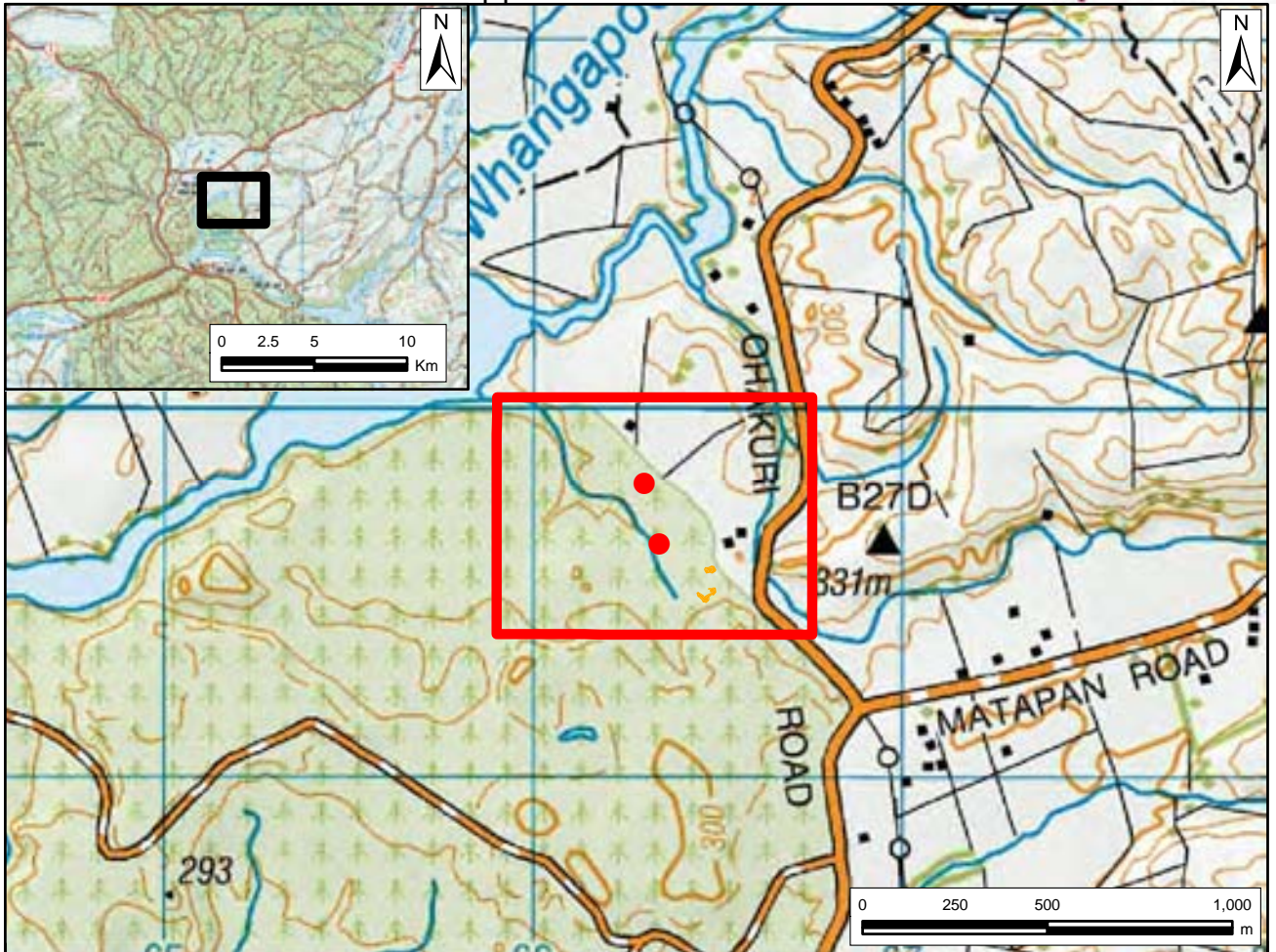


1.5 ATIAMURI GEOTHERMAL FIELD

List of Geothermal Sites

ATV01	Upper Atiamuri West
ATV02	Whangapoa Springs
ATV03	Matapan Road



UPPER ATIAMURI WEST

Site Number:	ATV01 ¹
Grid Reference:	NZTopo50 BF36 663 497; BF36 663 496
GPS Reference:	NZTM E1866297 N5749798; E1866338 N5749636
Local Authority:	Rotorua
Ecological District:	Atiamuri
Geothermal Field:	Atiamuri
Bioclimatic Zone:	Lowland
Tenure:	Unprotected private land
Altitude:	c.240 m
Extent of Geothermal Habitat	<0.1 ha
Extent of Geothermal Vegetation:	<0.1 ha
Date of Field Survey:	5 February 2007

