History

For several centuries before the 10 June 1886 'Tarawera' eruption, two small lakes existed in the area now occupied by Lake Rotomahana. Maori had given them the names Rotomakariri (Cold Lake) and Rotomahana (Warm Lake), so distinguishing their most obviously contrasting characteristics. The shores of old Rotomahana were adorned by the siliceous sinter deposits of innumerable boiling springs, including the unique Pink and White Terraces, and the lake waters were warmed by their discharges. Both lakes drained into Lake Tarawera via an overflow stream to the North North East.

Approximately 600 to 700 years ago the Maori people arrived in New Zealand and migrated inland from the coast. It was the Arawa canoe that brought the tribal group who reached the Rotorua and Taupo districts. They quickly recognised the advantages the hot springs possessed for facilitating cooking and bathing, and for providing warmth, and the tribe settled permanently in the thermal region.

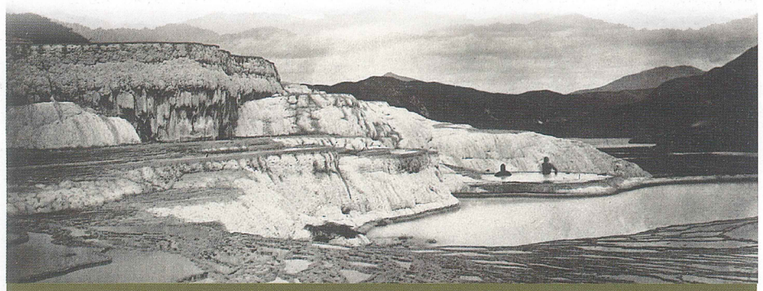
By the 1830s missionaries and occasional European traders had visited the Rotorua lakes district. In the next decade Lake Rotomahana and the Pink and White Terraces became known and their unique beauty and strange setting started to become widely publicised. In the following years and particularly after 1870 growing numbers of visitors began to arrive to see these magnificent natural structures. Local Maori villagers benefited from the revenue obtained from their services as guides and boatmen in the burgeoning tourist trade.

All this changed with the Tarawera eruption of 1886. In the earliest hours of 10 June 1886 persistent and increasingly felt earthquakes were noticed in the immediate vicinity of the mountain and as far as Rotorua. At about 2 o'clock in the morning a column of black ash suddenly erupted from Ruawahia, the mountain's highest dome. This column, illuminated with innumerable flashes of lightning, quickly became incandescent with the glow of red-hot lava and for the next two hours the whole length of the mountain-top presented the appearance of erupting a gigantic broad sheet of fire. At about 3 o'clock an enormous cloud was seen to rise above the site of Rotomahana. This was the first indication that the eruption was extending to the southwest. The eruption rift comprising the succession of craters across the mountain top eventually opened in both directions until a line almost 16 kilometres in length extending from a kilometre north-east of the mountain to Southern Crater at Waimangu was in violent upheaval. At Rotomahana it appears that rising basaltic magma (lava) triggered a tremendous explosion of the hydrothermal system that had fed the hot springs there. The resulting mass of ejecta is believed to have risen to a height of about 11 kilometres. It consisted of dust, sand, and rock, mixed with fragments of new lava and filled with steam and other gases. Much of the ejecta column collapsed, and, falling with great speed from the height to which it had risen, flowed across the surrounding country and inundated a circle of about 6 kilometres radius in a boiling flood. Further explosions of somewhat lesser magnitude continued for a few hours. Near the edge of the crater which formed at Rotomahana the deposit reached a maximum depth of about 40 metres. Altogether an area of about 15,000 square km received an appreciable covering as a result of the six-hour upheaval.

Seven small villages were destroyed during the eruption with around 105 lives being lost. All plant, bird and animal life in the area was extinguished by the Eruption.

By about 1910, the great crater at Rotomahana had more or less filled with water, mostly from rainfall within its catchment, to form the present-day lake. Today this lake has a surface area about twenty times greater than that of the previous lakes, and its water level is 40m higher due to the blockage of the former outflow valley.

In 1917, the last major event in the formation of the modern landscape occurred with the hydrothermal eruption of Echo Crater, in Waimangu Valley, and the consequent formation of Frying Pan Lake.



The White Terraces before the 1886 eruption of Tarawera.

World-wide Significance

Waimangu and Rotomahana lie within the Okataina Volcanic Centre which is part of the Taupo Volcanic Zone. This zone in turn is the New Zealand part of the Pacific 'Ring of Fire' where the Pacific Tectonic Plate meets the India-Australia Tectonic Plate. A feature of the Taupo Volcanic Zone is the relatively shallow depth - only a few kilometres beneath the surface - at which large masses of molten rock are believed to reside.

