

Mapping of Geothermal Streams and Springs

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1 Introduction

The Resource Management Act 1991 (RMA) requires that regional councils sustainably manage the geothermal resource. Geothermal features are a part of the geothermal resource and in some cases are outstanding natural features to be protected from inappropriate use and development (RMA s6(b)). Throughout the region, most geothermal features and ecosystems are adversely affected to a greater or lesser degree by geothermal resource use or uses of land and water. Section 35(1) & (2a) of the RMA requires regional councils to gather information and undertake or commission research, and monitor the state of the environment as necessary to carry out its functions.

Geothermal streams (streams with a temperature greater than 30 °C) and sinter-depositing springs are among the feature types classed as Significant Geothermal Features by the Waikato Regional Policy Statement (RPS). The RPS and Waikato Regional Plan contain policies and methods relating to the protection of Significant Geothermal Features. In addition the Waikato Regional Plan contains Rule 3.8.4.9 controlling drilling near geothermal features that naturally discharge liquid geothermal water (Geothermal Water Features).

As required by the RPS, the Geothermal Module of Waikato Regional Plan contains maps of Significant Geothermal Features in Development and Limited Development Geothermal Systems. It also contains maps of Geothermal Water Features within those system types.

From time to time, changes to the maps may be required if, for example, new features are discovered or new ones form, existing non-significant features become significant (or vice versa) through either a change in their nature or new understanding of their significance, or if the definition of the feature types changes. In addition, geothermal features can change in their extent, and improvements in mapping technology or the application of more detailed field investigations can lead to more accurate mapping of the features.

This report maps the extent of some geothermal streams and the location of some geothermal springs in Development Geothermal Systems and Limited Development Geothermal Systems. Some of these have not been previously mapped, while others have been mapped, but needed to be done so with greater accuracy.

This report presents the results of field investigations undertaken by Nicholas Holwerda and Ian Blair in late January 2007 to achieve that purpose.

Sites were visited at the following locations:

Geothermal Field	Site
Mokai	Waipapa Stream
Ngatamariki	Mangamingi Stream
Rotokawa	Lower Parariki Stream
Tauhara	Upper Otumuheke Stream
Wairakei	Hall of Fame Stream
	Te Rautehuia Stream
	Upper Te Kiri O Hine Kai Stream
	Waipouwerawera Stream
	Upper Wairakei Stream

2 Sites

2.1 Mokai

Stream name: Waipapa
Location: Rogerson Road
Date Visited: 24/01/2007

- No part of the main stream $>26.2^{\circ}\text{C}$. Therefore not considered geothermal.
- Discharge = 2m^3 , stream temperature range 21.8°C to 26.2°C .
- Stream only accessible at one point due to steep gorge and thick vegetation
- There was one major spring in existence. It had an area of $30\text{m} \times 10\text{m}$ (site **D**). It was bubbling up, producing a sulphur smell and steam. This spring was discharging 40 l s^{-1} into a small channel, temperature 56.1°C .
- There was one small spring downstream of the main spring on the river banks. Upstream of the main spring there were 19 small springs exiting holes in the gorge into the main stream. These ranged in discharge 2 l s^{-1} to 10 l s^{-1} and temperature range 56.1°C to 65.4°C . These springs could not be GPS, due to the gully.
- Springs were not encountered more than 250 m upstream of the main spring.
- The stream vegetation consisted of primarily native vegetation with some exotic scrub. The substrate was mostly cobbles and sand.
- Access up the stream was very difficult and any further mapping of the area would be hazardous.
- Site **D** (main Spring) = temp 56.1°C

