser was no longer erupting when we arrived at 10:30. Apparently it has not erupted for long for the past week.							

[WTF1052 Lady Knox Geyser]: Temperature and pH for entire record

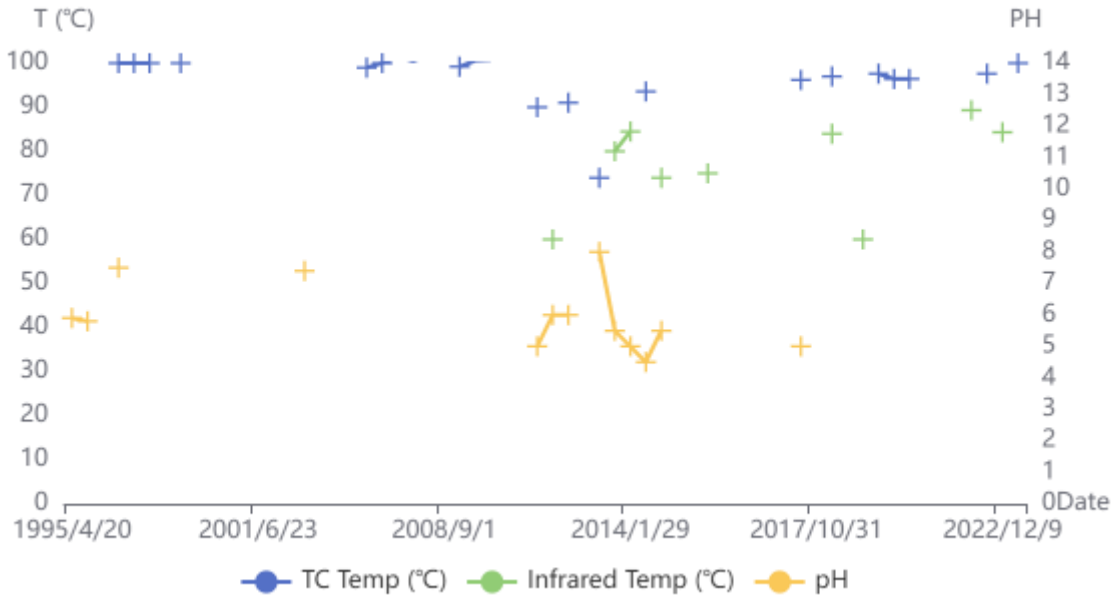


Fig.1 - taken on 2022-05-09 14:29:25"

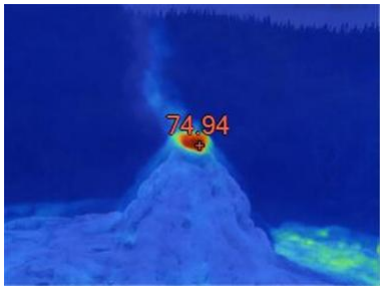
Fig.2 - taken on 2022-10-05 13:29:35"

Fig.3 - taken on 2022-12-09 11:05:34"

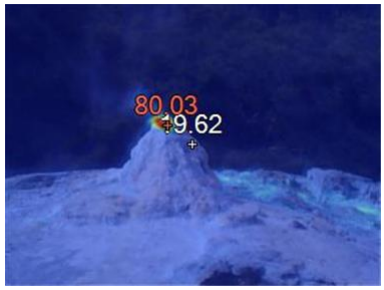
Fig.4 - taken on 2022-12-09 11:05:49"

Fig.5 - taken on 2023-02-24 10:59:23"

Infrared photos:



Lady Knox Geyser 05/12/2022



Lady Knox Geyser 24/02/2023

9.4 3074_178: WTF1053 Knox Spring Hole and channel

- The temperature has decreased over the period from 78.9 °C in March 2021 to 53.2 °C in February 2023.
- The pH of the feature has risen from pH3 to pH4.
- The feature was overflowing in our October visit, covering the run off area in yellow precipitate. This has continued on subsequent visits. There also appears to be a new outlet which has formed closer to the platform as can be seen in the photos below in December 2022 and February 2023.

Location: -38.350748, 176.37696

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	3.0	78.9	69.0	0.5		Clear	Colourless	Constant moderate ebullition
Comments	Discharge downstream is very sulphurous							
2022/05/09	3.0		75.9	0.2		Clear	Colourless	Constant bubbling and gas discharge
Comments	Gas monitor kept alarming							
2022/10/05	4.0	53.6	52.8		<0.5	Clear	Colourless	Constant gas discharge.
Comments	Water level high.							
2022/12/09	4.0	59.1	58.3	0.2	<0.5	Clear	Colourless	Constant bubbling on left side of pool.
Comments	Yellow precipitate present. New outlet has opened up 2 m to the right of the channel measuring 30 degrees.							
2023/02/24	4.0	53.2	52.4		<0.5	Clear	Colourless	Continuous gas discharge on right and left side of pool.
Comments	Yellow precipitate around the hole and in the outflow. Small outflow							

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition

from a rock to the right of the channel.

[WTF1053 Knox hole spring and channel]: Temperature and pH for entire record

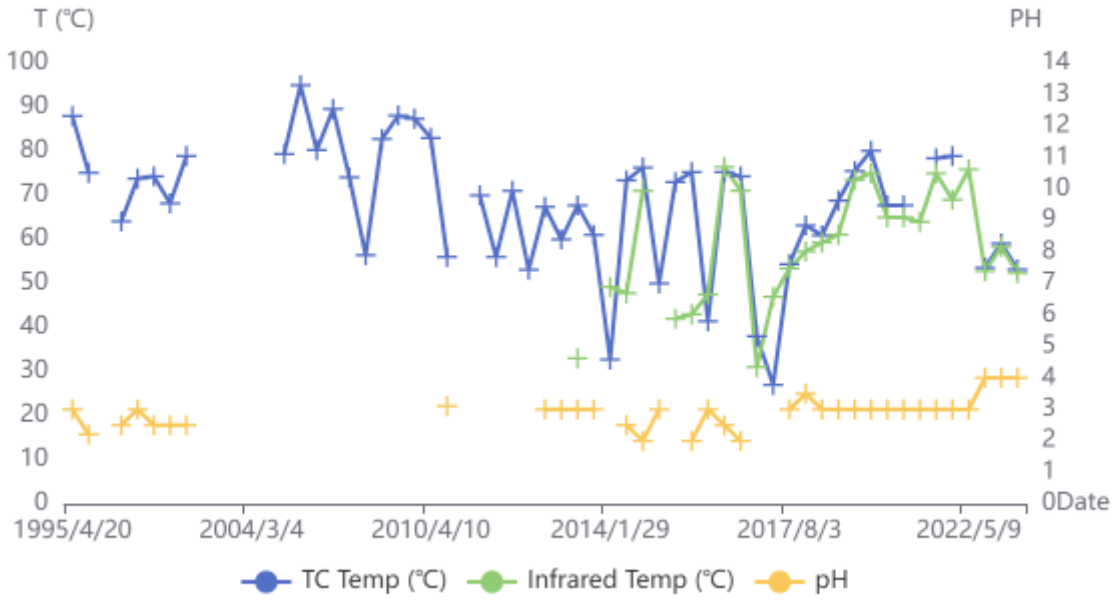


Fig.1 - taken on 2021-03-25 10:37:19"

Fig.2 - taken on 2021-03-25 10:37:24"

Fig.3 - taken on 2022-05-09 14:24:17"

Fig.4 - taken on 2022-10-05 13:16:34"

Fig.5 - taken on 2022-10-05 13:16:39"