Many scientists (including geologists, volcanologists, botanists) visit Waimangu and Rotomahana. Among its attractions to such researchers is the fact that in its Waimangu section it is the only major hydrothermal system in the world whose surface activities commenced wholly within historic times and did so at a precisely known date as the result of a volcanic eruption. Scientists maintain extensive networks of monitoring equipment within the Valley, on Mount Tarawera, and indeed throughout the whole of the Taupo Volcanic Zone. Among the larger lakes in the North Island Rotomahana is the youngest and, at about 125 m, is the deepest in the Rotorua lakes district.

BOTANY Waimangu and Rotomahana are very important botanically because they are the only areas in New Zealand where there has been the opportunity to record the re-establishment of a native forest following complete destruction of all plant life. Rotomahana is comparatively free from exotic plants. This is due to the protection it receives from its Scenic Reserve status, the small rainfall catchment over farmland, and its fairly isolated location. Road access to the lake is limited with the result that private boats seldom visit it and so are not introducing weeds from other sites. All types of thermally adapted plants known in New Zealand are represented at Rotomahana.

BIRDS Wildlife Refuge status ensures that many bird species are often present at Lake Rotomahana including the Grey Duck, Scaup (or native Diving Duck), the Cormorant, Black Swan (predominant species), Mallard, Coot, Dab Chick or Grebe, White Faced Heron, Pukeko, Pied Stilt and various sea birds.

TROUT American steel-head Rainbow Trout were introduced into the lake in 1913 and are now prolific. Difficult public access conserves their population and the absence of a water filled channel between Tarawera and Rotomahana Lakes maintains the purity of the breed.

The Pink Terrace was a popular bathing site before the 1886 eruption of Tarawera.

Protection of Waimangu Volcanic Valley and Lake Rotomahana

The Scenic Reserve status and Wildlife Refuge status of this area largely protect it from interference, with activities such as farming and industrial development being prohibited. However tourism, with its impact being limited to establishing the tourist amenities including the footpath, bus road and boat jetties, is an allowed activity. The boat trips produce almost no environmental impact. Thus Lake Rotomahana is preserved in its natural state and such changes as have occurred in the physical features and the vegetation since 1886 have done so with little interference from man. The natural changes have been documented from the earliest days to the present.

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Facts, research and authenticating of copy provided by Prof. R.F.Keam, University of Auckland and Bradley Scott, Institute of Geological & Nuclear Sciences, March 2012.

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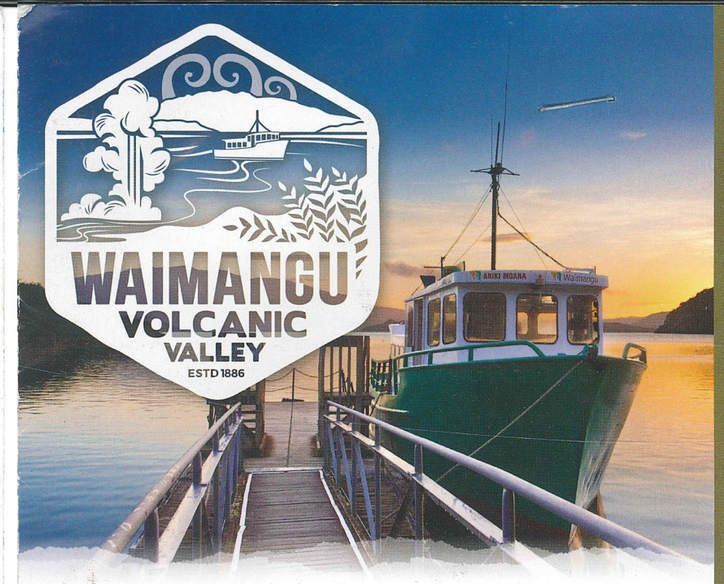


VOYAGER GUIDE

Haere Mai Welcome

Explore this amazing, natural environment that has been unaltered by man since its creation in 1886. The youngest of New Zealand's large, naturally formed lakes, Lake Rotomahana is New Zealand's original tourist attraction. Visitors travelled to Rotomahana attracted by the legendary Pink and White Terraces which were covered by the 1886 eruption. Rotomahana is the deepest lake in the Rotorua region. It is protected as a wildlife refuge, and large numbers of birds live here all year round. Beautiful geothermal springs and geysers display along the south west shoreline. It will always remain as one of New Zealand's beautiful, unspoilt, natural wilderness areas.