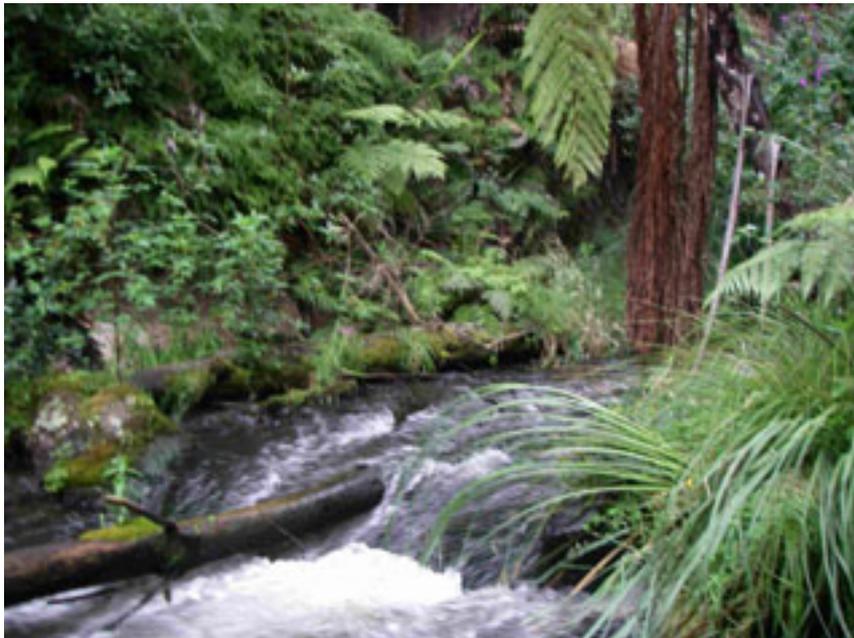


Figure 2-1 Main Waipapa stream in gorge



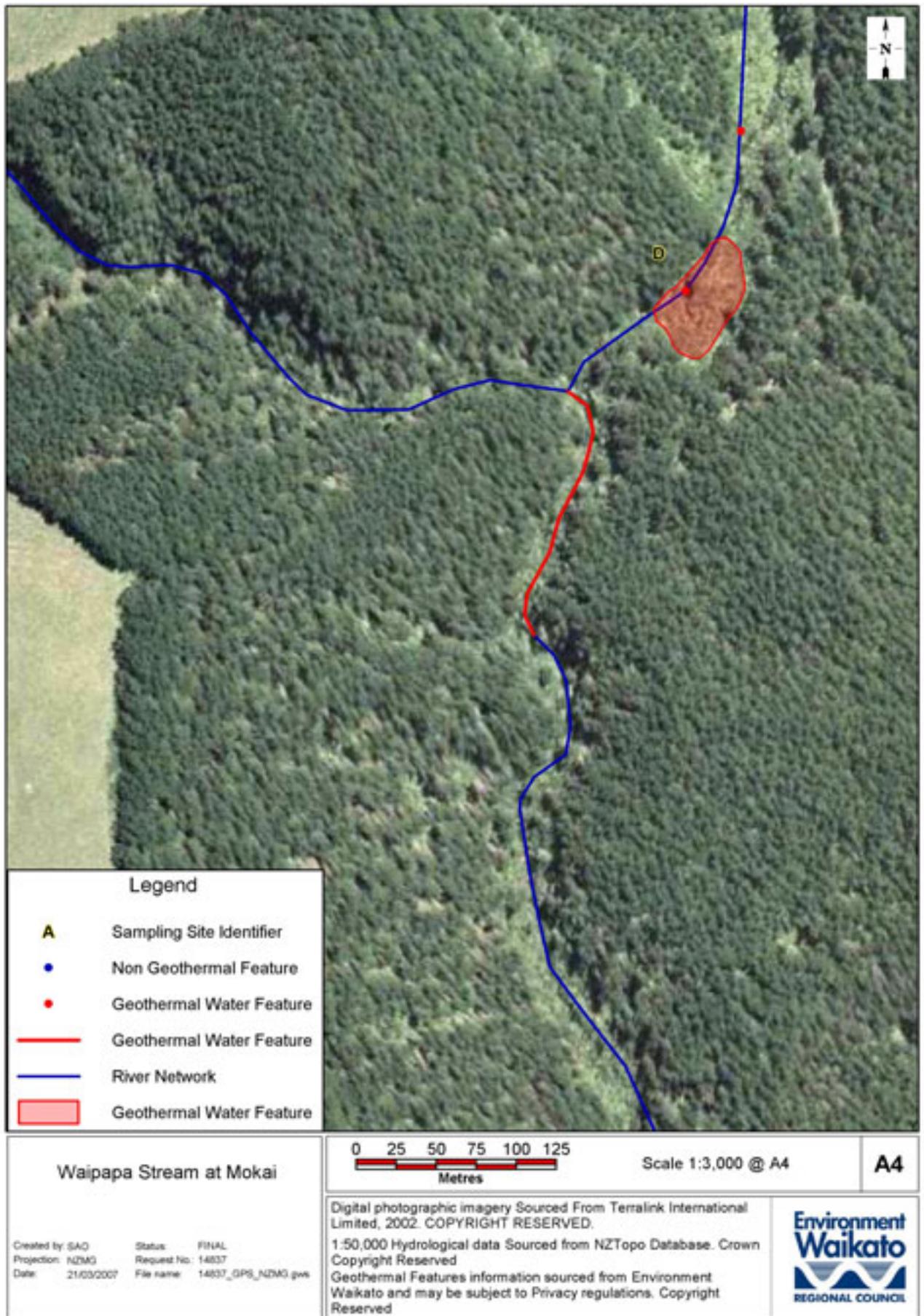
Figure 2-2: One of 19 springs exiting side of gorge wall



Figure 2-3: Small spring bubbling up in gorge



Figure 2-4: Main spring discharging 40ls-1, Site: D



Map 2-1: Waipapa Stream sites

2.2 Ngatamariki: Mangamingi Stream

Stream Name: Mangamingi

Location: Arawa Road

Date Visited: 24/01/2007

- No part of the stream observed to be $>21.1^{\circ}\text{C}$. Discharge $Q = 40\text{ls}^{-1}$
- Stream very hard to access due to thick vegetation
- There may have been some springs under the vegetation because the stream temperature rose from 14.4°C to 21.1°C over the length of the stream mapped.
- The stream vegetation consisted of native scrub and exotic plantation, the substrate was primarily cobbles and sand pumice.
- There were two wells located in the area. These wells were not in use. They were discharging gas and steam out of a pressure release valve. The catchment pond for one of the wells was 27.2°C .
- This stream was not mapped as geothermal but there did appear to be geothermal activity in the area.
- Site **C** (Stream water) = temperature 15.7°C
- Site **B** (well overflow pond) = temperature 27.2°C
- Site **A** (Capped well)