VEGETATION		LANDFORM	EXTENT
CODE	TYPE		
04.08 04.08.01	Blackberry-dominant scrub Blackberry scrub Dense blackberry with common Himalayan honeysuckle and broom over a tomo with a geothermal spring at the base (2 m wide and 2.5 m deep). The sides of the hole have scattered <i>Hypolepis distans</i> . A sinter deposit which extends c.1 m into the tomo is present.	Geothermal pit (c.2 m diameter).	<0.1 ha
13.01 13.01.01	Herbfield <i>Polygonum maculosa</i> herbfield A small fumarole (0.3 m diameter) surrounded by a dense patch of <i>Polygonum maculosa</i> with smaller patches of black nightshade (<i>Solanum nigrum</i>) and occasional Yorkshire fog.	Quenched fumarole (0.3 m diameter). Geothermal pit (c.2 m diameter).	<0.1 ha

Geophysical Assessment²:

Overview of field work and background:

The site was inspected on 5 February 2007 in the early afternoon. Overcast conditions prevailed the whole day, it was calm, air and ground temperatures were still in the range of 20° and 22°C. Two smaller previously unknown manifestations had been recently reported by the farmer, Mr B. Bergs.

A circular pit exposing an active thermal spring:

A subsurface thermal spring discharges at the bottom of a c.2.5 m deep, almost circular pit (diameter c.2 m) on Bergs Farm at E1866338 N5749636. The site lies c.190 m north-west from the Southern Atiamuri Hot Pool. Hot water with a temperature of 59.3°C flows as a trickle across the bottom of the pit. The upper part of the almost vertical wall of the pit exposes a grey, c.0.5 m thick, old silica sinter layer. The pit lies on top of a c.2.5 m high sinter mound which points to a long deposition history of this manifestation. The trickle flow of thermal water at the bottom drains through a subsurface

¹ Previously identified as U16/10 in Wildland Consultants (2004 and 2007a).

² Undertaken by Hochstein in 2007.

layer. The sinter mound is overgrown with dense scrub. The temperature of the hot spring is close to that measured at the surface of the nearby Upper Atiamuri hot pools (Site U16/6). No simple explanation can be put forward to describe the processes which might have led to the formation of a deep, vertical pit on top of an obviously old sinter mound.

A quenched fumarole: About 350 m to the northwest from the southern Atiamuri hot pool, also on Bergs Farm at E1866297 N5749798, there is a small thermal feature which appears to be a quenched fumarole which occurs within a vertical vent of <0.3 m diameter. The vent is out of sight and occurs at the bottom of a c.2 m deep and c.5 m wide depression which is overgrown by a dense exotic herbfield. Near the top of the vent, steam is condensed by liquid, black mud. The stable temperature c.0.1 m inside the mud layer was 97.5°C. The ground around the vent is heated to c.40°C at the surface, about 0.5 m away. Quenching of steam is associated with a hissing and bubbling noise. This feature was not described as a ‚boiling mud pool’ because of its small size.

Indigenous Flora: No threatened species are present, however *Hypolepis distans*, a characteristic species of geothermal wetlands is present.

Fauna: Common indigenous and introduced bird species typical of the habitat are likely to be present.

Current Condition (2007 Assessment): The geothermal sites are fenced, but are dominated by exotic plant species.

**Threats/Modification/
Vulnerability:**

Invasive pest plants (2007 Assessment): Blackberry, Himalayan honeysuckle and broom dominate the site, together comprising over 90% of the cover.

Human impacts (2007 Assessment): The site is surrounded by farmland.

Grazing (2007 Assessment): The geothermal areas are fenced from stock.

Adjoining land use (2007 Assessment): Farmland

Site Change:

Recent change: This site has not been revisited by the authors since 2007, but is unlikely to have undergone significant change over this timeframe.