Our Values

MANAAKITANGA Safety, Communication, Hospitality
We welcome you to our place, share the legacy and knowledge, we will look after you

KAITIAKITANGA Sustainable, Integrity, Authentic
Together we will look after this taonga and use tikanga, tika and matauranga to ensure its long term sustainability

WHANAUNGATANGA Teamwork, Support
We will respect each other and through shared experiences create a sense of belonging

IMPORTANT SAFETY MESSAGES

Waimangu is unique and fragile - please take care

- **Do not board the boat or leave the boat without the captain's consent.**
- **Ensure children are supervised at all times.**
- **Stay inside the boat handrails at all times**
- **Take care when moving around the boat.**
- **Report any concerns to the captain as soon as possible.**

Introduction to an active volcanic crater:

Research in January 2011 showed that many hot springs discharge into the bottom of Lake Rotomahana. Some of these possibly represent features that predate the 1886 eruption but many have formed since then. The research showed also that the Lake emits about 500 tonnes of carbon dioxide gas every day. The presence of the hot springs, but particularly the emission of such huge quantities of gas, are indicators that Rotomahana is located within a basin with the characteristics more of an active volcanic crater than of just a hydrothermal system. However, unlike the situation before the 1886 eruption, and because of the enormously increased volume of the post-eruption lake, the hot springs make little difference to its water temperature.

Points of interest on your cruise

1. HOT STREAM From the back of the boat, as the cruise begins, you can see where the stream from Waimangu enters the lake. Its warm mineralised water enriches the lake in this area, encouraging vegetation to grow and providing plentiful food for the bird life. The shallowness of the delta allows the birds easily to reach the food (and indeed the propeller from this boat stirs it up, increasing its accessibility). This is a wildlife refuge, which means that all bird species are protected, whether native or introduced.

2. ROCK WALLS Thick layers of yellowish compact volcanic rock ('ignimbrite'), clearly visible along the southern shore of the lake, are here exposed in the face of a fault-scarp. This scarp here forms one side of the volcanic rift that opened in 1886. The grey-coloured band of material overlaying the yellow rock is the 1886 eruption deposit.

3. PATITI ISLAND This island is composed of rock about 18,000 years old, the same as the oldest parts of Tarawera volcano. Before 1886 it appeared as a small hill. It is the remnant of a lava plug or dome that had solidified after being extruded here during that much earlier eruption. During the 1886 eruption much of it was blown away, exposing and somewhat shattering its original solid lava core.

4. TARAWERA VOLCANO Prominent to the north-east is the south-western end of Mount Tarawera. The summit of Tarawera volcano is 1111m (3363ft) above sea level and approximately 772m above the level of Lake Rotomahana. The edifice we see today has been built by at least four separate eruptions which have been dated to have occurred about 18,000, 15,000, 11,000, and 650 years ago.

The eruption about 650 years ago gave the mountain its highest three domes and also probably created the surface features at Rotomahana which allowed the Pink and White Terraces to form.

The 10 June 1886 eruption commenced near the mountain summit and spread north-east and south-west as the 16km long fissure progressively opened. In the visible end of the mountain is the crater known as Tarawera Chasm measuring 500m wide and 500m deep. It was the last crater to start erupting on the mountain on 10 June 1886.

The three skyline domes of Tarawera Volcano are not all visible from Rotomahana. Tarawera (burnt cliff or peaks), Ruawahia (split or cloven hole or cave), and Wahanga (bursting open) were all seemingly named in antiquity, and it is intriguing to consider whether or not such evocative names could have meant that early Maori were witnesses to its previous outburst about 650 years ago.