Fig.6 - taken on 2022-12-09 11:19:00"

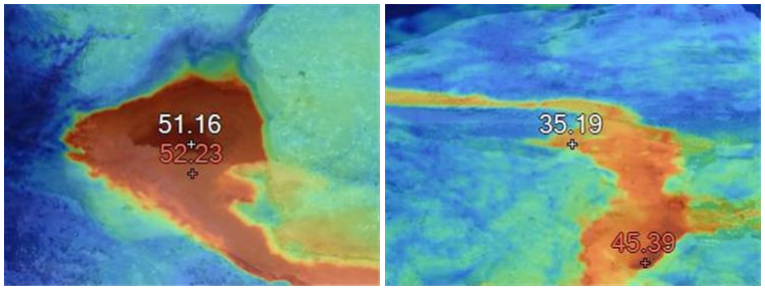
Fig.7 - taken on 2022-12-09 11:19:05"

Fig.8 - taken on 2022-12-09 11:19:30"

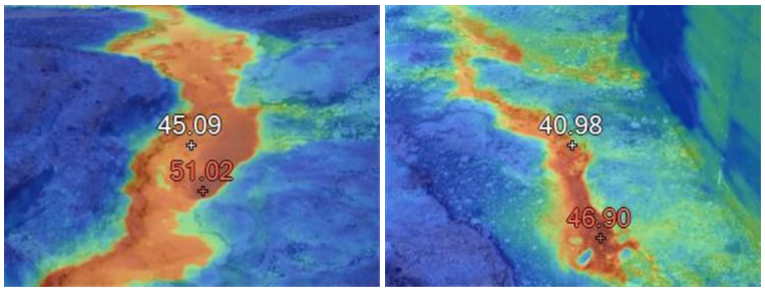
Fig.9 - taken on 2023-02-24 10:46:26"

Fig.10 - taken on 2023-02-24 10:46:31"

Fig.11 - taken on 2023-02-24 10:53:21"



Knox spring hole and channel 05/10/2022



Knox Spring Hole channel and new outlet 24/02/2023

9.5 3074_174: The Hidden Pool

- The temperature has been variable over the period, with the highest temperature of 39.5 °C recorded in December 2022 the lowest temperature of 34.9 °C recorded in February 2023.
- The pH alternated between pH3 and pH4 over the period.

Location: -38.34984, 176.372193

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/05/09	3.0	39.2		38.4		<20.0	Murky	Brown - Light	nd

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/10/05	4.0	34.9		33.2		<50.0	Murky	Brown - Dark	nd
Comments	A lot more water than usual.								
2022/12/09	3.0	39.5		36.4		<50.0	Murky	Brown	nd
Comments	Rocks have been stacked up limiting the flow.								
2023/02/24	4.0	37.8		37.3		<60.0	Murky	Brown	nd
Comments	Flow appears to be more than usual. Foam is forming on the surface of the pool.								

[WTF1049 The Hidden Pool]: Temperature and pH for entire record

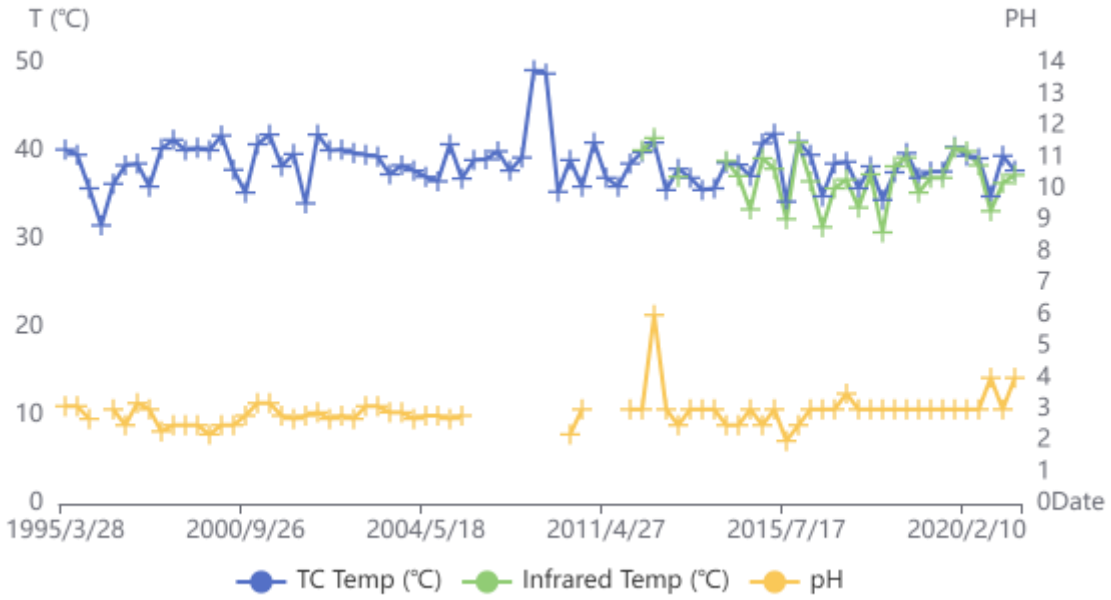


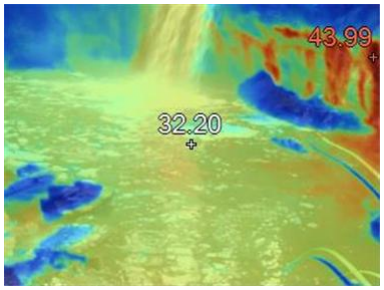
Fig.1 - taken on 2022-05-09 14:48:33"

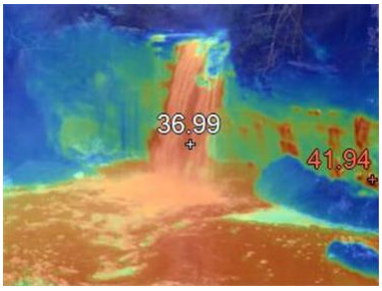
Fig.2 - taken on 2022-10-05 13:38:44"

Fig.3 - taken on 2022-12-09 11:31:55"

Fig.4 - taken on 2023-02-24 11:12:20"

Infrared photos:





Hidden Pool 05/10/2022 Hidden Pool 24/02/2023

9.6 3074_280: Venus Pool in Creek on Lady Knox Rd

- The pH has remained the same throughout the period.
- There was a decrease in temperature by 7 °C between May 2022 and October 2022. Since then we have not been able to get access to the stream with the thermocouple due to the vegetation growth, however it doesn't seem to have warmed up again from looking at the Infrared temperature.
- Trees have fallen into the stream and blackberry is growing on the bank.

Location: -38.350991, 176.369443

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/05/09	5.0	46.8	46.1			Clear	Colourless	nd
2022/10/05	5.0	39.8	38.6		<20.0	Clear	Colourless	Calm steaming
Comments	Some Manuka trees have fallen into the stream.							
2022/12/09	5.0		39.2			Clear	Colourless	nd
Comments	Could not get thermocouple temp as could not reach feature.							
2023/02/24	5.0		43.2		<10.0	Clear	Colourless	nd
Comments	Trees have fallen into the stream.							