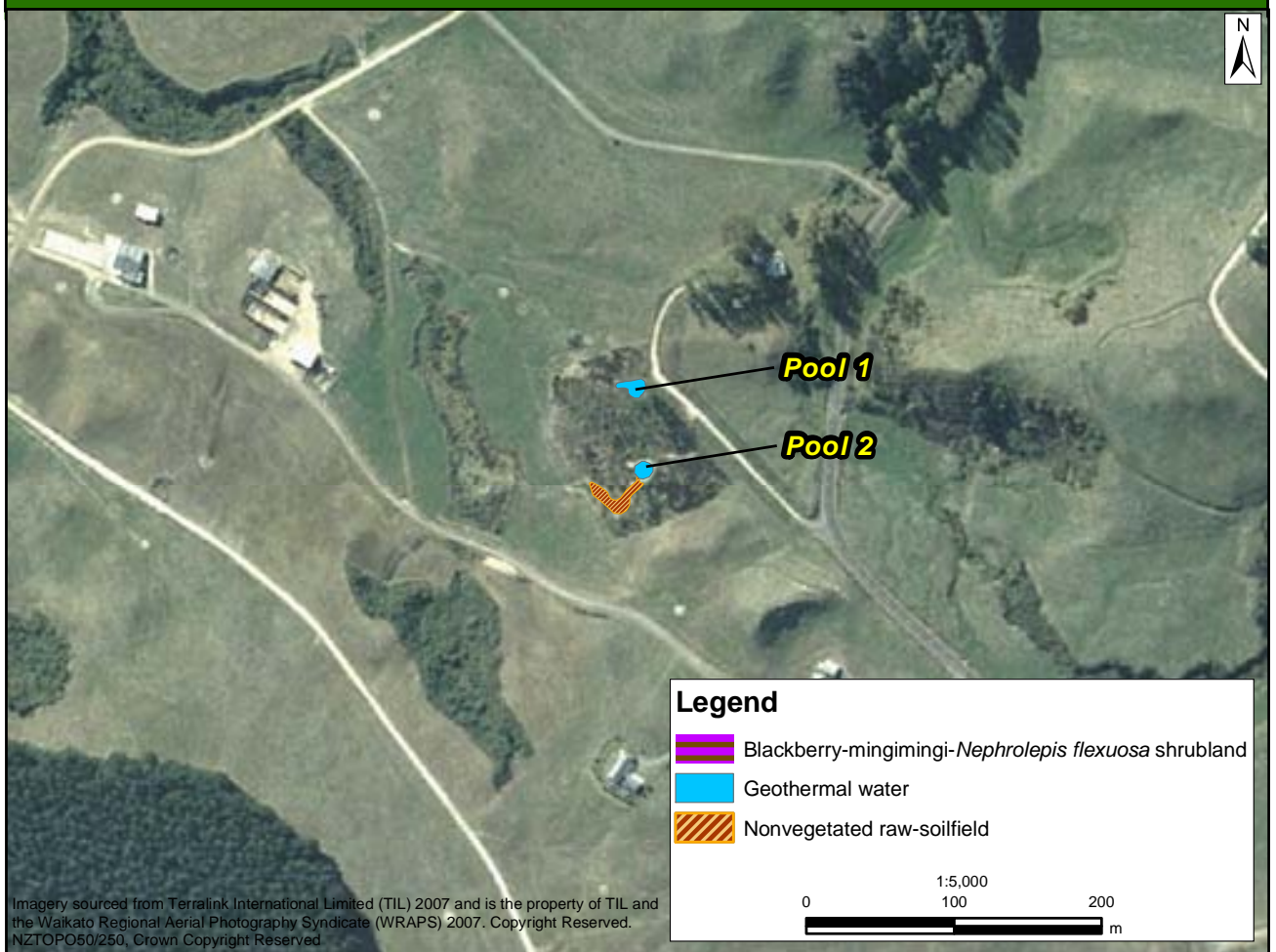
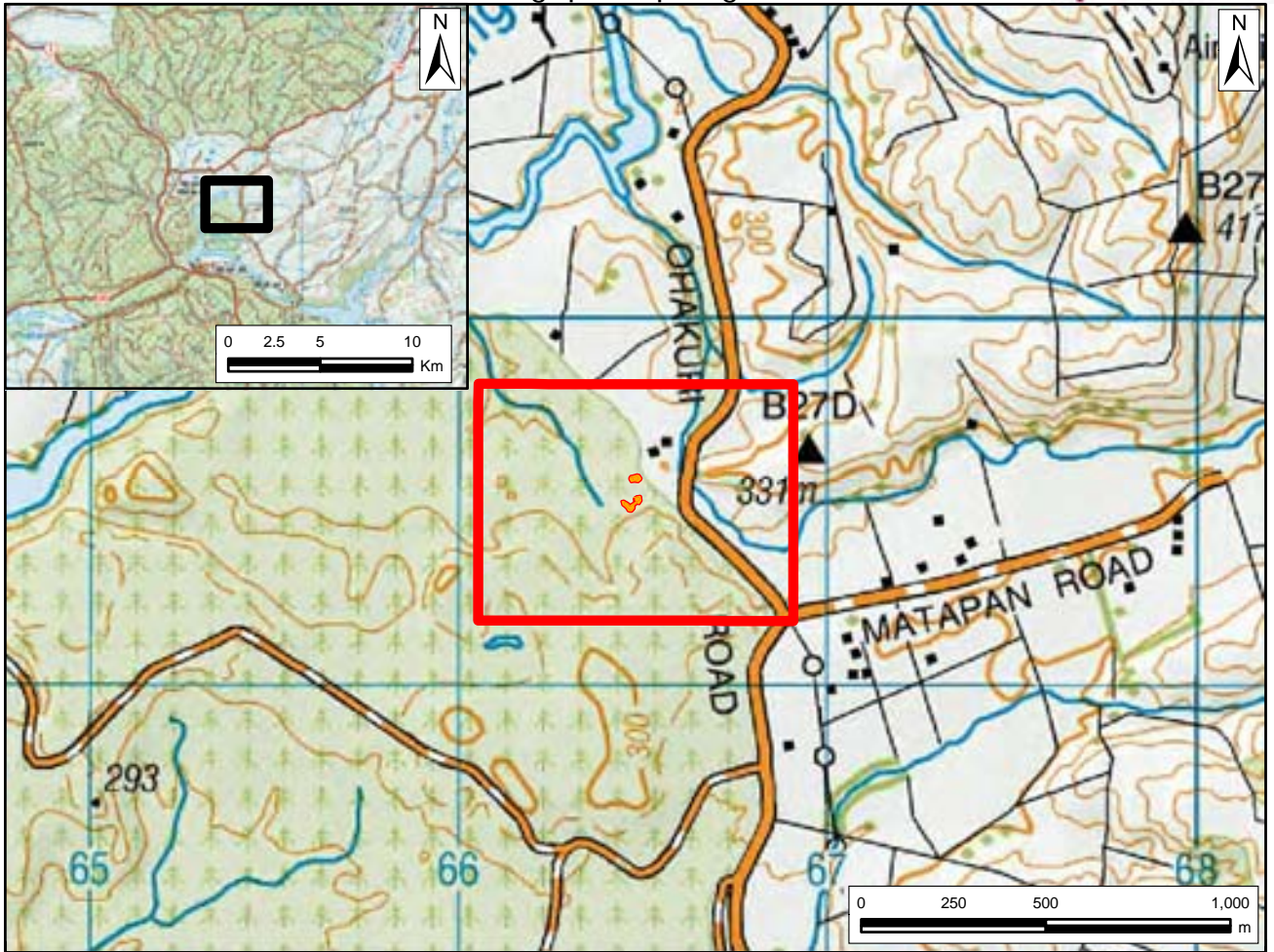
Historical: Site not assessed, as it is too small to be assessed based on historical photographs.