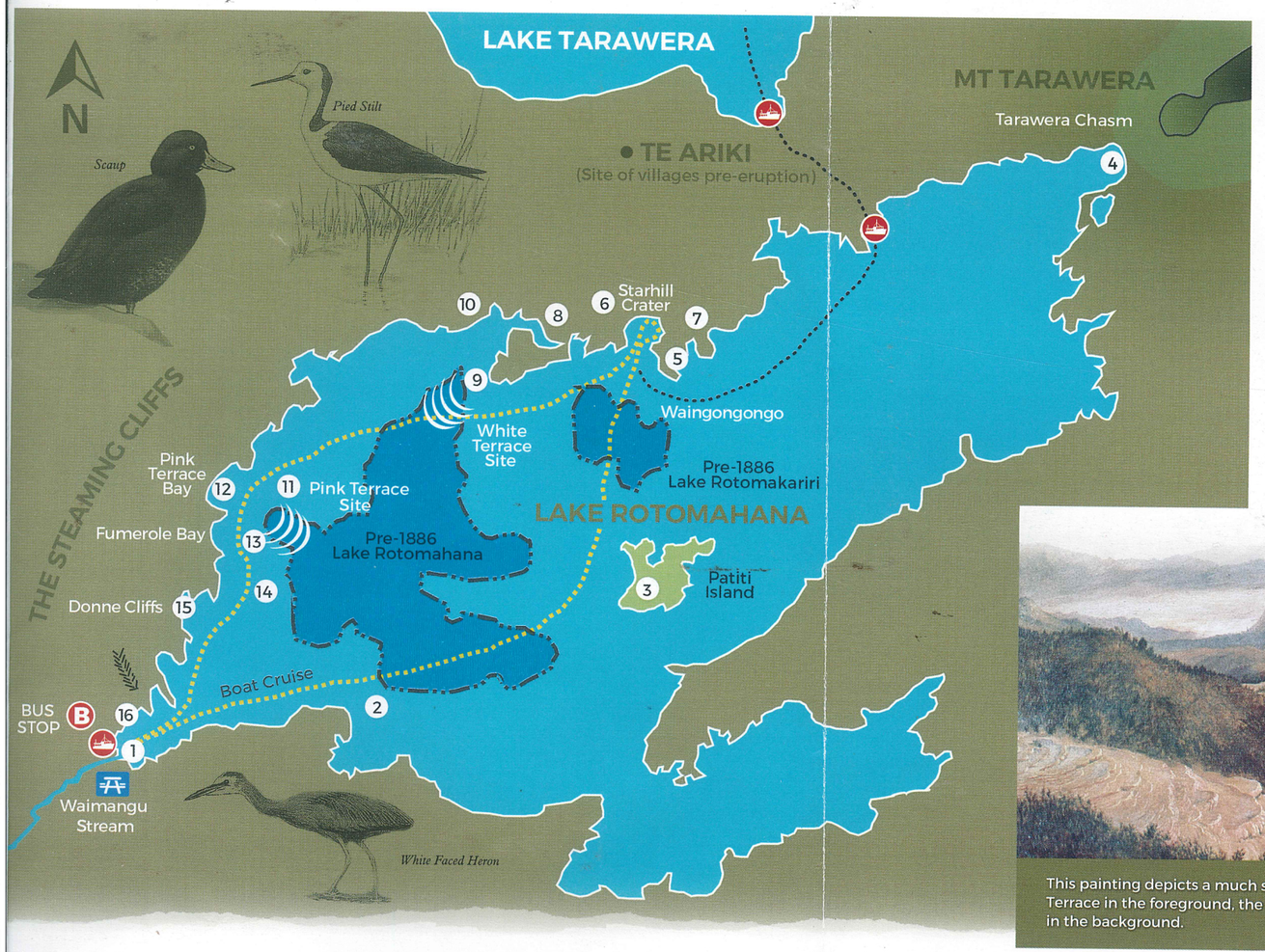
Tarawera is privately owned by the Maori sub tribes who have occupied the region since long before the 1886 eruption.

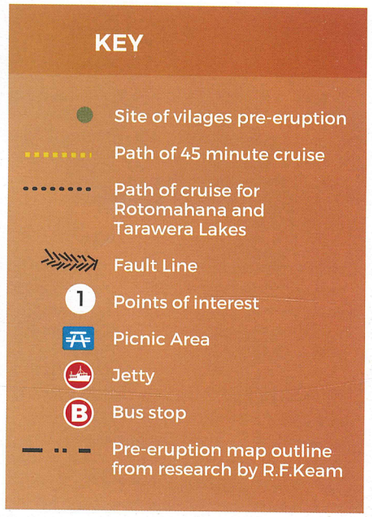
5. LAKE LEVEL All hills between this point and the volcano are part of subsidiary lava domes related to Tarawera and deeply buried beneath the deposits of 1886. In many places there is evidence of water seeping from Rotomahana into Lake Tarawera 1.5km away. Other than this seepage, the level of Lake Rotomahana is entirely evaporation - and rainfall - controlled. Lake level will normally rise and fall approximately 1m between winter and summer but, depending upon the varying annual rainfall, it can sometimes progressively rise or fall. For instance, in the 1930s the lake level was recorded at approximately 332m above sea level and in 1976 approximately 341m above sea level, a difference of 9m.

6. STAR HILL CRATER This small crater, formed during the 1886 eruption, was originally separate from the main Rotomahana crater but is now linked to Rotomahana lake by a narrow passage. Today the crater is 70m deep, approximately 20m below the water and 50m above. The hill in which it is located was christened Star Hill because it was first reached after the 1886 eruption by a member of an exploratory expedition funded by the Auckland Evening Star newspaper. Because of its very sheltered position, Star Hill Crater has a warm micro-climate which has encouraged the re-establishment of plants.