[Venus Pool in creek on Lady Knox Rd]: Temperature and pH for entire record

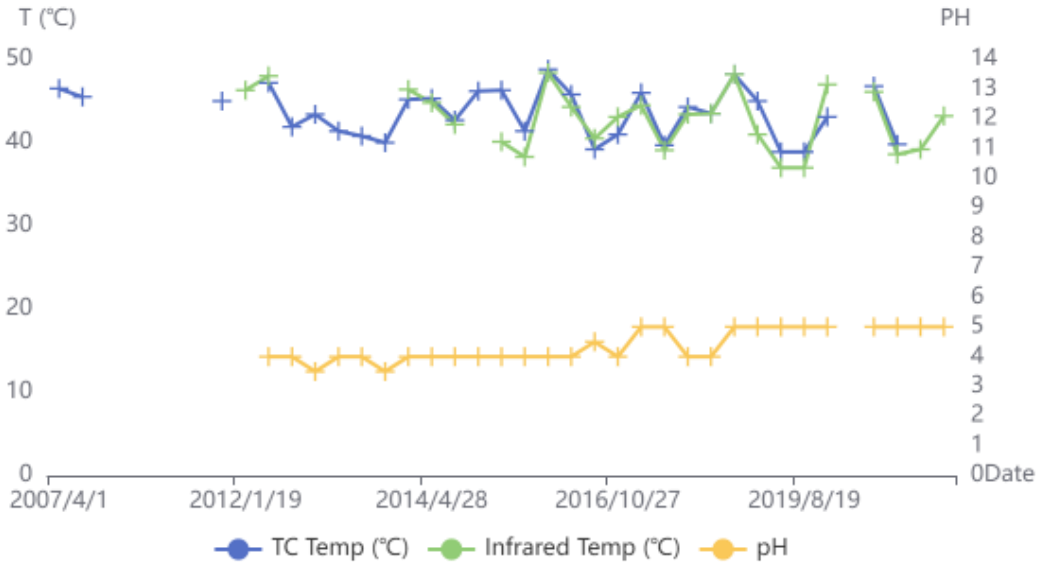


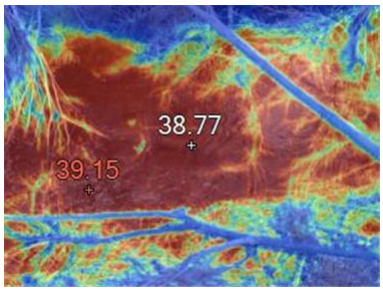
Fig.1 - taken on 2022-05-09 14:59:51"

Fig.2 - taken on 2022-10-05 13:54:52"

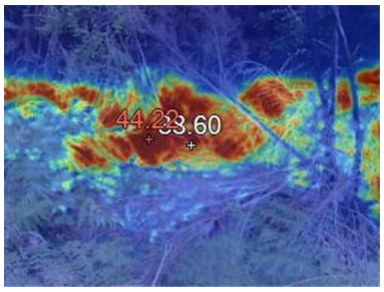
Fig.3 - taken on 2022-12-09 11:42:11"

Fig.4 - taken on 2023-02-24 11:27:28"

Infrared photos:



Venus pool creek 05/10/2022



Venus Pool creek 24/02/2023

9.7 3074_184: WTF1059 Weather Pool

- The temperature of the pool has increased over the period from 50.3 °C in March 2021 to 64.2 °C in February 2023.
- The infrared temperature is taken from the boardwalk.

Location: -38.356614, 176.36816

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25			50.3				Blue - Grey	None calm
2022/05/09			56.7			Cloudy	Blue - Green	Calm
Comments	Lots of h2s from downstream feature.							
2022/10/05			61.0			Murky	Grey - Light	Steaming
2022/12/09			55.9	0.01		Cloudy	Blue	Occasional bubbles around edges
2023/02/24			64.2	0.1		Cloudy	Blue - Light	Occasional bubbles
Comments	Mound of sediment visible in centre of the pool.							

[WTF1059 Weather Pool]: Temperature and pH for entire record

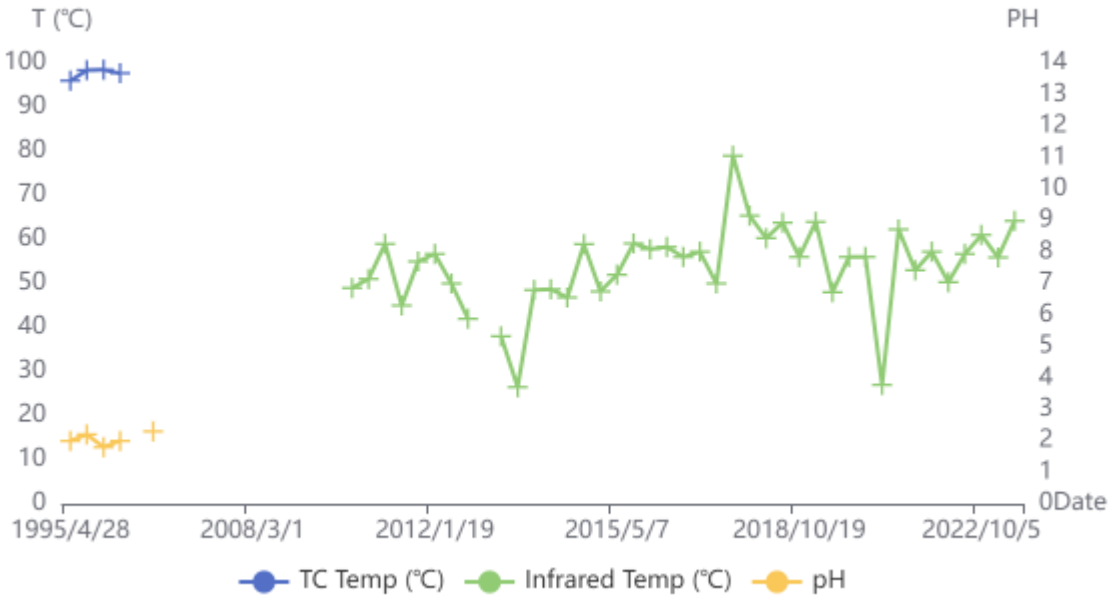


Fig.1 - taken on 2021-03-25 11:04:15"

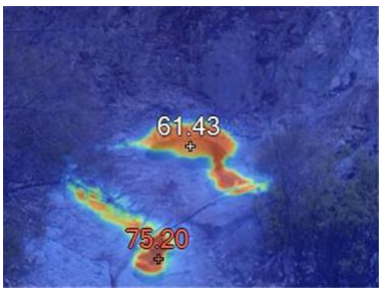
Fig.2 - taken on 2022-05-09 11:37:48"

Fig.3 - taken on 2022-10-05 11:13:08"

Fig.4 - taken on 2022-10-05 11:13:22"

Fig.5 - taken on 2022-12-09 12:14:54"

Fig.6 - taken on 2023-02-24 11:47:09"



Weather Pool 24/02/2023

9.8 3074_192: WTF1067 Sinter Terraces Foreground Pool

- The temperature has fluctuated over the period. The highest temperature was recorded in May 2022 at 67.7 °C and the lowest temperature was recorded in March 2021 at 53.0 °C.

Location: -38.358495, 176.369471

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25			53.0			Milky	Blue - Green	None
Comments	Single microbial raft floating							
2022/05/09			67.7			Clear	Green - Light	Calm
Comments	Change date and time on infrared camera							
2022/10/05			58.6			Murky	Green - Murky	Constant bubbling in centre of pool.
2022/12/09			62.1		<0.05	Murky	Green	Constant effervescing bubbles in centre of pool.
2023/02/24			64.0		<0.05	Clear	Green - Light	Constant upwelling in centre.
Comments	Orange and yellow precipitate around edges.							