Management Requirements: Restoration of the adjacent gully margins, which support geothermal and non-geothermal habitat and features, could be considered. There is the potential to link any restoration works with the nearby Whangapoa Springs site.

Significance Level: Local (Table 1 - Criterion 5; Table 2 - Factor 19)

Significance Justification: Upper Atiamuri West is of local significance because it comprises geothermal habitat, a nationally uncommon habitat type. However the geothermal features are very small and highly modified, with few indigenous species present.

References: Hochstein 2007; Wildland Consultants 2004 & 2007a.



WHANGAPOA SPRINGS¹

Site Number: ATV02
Grid Reference: NZTopo50 BF36 665 495
GPS Reference: NZTM E1866465 N5749485
Local Authority: Rotorua
Ecological District: Atiamuri
Geothermal Field: Atiamuri
Bioclimatic Zone: Lowland
Tenure: Protected (Whangapoa Springs Scientific Reserve) and unprotected private land
Altitude: c.240 m
Extent of Geothermal Habitat: c.0.1 ha
Extent of Geothermal Vegetation: c.0.1 ha
Date of Field Survey: 2 February 2011

VEGETATION		LANDFORM	EXTENT
CODE	TYPE		
05.13 05.13.07	Blackberry-dominant shrubland Blackberry-mingimingi-<i>Nephrolepis flexuosa</i> shrubland Both pools are mainly surrounded by blackberry, bracken, and broom with occasional Spanish heath, buddleia, <i>Paesia scaberula</i> , and <i>Cortaderia fulvida</i> . <i>Nephrolepis flexuosa</i> is common amongst the shrubs. This vegetation/habitat type also surrounds the spring outlet.	Hillslope terrace	c.0.1 ha
07.08 07.08.01 ²	<i>Nephrolepis flexuosa</i>-dominant fernland (not mapped) <i>Nephrolepis flexuosa</i> fernland Several small patches of <i>Nephrolepis flexuosa</i> occur around Pool 1 on steep banks above the hot spring. (Population size: (1) 3×0.2 m; (2) 7×2 m; and (3) 2×1 m (based on 2003 survey). The <i>N. flexuosa</i> was viewed through the fence in 2011 and the population size appeared relatively unchanged; however some of the population was obscured from view.	Steep bank	<5 x 5 m
22.01 22.01.01	Geothermal water Geothermal water	Hot spring	<0.1 ha
28.01 28.01.01	Nonvegetated raw-soilfield Nonvegetated raw-soilfield Pool 2 is surrounded by silica deposits with occasional <i>Cortaderia fulvida</i> , turutu, kiokio, and several prostrate kanuka plants. A small sinter terrace occurs downslope of Pool 2.	Hillslope terrace	<0.1 ha

Geophysical Properties³:

The southern hot pool: This pool had a surface area of c.600 m², infilling a deep crater with clear bluish coloured thermal water. The surface temperature was rather constant at 60°C (fluke thermocouple). Minor gas discharges showed up as bubbles in the centre of the pool. At the main

¹ Previously named Upper Atiamuri (site U16/8) in Wildland Consultants (2004)

² Areas of this vegetation type occur within the northern area mapped as 05.13.07, however were too small to be mapped separately.

³ Undertaken by Hochstein in 2007.

outflow and overflow at the SW rim, thermal water was discharged at a rate of c.1 kg/s at 58°C (pH = 7).

The northern hot pool: About 60 m north of the southern pool lies the somewhat smaller northern hot pool, which covers an area of c.400 m². It occurs in a deep hollow, and is surrounded by 2-3 m high cliffs. The thermal water is also of a blue colour, but slightly less clear. The surface temperature was also constant (c.60°C when measured with an IR gun). In the north corner, near a dug outflow channel, there was a significant gas discharge (continuous bubbles). Here, the pool temperature at c.0.2 m depth was 69°C. At the north outlet, the outflow rate was estimated to be 1-2 kg/s (discharging at 53°C).

Indigenous Flora:

Nephrolepis flexuosa and prostrate kanuka (classed as „At Risk-Declining’ and „At Risk-Naturally Uncommon’ respectively in de Lange *et al.* 2009), occur around the margins of these two hot springs. In 1979 only two clumps of *Nephrolepis flexuosa* were present (Ecroyd 1979) which were smaller than the clumps present at the recent site inspection (1979 population size: 0.3×0.3 m and 1.5×0.5 m; c.f. description in above table). Therefore the population has increased in size over the last 20 years. Because of fencing, not all of the population could be viewed in 2011.

Lycopodiella cernua, another species characteristic of geothermal areas, is also present.

Fauna:

Common indigenous and introduced bird species typical of the habitat are present.

**Current Condition
(2011 Assessment):**

The condition of the vegetation surrounding these pools has greatly improved since 2003. Blackberry and broom infestations have been significantly controlled and planting of indigenous tree species has taken place. The cover of an „At Risk-Declining’ species (*Nephrolepis flexuosa*) appears to have increased since 1979 (Ecroyd 1979a).

**Threats/Modification/
Vulnerability:**

*Invasive pest plants
(2011 Assessment):*

Scattered blackberry (5-25% cover) is present around the northern pool.

*Human impacts
(2011 Assessment):*

A 2 m tall fence surrounds Pool 1. We were not permitted past this fence on 2 February 2011. The natural outlet of Pool 1 has been lowered and reformed as a drain, and there was a small concrete trough present at the outlet.