7. RE-ESTABLISHMENT All plant and bird life in this region was extinguished in 1886. But during a research visit to the Rotomahana Crater during the summer 1886 / 87 Professor A.P.W. Thomas was surprised to find a patch of green ferns growing in the walls of Star Hill crater – "...an unexpected and remarkable sight in a crater which had been so active, especially as no other trace of vegetable life was to be seen for miles around in the waste of steaming water and volcanic ash." And now the vegetation and wildlife has regenerated to the extent you see. Evident here is re-establishing native forest in the second stage. The first, or primary, stage is ground cover such as kanuka and manuka, typified by small pointy leaves with a very hard, robust nature. The second stage is the growth of the first new canopy now seen developing here as bushy, shiny leafed trees. The third stage of re-establishment is marked by growth of the podocarps with their high canopy. Reaching the second stage has taken from 1886 to the present. Full development of the podocarps may take a hundred years more.

8. TE ARIKI AND THE TERRACES The land between Rotomahana and Tarawera is known as Te Ariki. This area was settled by Maori, perhaps 600 years ago. It was an important area for collecting food, and, over time, several small villages were established. At the time of the Maori people's first arrival, the Pink and White Terraces would probably been at the earliest stage of their development. However by the time European interest began, the Terraces were in their full glory. The local Maori owned and operated the associated tourism business. By the mid 1880s, visitors to the Terraces





This painting depicts a much smaller Lake Rotomahana with the Pink Terrace in the foreground, the White Terrace at a distance and Mt Tarawera in the background.

numbered perhaps 5000pa. After the 1886 eruption there was no visible trace of the Terraces and it was thought probable that they had been destroyed. However research in 2011 discovered that a small remnant of both the White Terrace and the Pink Terrace do exist. These are approximately 60 metres beneath the water surface. In 2012, a second, small, piece of the Pink Terrace was also discovered.

9. WHITE TERRACE SITE Before the eruption the White Terrace (Te Tarata "Tattooed Rock") was located at the north-east corner of old Lake Rotomahana, and covered 3ha (7 ¼ acres). It rose about 30m (100ft) above the lake. Composed of sinter deposited from the hot water discharging from a great boiling cauldron at its summit, this grand natural structure comprised hundreds of arcuate silica terraces ranging from millimetres to 3.5 metres in height. In many places basins lay behind the terrace fronts and a few contained water of sufficient depth and at such a temperature as to be suitable for bathing. Sometimes the cauldron emptied and when it commenced to refill the boiling water rising from the central vent was often projected high into the air to form a magnificent geyser. The Pink Terraces were built in a similar manner .

10. BASE SURGE DEPOSIT This inlet is the site of the deepest deposit (40m) produced by the 1886 eruption. Here, as is the situation all round the present lake, massive flows of debris were borne along and deposited by steam and other gases all flowing outwards at high speed from around the base of the eruption column. It is this deposit that dammed the former outflow from the Rotomahana basin and has allowed Rotomahana lake to rise to its existing level. The green grassy area indicates the overflow point for Rotomahana to empty into Lake Tarawera. For safety reasons a culvert was introduced here some years ago as an artificial discharge channel when it appeared possible that a sudden uncontrolled overflow from the lake might occur, but in fact lake water has seldom if ever flowed through it.

11. PINK TERRACE SITE The famous Pink Terrace which, together with the White Terrace, was renowned as one of the natural wonders of the world, once draped the hill slopes bordering old Lake Rotomahana. The Pink Terrace (Otukapuarangi "Cloudy Atmosphere") covered 2.2ha (5 acres) and rose about 26m (85ft) above the old lake. The salmon-pink colouring of the silica deposit is believed to have been due to the presence of rare sulphides being incorporated within the sinter. The basins near the top contained shimmering blue water at exactly the right temperature for bathing and to take personal advantage of this was the final culminating experience of pre-eruption visitors during their day at Rotomahana.

THE STEAMING CLIFFS Hot water springs, geysers and steaming vents display along the steep south west side of the lake. Collectively known as the Steaming Cliffs, these features are the current day surface expression of the geothermal system which had existed since prior to the 1886 eruption. (Note : While the 1886 outburst mostly destroyed the surface features that existed in this area at that time, the Geothermal System itself was remarkably unaffected by the eruption.) Sometimes one or another of two geysers can be seen playing onshore here not far from the lake edge.

12. 1886 MUD DEPOSITS The parallel bedding lines in the exposed bank at the southern corner of Pink Terrace Bay show how successive waves of mud accumulated layer upon layer during the 1886 eruption, up to 22m deep in places near here.