[WTF1067 Sinter Terraces-Foreground Pool]: Temperature and pH for entire record

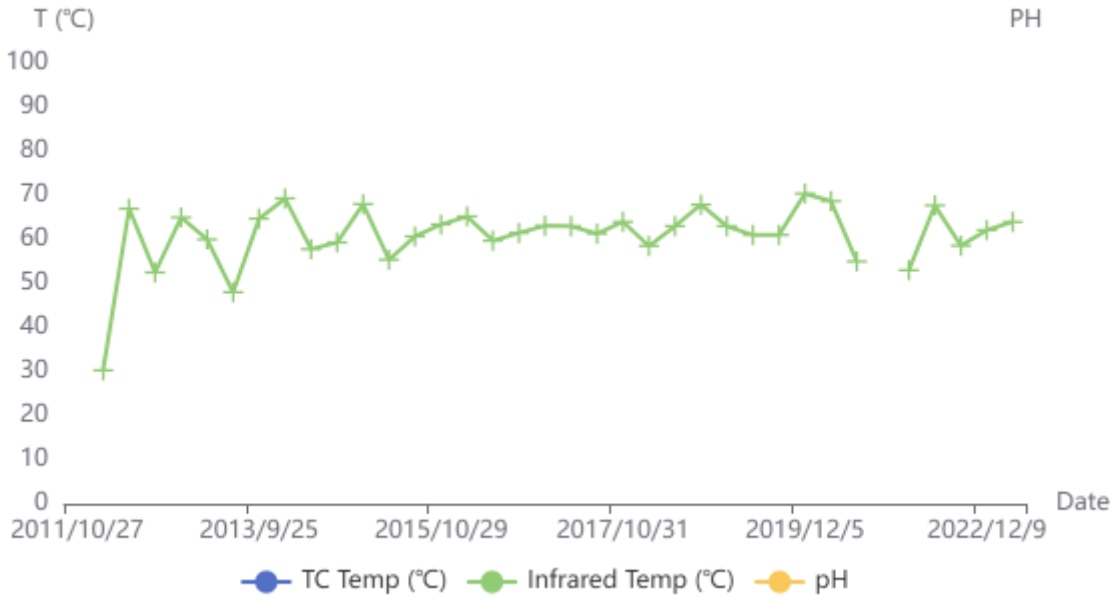


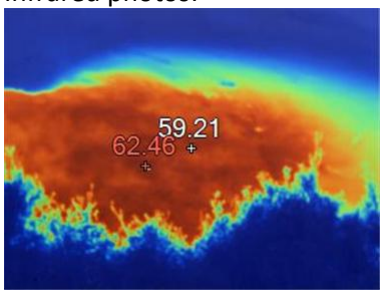
Fig.1 - taken on 2022-05-09 11:56:48"

Fig.2 - taken on 2022-10-05 11:24:23"

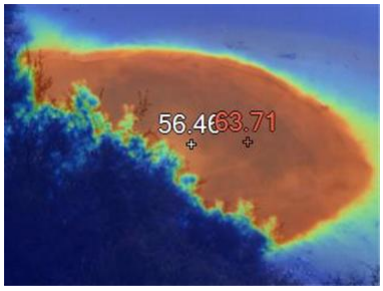
Fig.3 - taken on 2022-12-09 12:25:16"

Fig.4 - taken on 2023-02-24 12:00:45"

Infrared photos:



Foreground pool 05/10/2022



Foreground pool 24/02/2023

9.9 Artists Palette

3074_282: WTF2069 Pool N of Jean Batten Geyser

- The temperature has increased over the period from 21.0 °C in March 2021 to 34.8 °C in February 2023.
- The pH has alternated between pH4 and pH5.
- The ground around the feature is getting increasing unstable with many soft and hollow areas.

Location: -38.359224, 176.369803

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	4.0	18.4		21.0			Clear	Grey	None still

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/05/09	5.0		23.5			Cloudy	Blue - Grey	Calm
2022/10/05	5.0	27.8	28.0			Clear	Colourless	Calm
Comments	Lots of water on the terraces from recent rain events.							
2022/12/09	4.0	31.1	27.9			Clear	Colourless	Calm
Comments	There are some areas of hollow ground where the boardwalk used to be. Future access might be limited.							
2023/02/24	5.0	34.8	30.0	0.01		Clear	Colourless	Calm
Comments	Feature is not showing any signs of activity at present. Jean Batten geyser is steaming.							

[WTF2069 Pool N of Jean Batten Geyser]: Temperature and pH for entire record

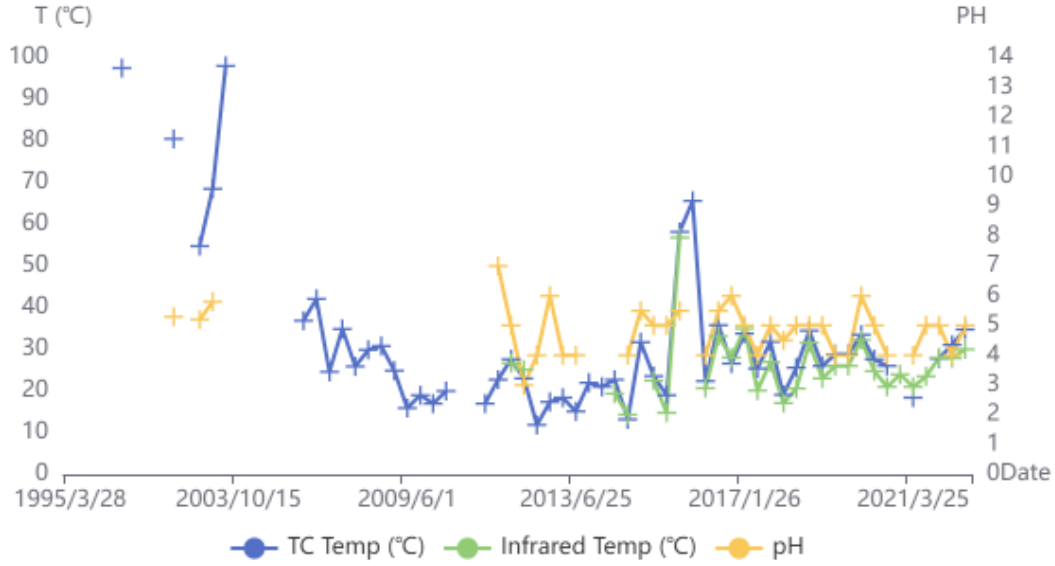


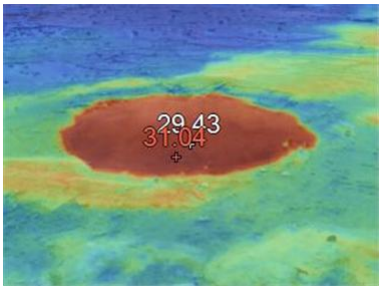
Fig.1 - taken on 2021-03-25 11:22:56"

Fig.2 - taken on 2022-05-09 12:13:39"

Fig.3 - taken on 2022-10-05 11:34:06"

Fig.4 - taken on 2022-12-09 12:39:18"

Fig.5 - taken on 2023-02-24 12:10:22"



Pool N of Jean Batten Geyser 24/02/2024

3074_194: WTF1069 Jean Batten Geyser

- The ground in front of the Geyser is cracking and hollow.
- The geyser was steaming at the visits in March 2021 and May 2022.

Location: -38.359252, 176.369758

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/05/09									Steaming
Comments	Ground in front of Jean Batten geyser cracking and hollow.								