In the past there was a small wooden platform in Pool 2 that was used for cooking food. This was no longer present in 2011.

*Grazing
(2011 Assessment):*

The pools are fenced to exclude grazing.

*Adjoining land use
(2011 Assessment):*

Reserve (planted indigenous shrubs).

Site Change:

Recent change: The pools themselves are unchanged since 2003. However, the site is now securely fenced, and has been planted with indigenous tree species.

Historical: Site not assessed, no historical photos found.

Management Requirements: The area of blackberry shrubland has potential for restoration.

Significance Level: Regional (Table 1 - Criteria 1, 3, 5; Table 2 - Factor 6).

Significance Justification: This site has been ranked as being of regional significance because of the physical geothermal features and because it is a scientific reserve. There are also small populations of two „At Risk’ species (prostrate kanuka and *Nephrolepis flexuosa*).

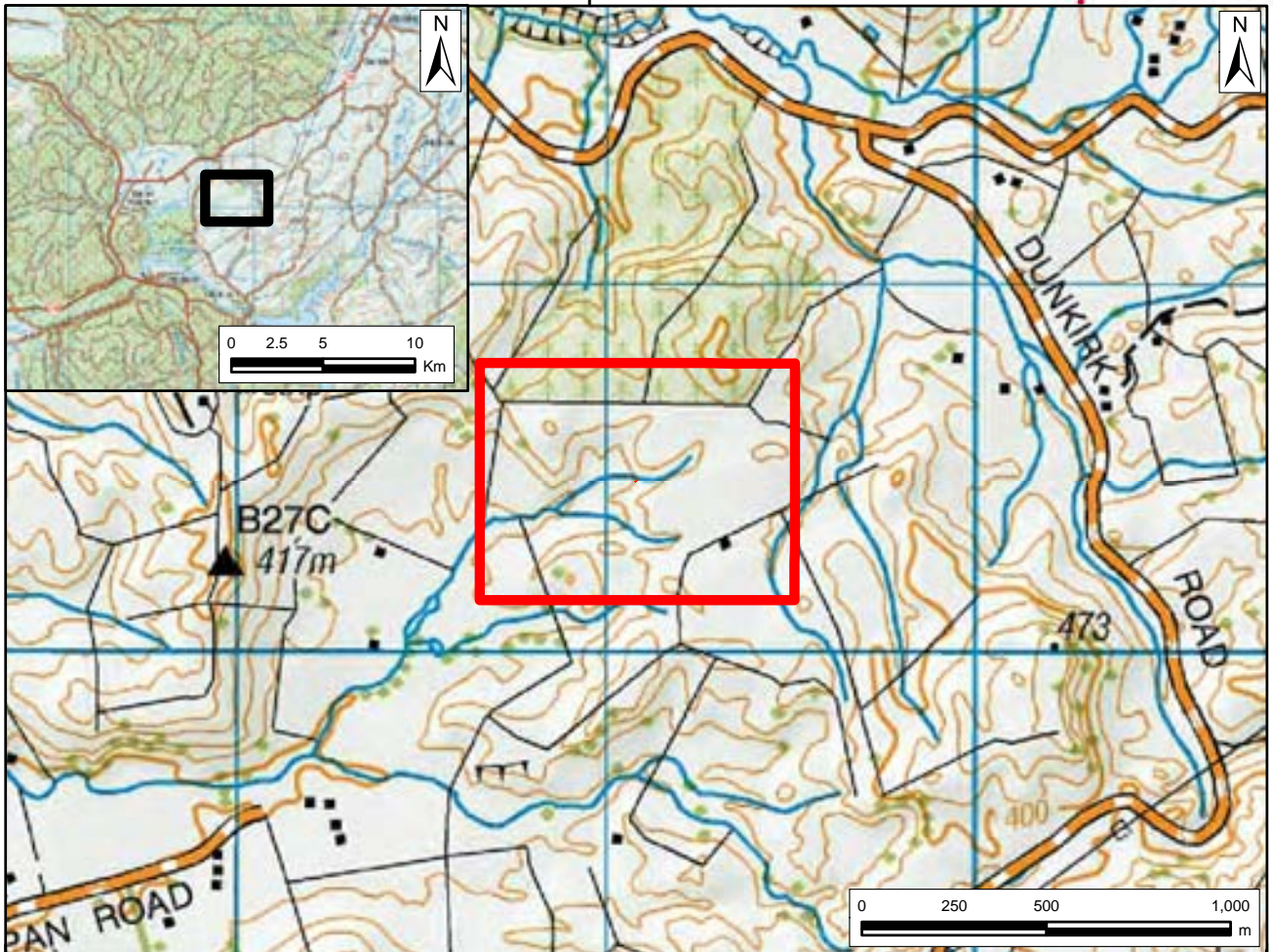
The classification as a scientific reserve under the Reserves Act is because of the high value of the “hot flowing neutral springs” that are present. The springs were ranked C2 in Cody (1995) using the NZ Geopreservation Inventory Ranking System where C stands for “Regional - site of regional scientific, education or aesthetic importance” and 2 stands for “moderately vulnerable to modification by humans” (defined in Kenny & Hayward 1993).