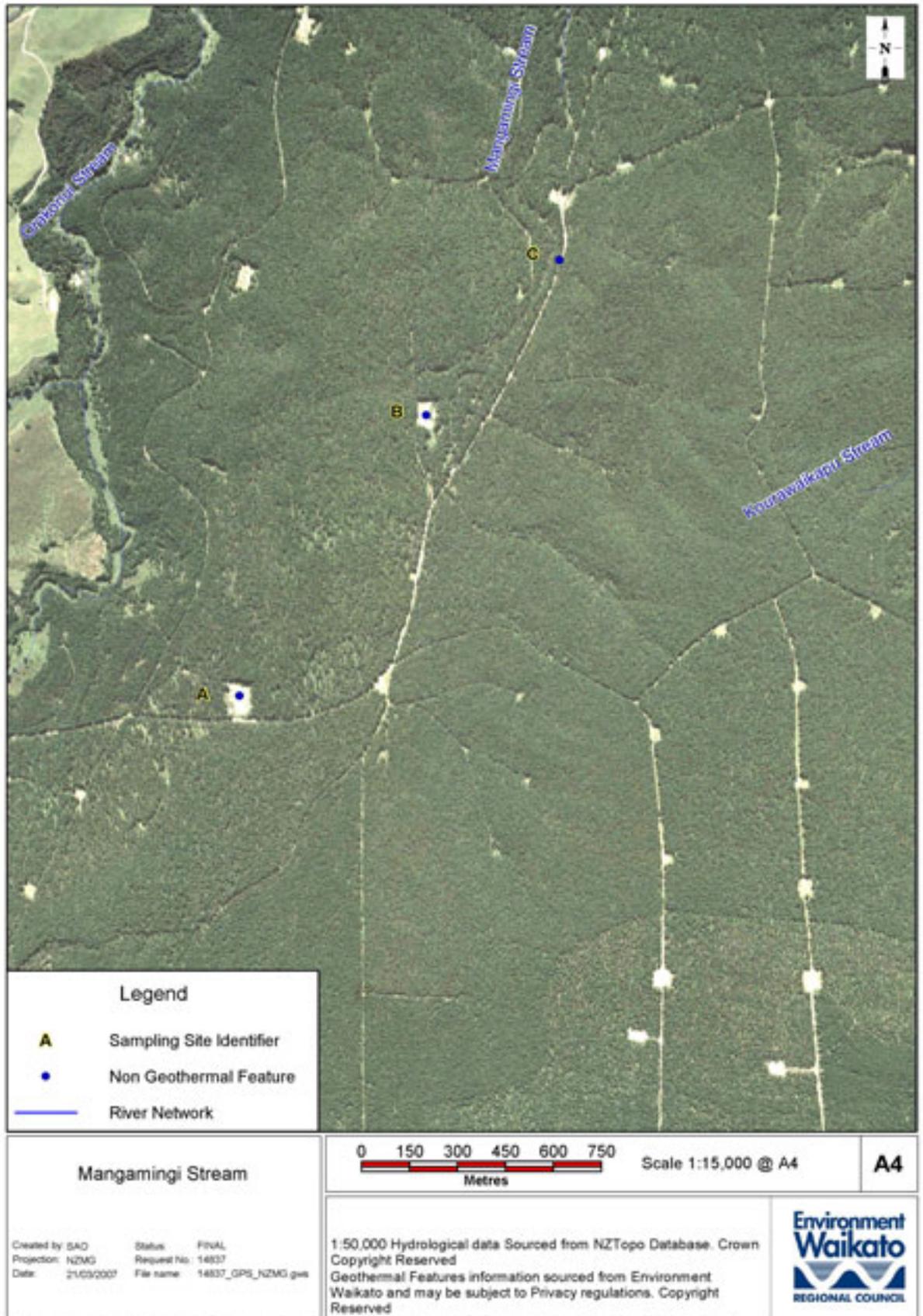
Figure 2-5: Well #2, Site: A



Figure 2-6: Well #2 holding pond 27.2°C, Site: B



Figure 2-7: Well #3 discharging gas/steam vent, Site: B



Map 2-2: Mangamingi Stream Sites

2.3 Rotokawa: Lower Parariki Stream

Stream Name: Parariki

Location: Tauhara trust Land, (accessed through Wairakei Pastoral Forestry Land)

Date Visited: 31/01/2007

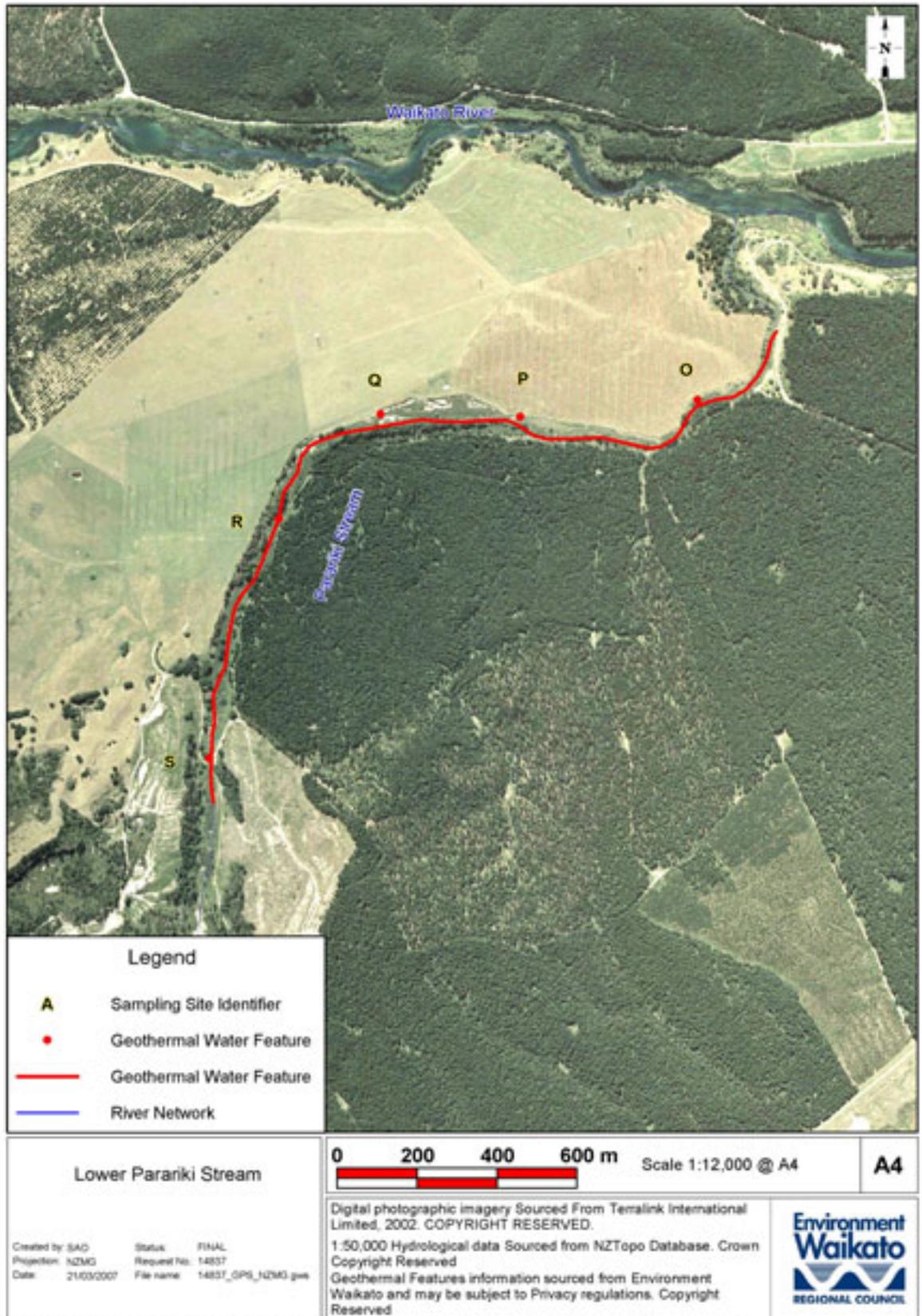
- Every point of stream sampled was $>30^{\circ}\text{C}$. Temperature range from 38.1°C at upper bridge site, to 32.6°C at lower site.
- Stream very easy to access at all locations down from bridge to Waikato River.
- Stream partially shaded, with native scrub and exotic plantation. The bed was mostly small gravels and sand
- Extent of geothermal mapped area has been inferred upstream and downstream from the GPS points. Previous mapping shows geothermal water upstream of point **S**. Geothermal water has been estimated to exist 300 m d/s of point **O**
- Site **O** (stream water) = temperature 32.6°C
- Site **P** (stream water) = temperature 34.4°C
- Site **Q** (stream water) = temperature 34.6°C
- Site **R** (stream water) = temperature 35.7°C
- Site **S** (stream water) = temperature 38.1°C