[WTF1069 Jean Batten Geyser]: Temperature and pH for entire record

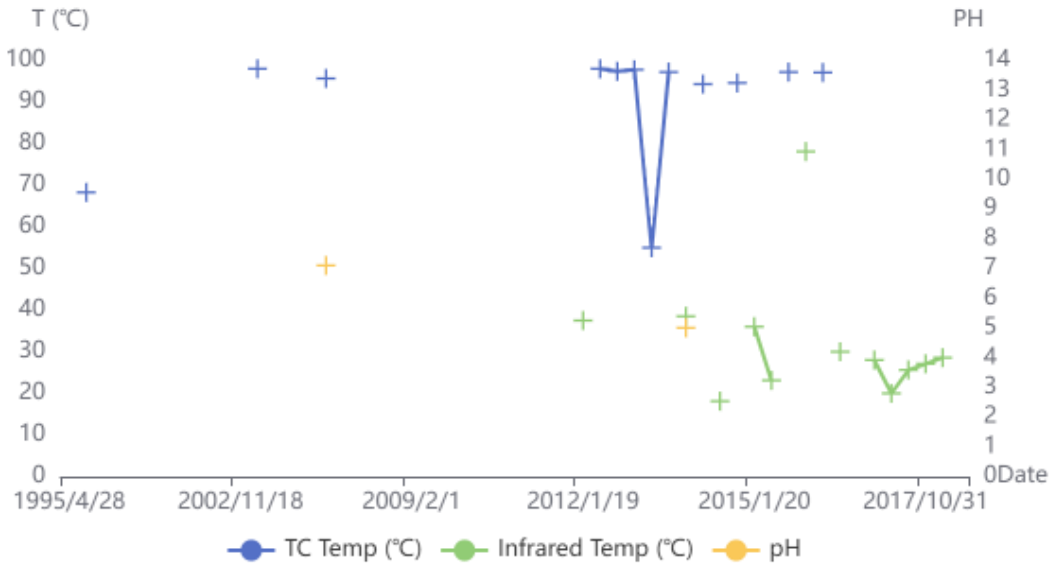



Fig.1 - taken on 2021-03-25 11:24:12"


Fig.2 - taken on 2022-05-09 12:17:19"

9.10 3074_195: Waiotapu Geyser

- The temperature decreased over the period from 81.7 °C in March 2021 to 66.5 °C in October 2022.
- The pH has dropped from pH5 to pH4.
- The area has been cordoned off behind a locked gate due to a rockfall, therefore we can no longer access the geyser.

Location: -38.361322, 176.369202

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	5.0	81.7	69.0	0.4		Clear	Colourless	Infrequent periods of low ebullience
2022/05/09	5.0	80.3	66.2	0.3		Clear	Colourless	Occasional bubbles
Comments	Path closed.							
2022/10/05	4.0	66.5	62.4	0.3		Murky	Colourless	Occasional large bubbles
Comments	Area is still cordoned off due to the rock falls in the area.							

[Waiotapu Geyser]: Temperature and pH for entire record

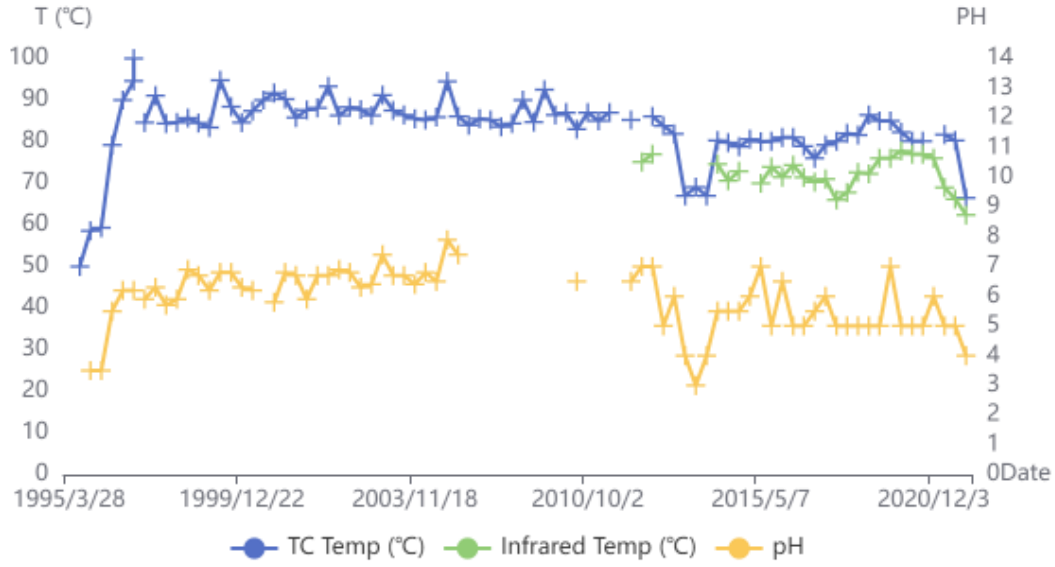
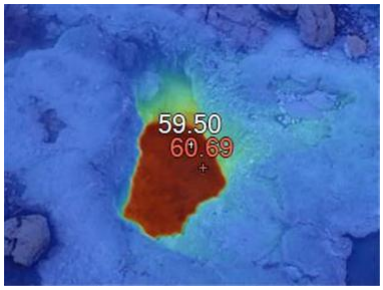


Fig.1 - taken on 2021-03-25 11:34:27"

Fig.2 - taken on 2022-05-09 12:31:55"

Fig.3 - taken on 2022-10-05 11:47:58"

Infrared photos:



Waiotapu geyser 05/10/2022

9.11 3074_199: WTF1075 Oyster Pool

- The temperature has fluctuated slightly over the period, with a temperature variation within 3.7 °C.
- The pH has remained at pH5 over the period.

Location: -38.361701, 176.369506

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	5.0	64.2	58.0			Milky	Blue - Grey	Constant ebullience
2022/05/09	5.0	67.3	62.5			Cloudy	Green - Light	Constant bubbling in centre and left of pool.
2022/10/05	5.0	67.1	53.3			Cloudy	Green - Light	Constant bubbling in centre and far left of pool.
2022/12/09	5.0	67.9	53.4		<0.05	Cloudy	Green - Light	Constant bubbling in centre of pool.
2023/02/24	5.0	66.9	59.3		<0.05	Cloudy	Green - Light	Constant bubbling in centre of pool.

[WTF1075 Oyster Pool]: Temperature and pH for entire record

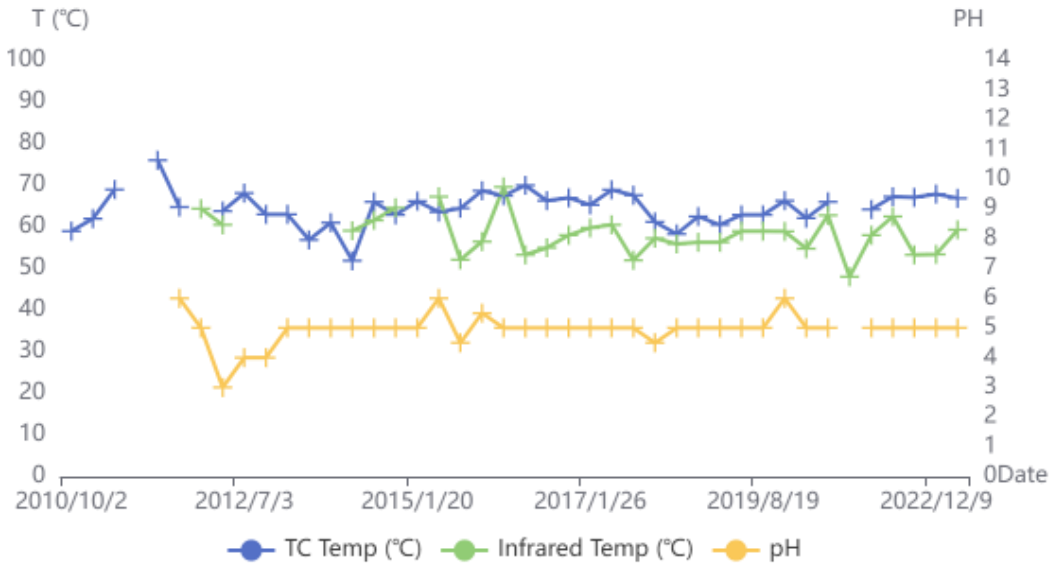


Fig.1 - taken on 2021-03-25 11:49:40"