Notes: The surrounding site has been planted in indigenous tree species.

Given (1996) assessed the botanical value of many of the geothermal sites in the Waikato Region and in this study, this site was classed as Category C - the third highest category.

In earlier assessments (e.g. Wildland Consultants 2004 & 2008) this site was called “Upper Atiamuri”.

References: Ecroyd 1979a; Given 1996; Hochstein 2007a; Unpublished Atiamuri PNAP data 1995; Wildland Consultants 2004 & 2008.



MATAPAN ROAD

Site Number: ATV03
Grid Reference: NZTopo50 BF36 691 505
GPS Reference: NZTM E1869082 N5750467
Local Authority: Rotorua
Ecological District: Atiamuri
Geothermal Field: Atiamuri
Bioclimatic Zone: Submontane
Tenure: Unprotected private land
Altitude: 333 m
Extent of Geothermal Habitat: <0.1 ha
Extent of Geothermal Vegetation: <0.1 ha
Date of Field Survey: 2 February 2011

Code	Type	Landform	Extent
07.12	Deparia-dominant fernland	Hillslope	<0.1 ha
07.12.01	Deparia fernland <i>Deparia petersenii</i> occurs around a geothermal spring. Green, orange and red algae are present on the substrate behind the waterfall below the spring. <i>Paesia scaberula</i> , wheki, <i>Asplenium oblongifolium</i> , and tall willow herb (<i>Epilobium ciliatum</i>), occur on the cooler margins.		
08.01	Yorkshire fog-dominant grassland	Hillslope	<0.1 ha
08.01.01	Yorkshire fog grassland Pasture surrounding the <i>Deparia</i> fernland includes Yorkshire fog, tall fescue (<i>Schedonorus arundinaceus</i>), and creeping bent (<i>Agrostis stolonifera</i>).		

Geophysical Assessment¹: There are two springs, one discharging *c.*3 m above the pool with a temperature of 64°C. A cooler spring with a smaller flow discharges from the right of the rock face around 1 m above the pool. No smell of H₂S was recorded. The rocks below the spring and in the pool are covered in black algae.

Indigenous Flora: No „Threatened’ or „At Risk’ species of flora were recorded.

Fauna: Yellowhammer was heard during the survey and other common pasture bird species are likely to be present.

Current Condition (2011 Assessment): This small (*c.*10 m x 3 m) geothermal spring on a hillslope is unfenced and the margins are grazed. The water temperature of the spring at the time of survey was 69.1°C. The thermal stream enters another small (cold) stream *c.*20 m below the spring.

¹ Geophysical assessment undertaken by Julian McDowell and reviewed by Juliet Newson, 2010.

**Threats/Modification/
Vulnerability:**

*Invasive pest plants
(2011 Assessment):* None evident, surrounded by pasture grasses.

*Human impacts
(2011 Assessment):* Surrounded by farm land.

*Grazing
(2011 Assessment):* This spring is unfenced and within grazed pasture.

*Adjoining land use
(2011 Assessment):* Farming, pine plantation nearby.

Site Change:

Recent change: Site has not been assessed previously, but is unlikely to have undergone significant recent change.

Historical: Site not assessed, no historical photos found.

Management Requirements: This site should be fenced to exclude domestic animals and restoration planting on the margins should be considered.

Significance Level: Local (Table 1 - Criterion 5; Table 2 - Factor 19).

Significance Justification: Matapan Road is locally significant because it comprises a very small example of a geothermal vegetation and habitat, a type that is nationally uncommon.

References: Newson 2010.