Figure 2-8: Upper bridge site, 38.1°C , Site: **S**



Figure 2-9: Lower site on stream 34.6°C , Site: **Q**



Map 2-3: Lower Parariki Stream Sites

2.4 Tauhara: Broadlands Rd Reserve Stream

Stream Name: Otumuheke
Location: Taupo Pony Club
Date Visited: 24/01/2007

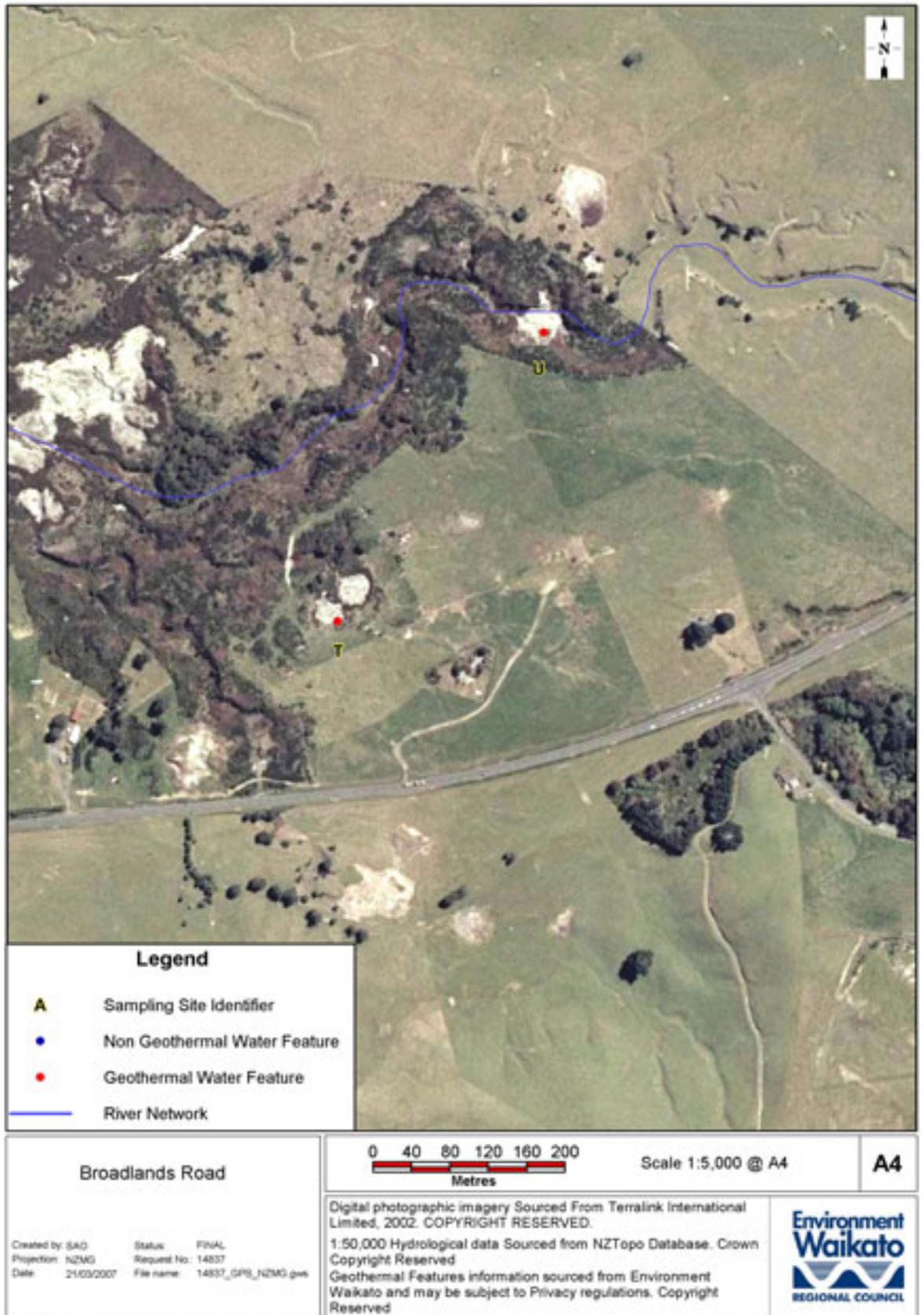
- No surface water present in Gully
- Two steaming fumaroles present in gully, discharging steam and sulphur smell.
- Gully very difficult to access due to steep cliffs and thick vegetation
- Site **T** (steaming fumarole – feature)
- Site **U** (steaming fumarole – feature)