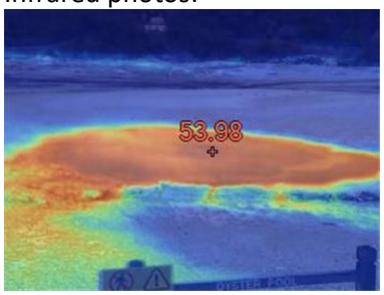
Fig.2 - taken on 2022-05-09 12:55:49"

Fig.3 - taken on 2022-10-05 12:23:36"

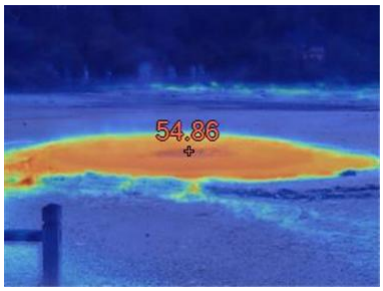
Fig.4 - taken on 2022-12-09 13:01:55"

Fig.5 - taken on 2023-02-24 12:32:10"

Infrared photos:



Oyster Pool 05/10/2022



Oyster Pool 24/02/2023

9.12 3074_212: WTF1088 Lake Ngakoro

- The temperature has increased slightly by 1.5 °C over the period. This was using the infrared gun from the platform.
- There has been an increase in sediment flowing into the lake from the inflow, as can be seen in the photos below.

Location: -38.363109, 176.36877

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/05/09				19.5			Murky	Green - Murky	Effervescing around edges
2022/10/05				18.0			Murky	Green	Calm
Comments	Could not measure from inflow due to gas alarms going off.								
2022/12/09				20.5	1.0		Cloudy	Green	Bubbling around edges.
2023/02/24				21.0	1.0		Murky	Green	Calm

[WTF1088 Lake Ngakoro]: Temperature and pH for entire record

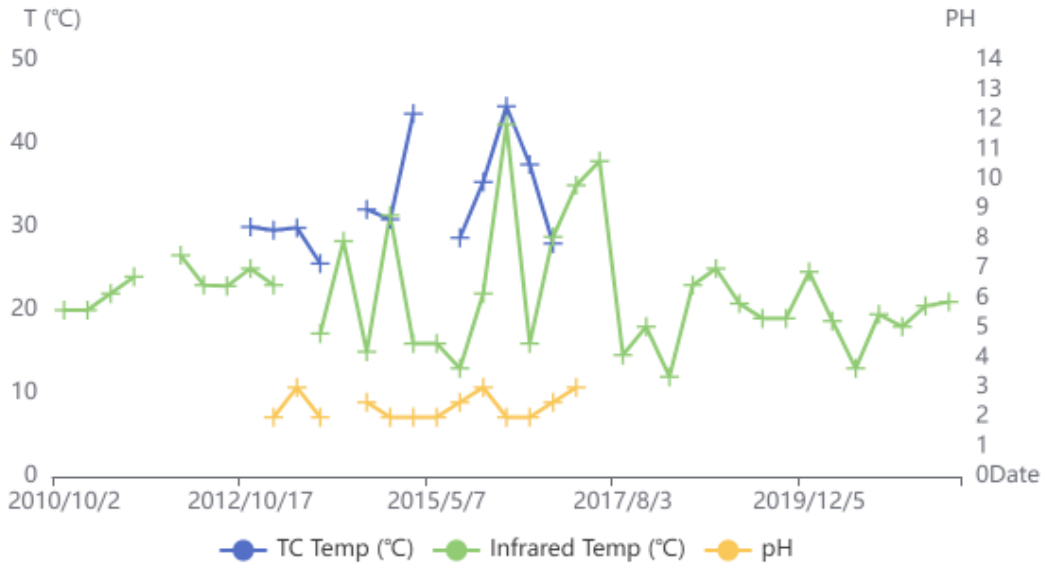


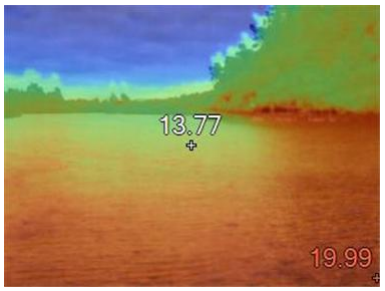
Fig.1 - taken on 2022-05-09 13:06:29"

Fig.2 - taken on 2022-10-05 12:05:15"

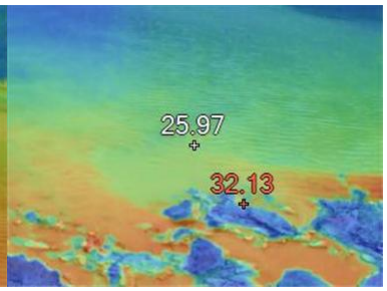
Fig.3 - taken on 2022-12-09 13:09:56"

Fig.4 - taken on 2023-02-24 12:53:09"

Infrared photos:



Lake Ngakoro 05/10/2022



Lake Ngakoro 24/03/2023

9.13 3074_296: Lake Ngakoro Inflow

- The temperature and pH have remained constant.
- We could not sample at every visit due to the gas monitors alarming.

Location: -38.363002, 176.368754

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2022/05/09							Cloudy	Green - Light	nd
Comments	Could not get sample as gas monitors alarming								
2022/10/05				32.4		<20.0	Murky	Green - Light	nd
2022/12/09	3.0	31.1		29.8		<40.0	Murky	Green - Light	nd
2023/02/24	3.0	31.2		30.9		<50.0	Cloudy	Green - Light	Nd
Comments	Could not access stream, gas monitors went off.								