13. ROTOMAHANA EROSION For about twenty years after the 1886 eruption little plant life grew on the new deposit because of its instability and the lack of accessible organic material. Over that time erosion produced the razor-back ridges and short blind gullies evident in this bay. Unfortunately this terrain is almost impossible to walk through so it offers the ideal of an undisturbed environment for animals such as feral pigs, deer, wallabies and possums, pests which eat the native forest or prey on birds.

14. FUMAROLE BAY An area of intense steam vents, or 'fumarolic' activity. Surface temperatures of the rock walls range from 40 to 70°C, the lower extent of this range allowing thermally adapted plants to live on the banks. Temperatures 10cm beneath the surface can reach up to 100°C. The large fumarole at the east end of the bay emits steam at 101.7°C. A hydrothermal eruption in 1951 occurred near this bay. This event sent a wave of water across the entire lake and, near the source, disturbed shoreline vegetation to approximately 1.5 metres above the lake.

15. DONNE CLIFFS This magnificent near-vertical face has hot earth from lake edge to cliff top. Thermal plants proliferate in the cooler places. In this area there are several geysers whose activities depend closely upon lake level. Red colouring in the cliffs is caused largely by iron oxide.

16. FRACTURE A line of bare, coloured ground extends a short distance along the crest of the ridge. This represents the surface expression of a fracture up which thermal gases are percolating. In this particular case there is no displacement between the two sides of the fracture, but in many cases relative movement has occurred producing 'faults'. The Rotorua Taupo region is generously supplied with faults and many are associated with the thermal activities and with the locations of the volcanoes.

…e adhere to the delicate miniature silica
…rent colours are caused by the varying temperature
…n algae cannot survive at more than 75°C (167°F).

…G The silica rich waters of this boiling spring form an unusual shell-shaped …aintain the adjacent stream temperatures. Springs such as this are home to …philic bacteria. Similar simple organisms are believed by many scientists to have been present …t the beginnings of life on Earth.

21. SILICA STALACTITES These have formed from dripping and trickling mineral rich water in a similar way to limestone stalactites. These examples have been able to form from hot water percolating out of Mt. Haszard in the time that has elapsed since Waimangu Geyser stopped its eruptions.

BUS STOP 1.

22. BURIED SOIL The prominent black band through this bank marks the soil buried by the material erupted from Lake Rotomahana and Mt. Tarawera on 10 June 1886. The white pumice layer below the buried soil is nearly 2000 years old and was erupted from Lake Taupo by the world's most violent volcanic eruption in recent millennia, the Taupo Pumice eruption.

23. KAOLIN SLOPE The fine white kaolin clay evident here is the type used in porcelain production, being formed when the heat and gases in the steam gradually alter the solid rock of the hill. The hot springs playing out of the bank share the same water source as steam vents within craters on the hill.

24. HOT AND COLD STREAMS The cold water Haumi stream flowing out of Lake Okaro, a cold crater lake south of Waimangu, here joins Hot Water Creek, formed by the outflow from Echo and Inferno Craters and numerous hot springs above here.

25. SOIL LAYERS This road cutting displays a succession of old soil and pumice beds that indicate the recent geological history of the Waimangu-Tarawera area.

26. HOT SPRINGS Across the stream is an unusual combination of steam vents, a large hot spring and plants. An assortment of mosses, ferns and lichens thrive in the warm, humid and shadowy conditions.

27. MARBLE TERRACE AND BUTTRESSES The buttresses in front of you and the sinter flat beyond are composed of a similar material to the Pink and White Terraces that were situated on Lake Rotomahana, but destroyed by the 1886 Tarawera Eruption. These terrace buttresses are formed by silica depositing out of solution and building in successive layers over time. The silica rich water is supplied from a large hot spring in Iodine Pool (so named for the brown colouring on rocks and banks). The water leaves Iodine Pool at an average 97°C (208°F) to flow across Marble Terrace in shallow waves. Marble Terrace and its buttresses are growing over a stream terrace formed when Lake Rotomahana was at a higher level in the 1970's and the stream frequently flooded this area. The large hot spring which flows into Iodine Pool can be seen at the apex of the Terrace (across the road).

BUS STOP 2. Toilets at Warbrick Terrace, 150m walk from bus stop. No toilets are available at the Lake or on the boat.