Figure 2-10: Steaming fumarole area, Site: T



Figure 2-11: Steaming area in gully, Site: T



Map 2-4: Broadlands Rd Sites

2.5 Wairakei

2.5.1 Hall of Fame Stream (also Waikato River)

Stream Name: Hall of fame Stream

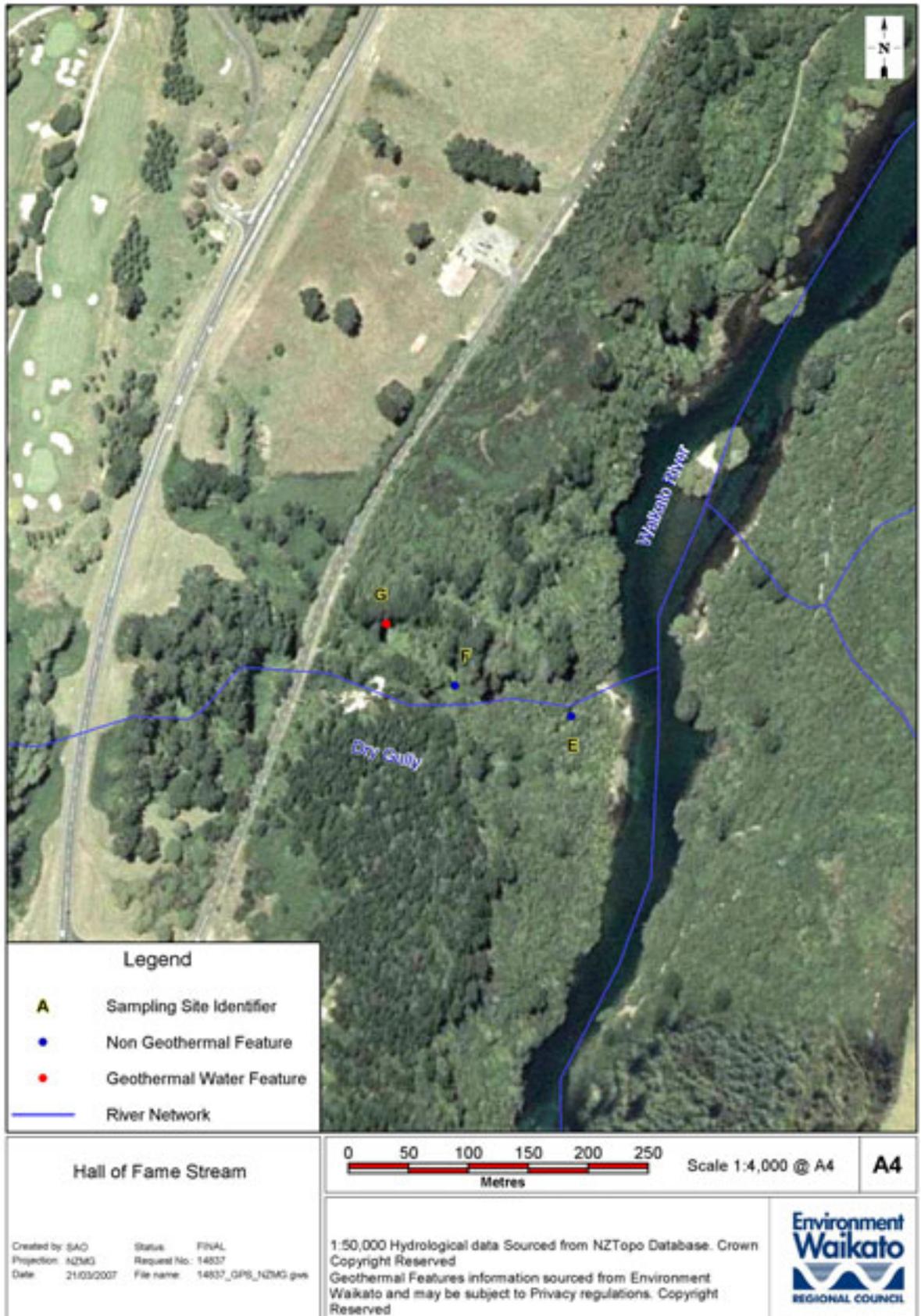
Location: Te Totara Valley Track

Date Visited: 25/01/2007

- The stream emerged from a cave as a spring from underground. The first 3m of stream reach measured at 30.1°C. The approx. discharge was 5 ls⁻¹
- The stream was accessible at all points along the walkway, so easily sampled.
- There were two small springs found further down the walkway towards Wairakei yet these were only 24.0°C (not geothermal).
- There was a sign at the junction of the stream and Waikato River saying 'Hot water beach'. We were not able to find any hot water source at this location. We assumed the stream water was the source of warmer water.
- The stream was well shaded and vegetation was primarily native vegetation with some blackberry.
- Site **E** (stream water) = 28.4°C
- Site **F** (stream water) = 29.4°C
- Site **G** (stream water) = 30.1°C