[Lake Ngakoro inflow]: Temperature and pH for entire record

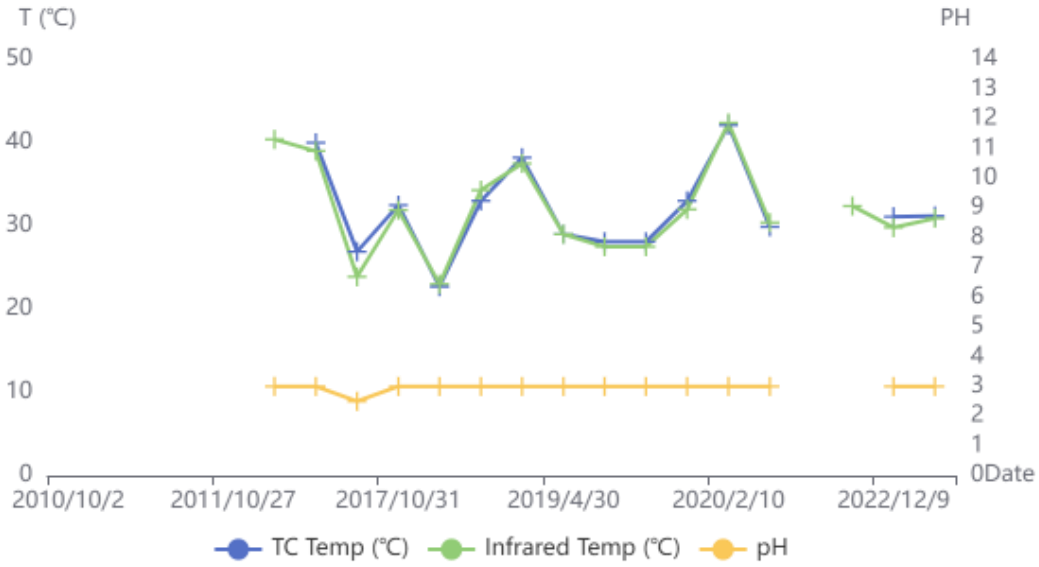


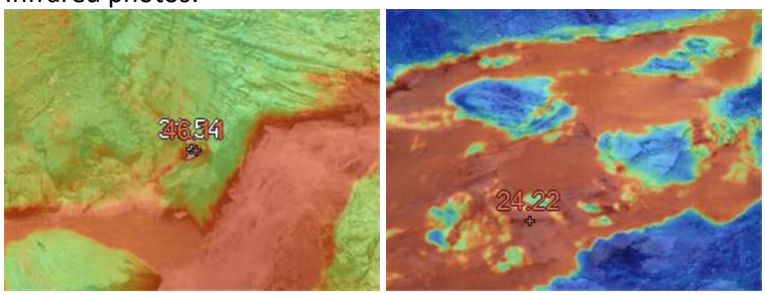
Fig.1 - taken on 2022-05-09 13:10:01"

Fig.2 - taken on 2022-10-05 12:11:47"

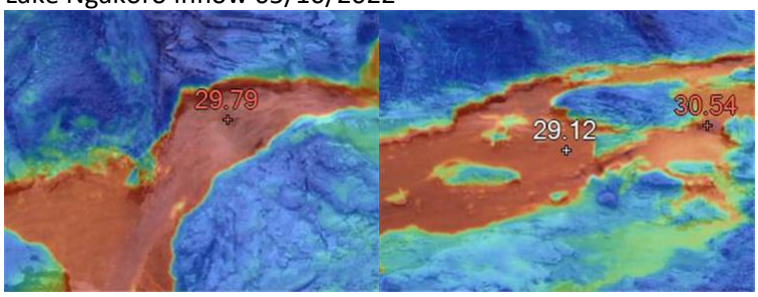
Fig.3 - taken on 2022-12-09 13:19:16"

Fig.4 - taken on 2023-02-24 12:47:22"

Infrared photos:



Lake Ngakoro inflow 05/10/2022



Lake Ngakoro Inflow 24/02/2023

9.14 3074_286: WTF3064 Champagne Pool Sampling Pt 3

- The temperature has fluctuated over the period, with the highest temperature of 78.5 °C recorded in March 2021, and the lowest temperature of 73.2 °C recorded in May 2022. It has since risen to 77.4 °C
- The pH has fluctuated between pH5 and pH6 over the period.

Location: -38.359253, 176.369403

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	6.0	78.5	63.0			Clear	Colourless	Constant low ebullience effervescent
2022/05/09	5.0	73.2	67.7			Murky	Green - Murky	Effervescing
2022/10/05	6.0	74.9	67.4			Murky	Green - Murky	Effervescing around edges
Comments	Lots of steam.							
2022/12/09	5.0	75.9	54.5			Murky	Green	nd
Comments	Gas monitors continually going off. Pool very steamy.							
2023/02/24	6.0	77.4	68.2	0.2		Clear	Green	Effervescing

[WTF3064 Champagne Pool Sampling Pt 3]: Temperature and pH for entire record

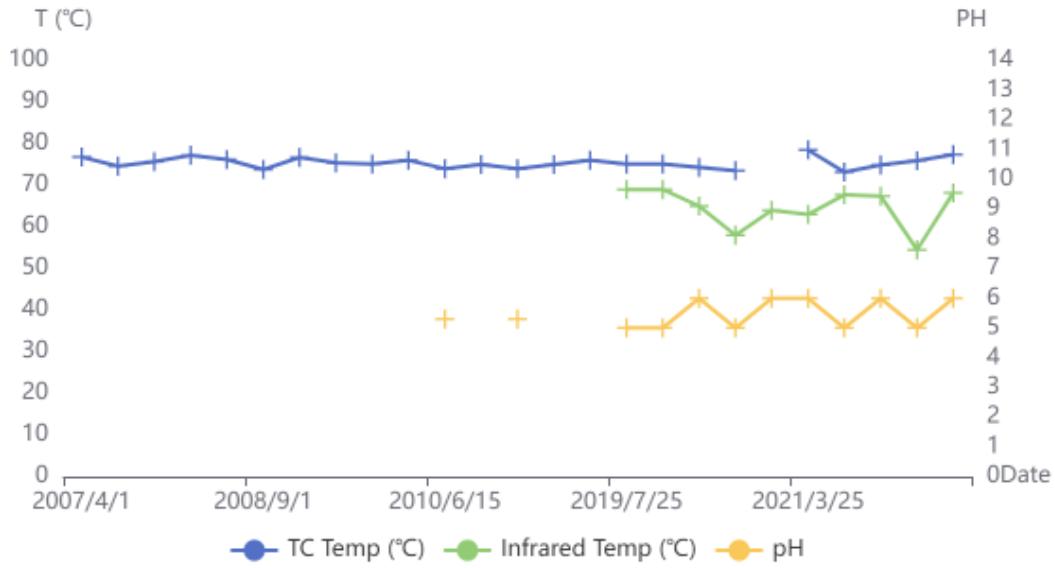


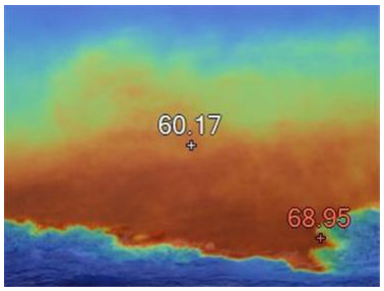
Fig.1 - taken on 2021-03-25 12:08:25"

Fig.2 - taken on 2022-05-09 13:36:38"

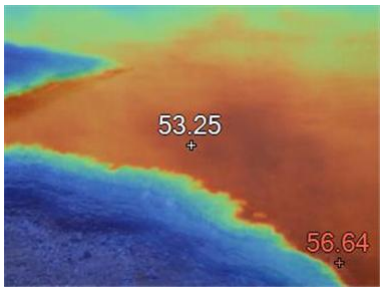
Fig.3 - taken on 2022-10-05 12:42:33"

Fig.4 - taken on 2023-02-24 13:15:53"

Infrared photos:



Champagne pool 05/10/2022



Champagne pool 24/03/2023

9.15 3074_184: WTF1060 Devil's Bath

- The feature showed an unusually high temperature of 31.5 °C in October 2022. All other visits recorded temperatures between 17.0 °C and 19.7 °C.
- The water level is higher that it has been in the past few years, covering the old high water mark. The new level reference is the round outcrop on the left of the pool, as can be seen in the last photo below.