28. WARBRICK TERRACE Take the path past Bus Stop #2 into Rainbow Crater, formed by the 1886 eruption. Warbrick Terrace is a set of multi-coloured fast growing silica platforms forming over an old stream terrace in a similar way to Marble Terrace (#27). In addition algae in recent years have assisted in the silica deposition to build a dam across the warm stream draining through the crater. A further series of ripple terraces are now forming at right angles to the original ones. The name commemorates members of the Warbrick family who were intimately connected with the history of this area. Alfred Patchet Warbrick, who was reputed to have been born on the shores of old Lake Rotomahana, spent 45 years guiding thousands of people and exploring the Rotorua hydrothermal and volcanic region, climbing, camping and path-finding. He was involved in the first rescue expedition across Lake Tarawera a few days after the 1886 eruption. After Waimangu Geyser broke out he became an employee of the Government Department of Tourist and Health Resorts as Chief Guide in the Waimangu, Rotomahana, and Tarawera region and assisted in developing and expanding a system of land and lake tours in the geyser country of Rotorua. A brother Joseph was one of the victims of the Waimangu Geyser eruption of 30 August 1903. The Warbricks were members of the first Maori rugby team to tour England and belonged to the Ngati Rangitihi Tribe. Please return to the Main Walkway at Bus Stop 2.

29. NATURE TRAIL Follow a twenty minutes' walk on the old lake floor to the scenic shore of Lake Rotomahana, through the wildlife refuge and scenic reserve. The predominant plant in this area is the New Zealand native Toetoe which is uncommon. Look for plant identification plaques on your walk.

30. TARAWERA VOLCANO AND LAKE VIEW Tarawera volcano with Tarawera Chasm (also known as Red Crater - 1886) rising beyond Lake Rotomahana. This point is the 1974 boat jetty site. Lake Rotomahana is a bird sanctuary, with many species often to be seen here.

31. PICNIC AREA AND LAKE VIEWS

32. LAKE ROTOMAHANA BOAT CRUISE Tickets are usually available from the boat captain. The cruise offers a 45 minute circle of the lake to view geothermal and volcanic features not visible from the shore. These include steaming cliffs, eruption sites and craters, geysers and many fumaroles. The captain gives a commentary on the history of eruptions in this location and the consequent reshaping of the lake and surroundings. Lake Rotomahana was the site of the world famous Pink and White Terraces prior to the eruption of Mount Tarawera in 1886. Cold drinks and snacks available. Sorry, no toilet on board.

BUS STOP 3.

MT. HASZARD HIKING TRAIL Requires good fitness - rough underfoot. Do not leave the marked trail at any time. Steep hill up to B (Shelter Shed Site). Please be careful.

A. Echo Crater Panorama While resting here, look back over Echo Crater with Frying Pan Lake steaming in the background. The lake occupies the western basin of the crater, with Cathedral Rocks to the right, and in the foreground lies Waimangu Geyser Basin the now sediment filled floor of the old Geyser itself. Note the cross on the rim of the crater where four people were standing when they lost their lives by an untimely eruption on 30 August 1903. Dominant on the south-western skyline is Rainbow Mountain (Maungakakaramea) an 180,000 year old volcano known for its colourful slopes.

B. Shelter Hut Site In October 1900 Waimangu Geyser was first seen in eruption and by the summer of 1902/03 a regular tourist trip was operating from Rotorua visiting Te Wairoa (Buried Village), Lakes Tarawera and Rotomahana, and Waimangu, before returning to Rotorua "The Round Trip" (This tour still runs today). During 1902 a shelter was built on this site for visitors to rest as they watched Waimangu Geyser in action. The Geyser's last eruption was on 1 November 1904.

C. Rift Valley (Line of Craters) Panorama In the foreground lies shallow Raupo Pond Crater, formed in 1886 by the Tarawera eruption. It was host to the 'Mud Rift', a geothermal feature which was active from 1906 to 1981 when a minor hydrothermal eruption destroyed it. In the middle distance steam can be seen rising from the walls of Black Crater. Lake Rotomahana in the middle distance, infills craters created in the 1886 eruption. In that eruption, rising basalt magma (lava) caused an immense hydrothermal eruption of the geothermal system that supplied the Pink and White Terraces. This was followed by very explosive 'phreatomagmatic' eruptions. (Explosive boiling of water both in the lake and within saturated rock beneath it, caused by its contact with the magma). The two terraces were destroyed (see #32 Boat Cruise). To the right within the lake lies Patiti Island, the remains of an 18,000 year old lava dome.

Beyond Rotomahana is Tarawera Volcano, estimated to include about 13.5 cubic kilometres of rock. Tarawera was built up by a series of eruptions approximately 18000, 15000, 11000 and 650 years ago. In 1886 the intruding basalt magma rose through a series of dykes that formed beneath the mountain, beneath Rotomahana and beneath the Waimangu area. At this point you are standing 94m above Lake Rotomahana which is itself 340m above sea level. Tarawera mountain summit rises 1111m above sea level.