Figure 2-12: Hall of Fame stream, coming out of cave with temperature of 30.1°C, Site: **G**



Map 2-5: Hall of Fame stream

2.5.2 Te Rautehuia Stream

Stream Name: Te Rautehuia

Location: Wairakei North – Landcorp station

Date Visited: 31/02/2007

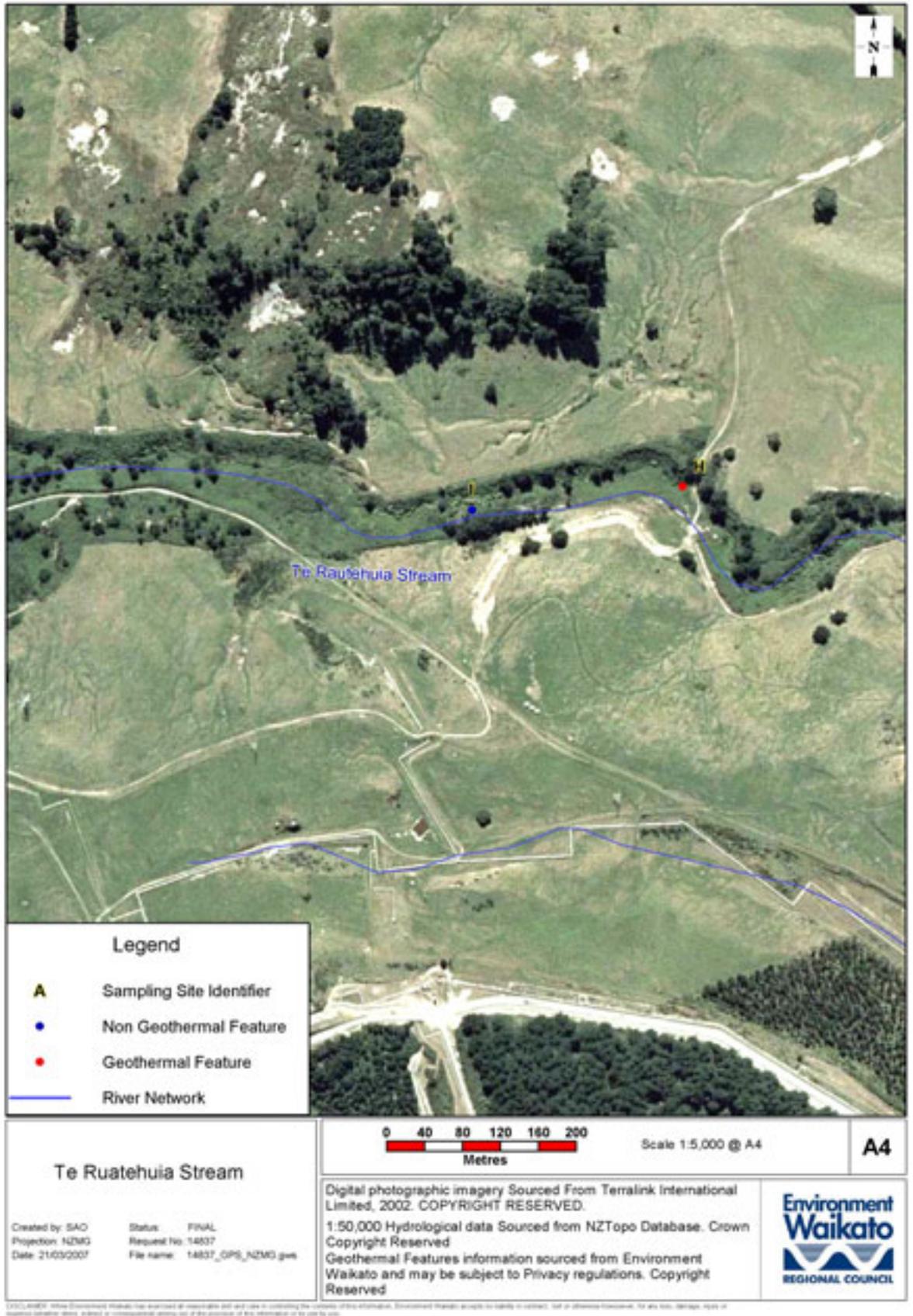
- The stream was accessed by travelling through Landcorp station land (Wairakei North)
- This area has significant geothermal activity with several fumaroles present on cliff faces in the valley. These were only discharging steam, no water.
- No part of the stream was greater than 21.1°C. The stream was discharging approx 80 ls⁻¹ to 150 ls⁻¹ from the upstream site to the downstream site.
- The stream was very hard to access with only two locations along its reach sampled. The valley was extremely blackberry-choked and would prove hazardous if attempting to sample the stream.
- There was one large geothermal spring present in the stream valley, (Site **H**). This spring was next to the main stream bridge and has been used for singeing pigs. It is approx 4 m diameter and 0.2 m deep. Its temperature was 72.0°C and discharging 8 ls⁻¹ down a 5 m reach into the main stream. This input to the main stream only raised the temperature by 1.0°C, therefore was diluted quickly.
- The stream was well shaded and the valley blackberry-choked.
- Site **H** (Main Spring) = temperature 72.1°C
- Site **I** (Stream water) = temperature 19.0°C