Location: -38.357366, 176.367382

Date	pH	TC (°C)	Temp	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25				19.7			Milky	Green - Lime	None
2022/05/09				17.7			Cloudy	Green - Lime	Calm
Comments	Water level is high								
2022/10/05				31.5	2.0		Cloudy	Green - Lime	Occasional bubble in centre.
Comments	Water level high.								
2022/12/09				17.0	1.5		Cloudy	Green - Lime	Occasional bubbles on far side of pool.
2023/02/24				19.2	2.0		Cloudy	Green - Lime	Calm
Comments	Water level is quite high.								

[WTF1060 Devil's Bath]: Temperature and pH for entire record

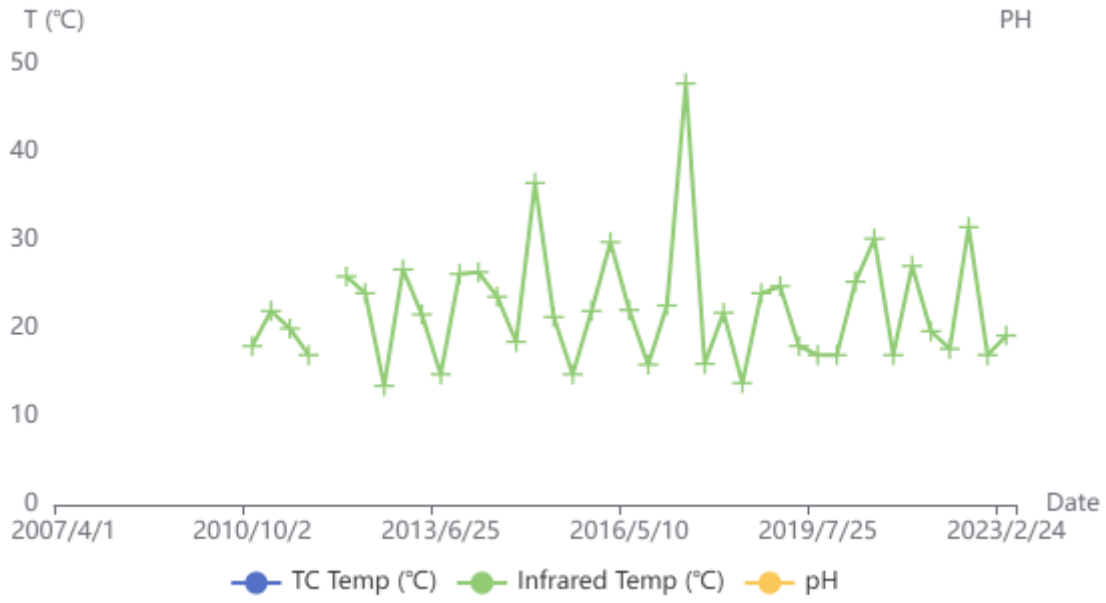


Fig.1 - taken on 2021-03-25 12:17:16"

Fig.2 - taken on 2022-05-09 13:47:53"

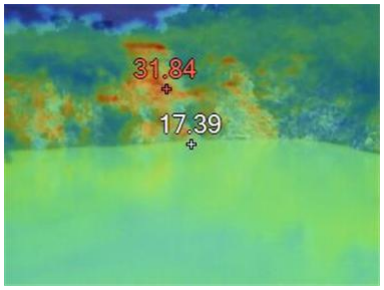
Fig.3 - taken on 2022-10-05 12:53:53"

Fig.4 - taken on 2022-12-09 13:50:23"

Fig.5 - taken on 2023-02-24 13:33:05"

Fig.6 - taken on 2023-02-24 13:33:58"

Infrared photos:



Devils bath 05/10/2022

9.16 3074_281: Waiotapu Loop Road Pools

- The pool often has bathers, we noted 10 bathers in May and 7 bathers in October.

Location: -38.35606, 176.364233

Date	Bathers	Clarity	Colour	Ebullition
2021/03/25	0	Cloudy	Colourless	Low
2022/05/09	10			
2022/10/05	7			
2023/02/24	0			

Fig.1 - taken on 2021-03-25 12:34:54"

Fig.2 - taken on 2021-03-25 12:34:59"

Fig.3 - taken on 2023-02-24 13:52:23"

Fig.4 - taken on 2023-02-24 13:52:30"

10 Whangairorohea

10.1 3076_1: Tahunaatapu Pool

- The temperature of the pool has increased by 5.1 °C since the previous visit in March 2021.
- The colour of the pool has changed, and the pool is now overflowing.
- The pH has remained the same over the period.
- The algal communities have decreased on the pool surface.

Location: -38.505112, 176.245156

Date	pH	TC Temp (°C)	Infrared Temp (°C)	Level (m)	Flow (l/s)	Clarity	Colour	Ebullition
2021/03/25	7.0	36.9	36.0			Clear	Colourless	Low but persistent in the centre of pool
Comments	Algal communities floating on surface							
2022/12/05	7.0	42.0	41.0	0.39	<5.0	Clear	Blue - Green	Periodic small bubbles in centre of pool.
Comments	Brown algae around edges of pool and floating on the surface on left side of pool.							

[Tahunaatapu Pool]: Temperature and pH for entire record

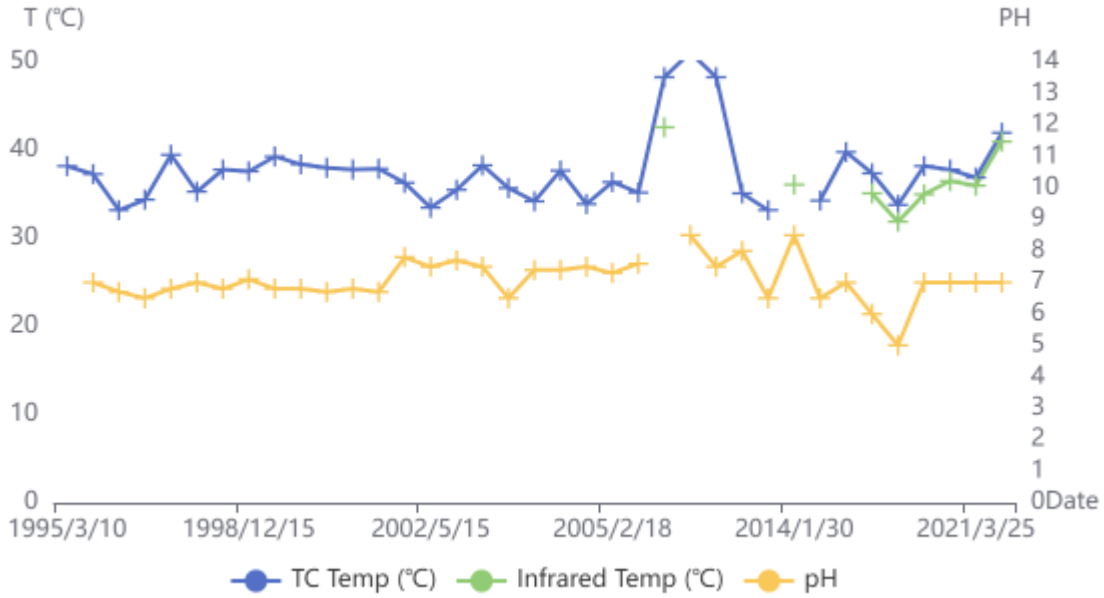


Fig.1 - taken on 2021-03-25 14:56:13"

Fig.2 - taken on 2021-03-25 14:56:34"

Fig.3 - taken on 2021-03-25 14:56:56"

Fig.4 - taken on 2022-12-05 13:01:05"

Fig.5 - taken on 2022-12-05 13:01:30"

Fig.6 - taken on 2022-12-05 13:01:56"