Figure 2-13: Fumarole in Valley



Figure 2-14: Main Geothermal Spring, temperature 72.1°C, Site: H



Map 2-6: Te Rautehuia Stream

2.5.3 Upper Te Kiri O Hine Kai Stream (aka Kiriohineki)

Stream Name: Upper Te Kiri O Hine Kai

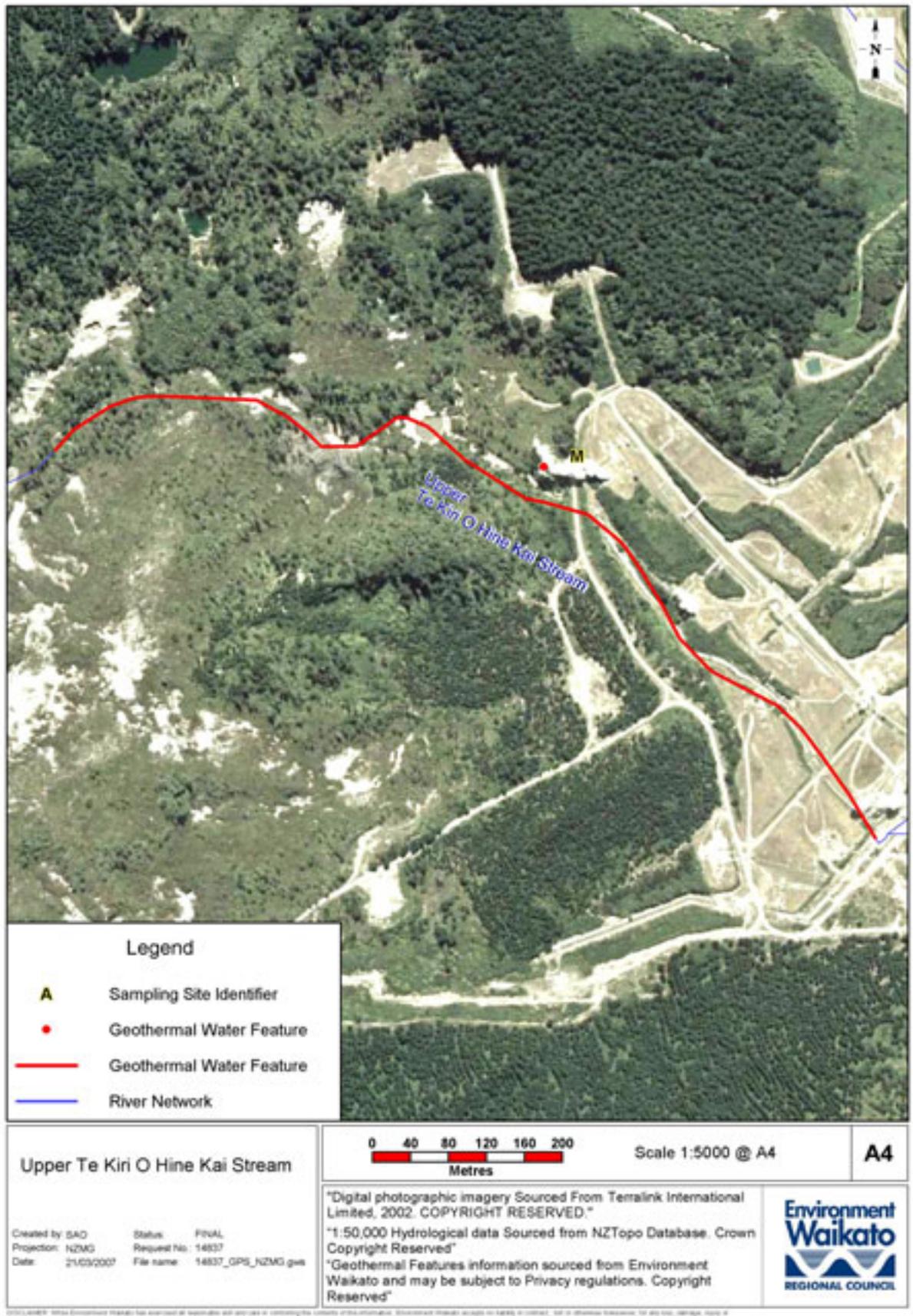
Location: Contact Energy Bore Field

Date Visited: 25/01/2007

- Stream only accessible at one location along whole stream reach. Very steep cliffs in valley, unstable geothermal ground and thick vegetation.
- Site sampled, discharge 5 ls^{-1} and temperature 52.4°C .
- There was a small side stream/channel discharging 20 ls^{-1} at 80.2°C just downstream of the sampled location. Therefore stream considered geothermal right down the reach.
- The main stream had a white slime growing in the water, this was choking the stream.
- Site **M** (stream water) = temperature 52.4°C
- The extent of the geothermal mapped area on the map has been inferred from our field observations and Contact Energy information.



Figure 2-15: Sampling the stream, 52.4°C , Site: M



Map 2-7: Upper Te Kiri O Hine Kai Stream

2.5.4 Upper Wairakei Stream

Stream Name: Wairakei Stream

Location: Thermal Valley Tourist Venture Walkway

Date Visited: 25/01/2007

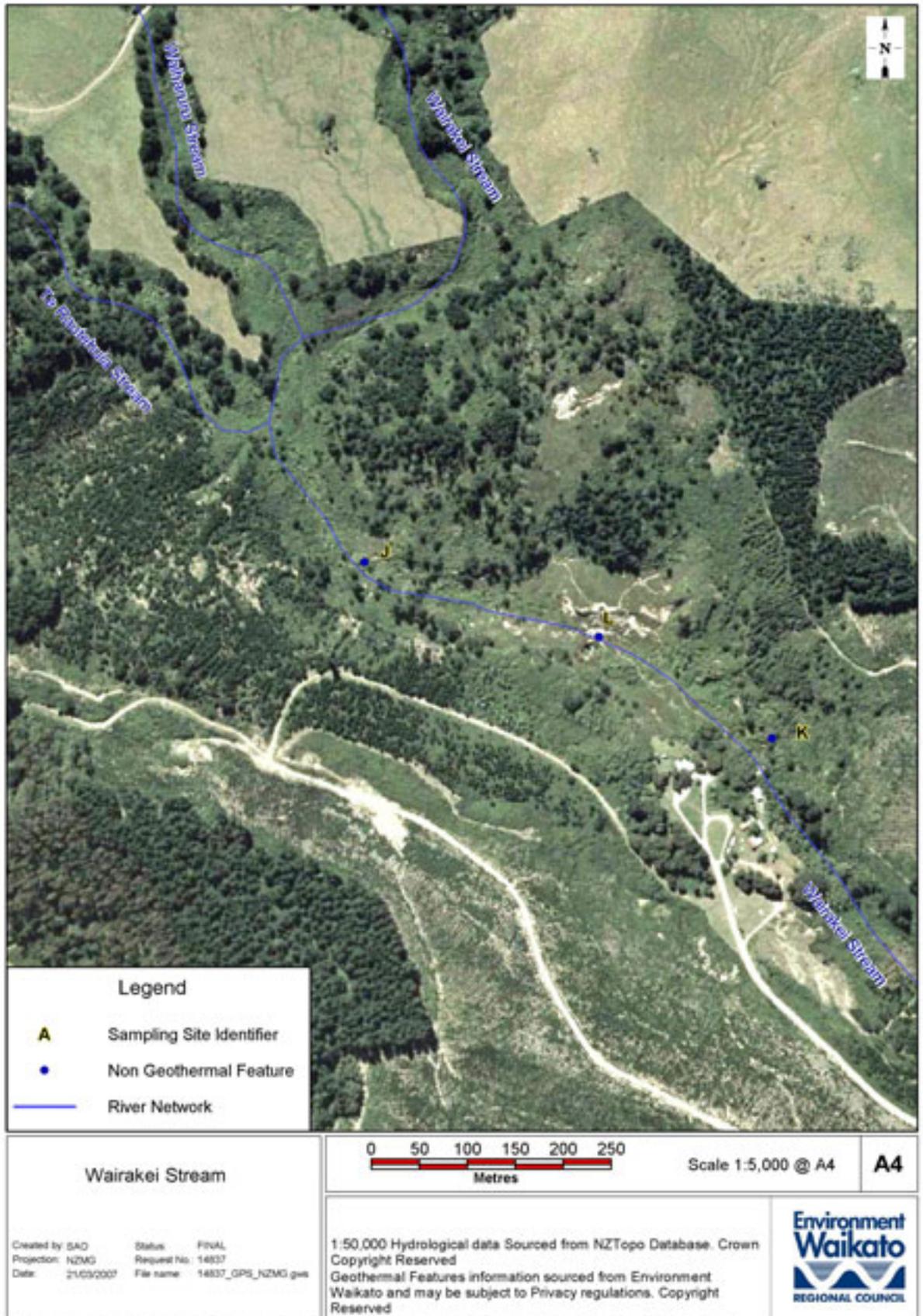
- The stream is located on the tourist venture land. It was accessed along the tourist walkway that goes up the valley.
- The stream was very hard to access due to thick vegetation and unstable ground. It was only sampled in 3 locations where the track crossed the stream.
- No part of the stream was geothermal, temperature 21.1°C, discharge 120 ls⁻¹.
- There were several inactive geothermal features in the valley.
- The stream was well shaded and vegetation was primarily native scrub.
- Site J (Stream water) = temperature 21.1°C
- Site K (stream water) = temperature 21.1°C
- Site L (stream water) = temperature 20.9°C



Figure 2-16: Wairakei Gully, Looking upstream from site: J



Figure 2-17: Wairakei Stream, 21.1°C, some steam ejecting out of vent along side stream. Site: L



Map 2-8: Upper Wairakei Stream

2.5.5 Waipouwerawera Stream

Stream name: Waipouwerawera

Location: McLachlan farms

Date Visited: 25/01/2007

- Stream accessible at one point only – at small pump shed behind house.
- Stream temperature 15.6°C, discharge 20 l s⁻¹, no geothermal activity present in area.
- Fumarole extinct for 10-15 years
- Site **N** (stream water) = temperature 15.6°C



Map 2-9: Waipouwerawera Stream

Appendix 1: Site data

Site:	GPS, Map reference ID	GPS locations		Stream/Site Temp
		Easting	Northing	
Mokai				
Waipapa Stream	D	2767841	6300943	56.1
Ngatamariki				
Mangamingi Stream				
	C	2788097	6291847	15.7
	B	2787680	6291357	27.2
	A	2787096	6290471	
Rotokawa				
Lower Parariki Stream	S	2789182	6282612	38.1
	R	2789356	6283216	35.7
	Q	2789611	6283480	34.6
	P	2789960	6283473	34.4
	O	2790403	6283515	32.6
Tauhara				
Broadlands Rd Stream	U	2781498	6275922	
	T	2781283	6275618	
Wairakei				
Hall of Fame Stream	G	2778966	6280167	30.1
	F	2779023	6280115	29.4
	E	2779120	6280089	28.4
Te Rautehuia Stream	I	2776585	6283603	19
	H	2776807	6283628	72.1
Upper Te Kiri O Hine Kai Stream	M	2777040	6282331	52.4
Upper Wairakei Stream	L	2778502	6283028	20.9
	K	2778682	6282921	21.1
	J	2778258	6283107	21.1
Waipouwerawera Stream	N	2775009	6280238	15.6