D. Fairy Crater This deep, steep sided crater is another of the series blasted through the summit of Mt Haszard on 10 June 1886. From this viewpoint the spectacular lava bluffs forming the crater walls can be seen. The crater reaches depths of 56m. The crater was not named at the time of its formation, and was first recorded with its present appellation in the 1920s. From here the trail follows approximately the line of the original 'Round Trip' track as you start to descend towards Black Crater.

E. Eastern Valley Panorama From this vantage point one sees a mixture of geographic forms. Below you to the right lies the lower Waimangu Valley, a stream valley, approximately parallel to the 'Rift Valley' (line of craters). (see also #25). The Haumi and Waimangu Streams flow through this lower part of the valley below their confluence. (see #24)

Above this valley lies the 'ignimbrite plateau' of the Taupo Volcanic Zone, thousands of hectares of volcanic rock eroded to form unusual flat top hills known as tors. Land on the plateau is dominantly used for farming and growing exotic forest. In the far distance can be seen the summits of the Urewera ridges, more distant parts of which form a section of the North Island axial ranges. As you descend from this vista, the Waimangu delta, Lake Rotomahana and Mt Tarawera dominate your view. The prominent steam plume in the lower Waimangu Valley rises from Iodine Pool. Lake Rotomahana and Tarawera volcano are framed by the walls of the Rift Valley.
Please stay on the trail at all times

F. Black Crater Saddle Here one looks up into Black Crater, walled by the massive lava outcrops of Mt Haszard on the east (left side) and steaming hot ground on the other, discoloured to pinks and reds. Two craterlets were formed here during the 1886 eruption and the resulting divide can be seen crossing the crater floor in the middle distance. This crater was named by the first exploring expedition to Rotomahana after the 1886 eruption and the choice was based on the appearance of the deposits accumulating around it at that time.

G. Lower Rift Valley From the Saddle, the Rift Valley (Line of Craters) continues down towards Lake Rotomahana. Geothermal activity is dominated by steaming ground on the rift walls. Steam rises also from numerous hot areas on the crater floor including the Warbrick Terrace boiling spring (see #28). From this point the trail descends to the valley floor before rejoining the Waimangu Valley walkway at #25. Steep hill down to rejoin main valley walkway at #25 - Please be careful.

MISSION STATEMENT He Taonga tuku iho. Sharing our kōrero, our history. Delivering exceptional experiences to our manuhiri in a sustainable way.

OWNERSHIP Waimangu is a Scenic Reserve administered by the Department of Conservation. Part of the Reserve is leased by the Crown to a wholly New Zealand owned company who provide the amenities for all visitors to Waimangu.

Facts, research and authenticating of copy provided by Prof. R.F.Keam, University of Auckland and Bradley Scott, Institute of Geological & Nuclear Sciences, March 2012.

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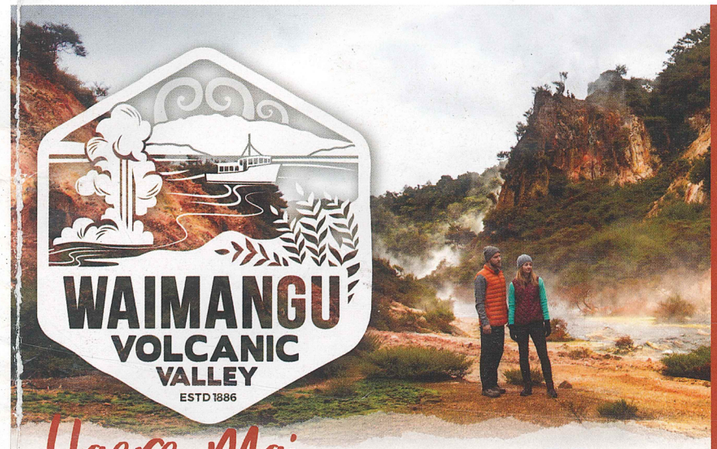


WANDERER GUIDE

Haere Mai Welcome

Connect with the beating heart of the world's youngest geothermal valley, its unique history and legacy. This valley continues to live, breathe, and develop. It is fresh, it is new, it's changing every day. Immerse yourself in the stories of the Mt. Tarawera volcanic eruption, its people, and the resulting dramatic landscape changes that created the world's youngest geothermal valley. Learn about the unique geothermal features, the regenerating native forest, and the amazing birdlife on your visit with us today.

Our Values

MANAAKITANGA Safety, Communication, Hospitality
We welcome you to our place, share the legacy and knowledge, we will look after you

KAITIAKITANGA Sustainable, Integrity, Authentic
Together we will look after this taonga and use tikanga, tika and matauranga to ensure its long term sustainability

WHANAUNGATANGA Teamwork, Support
We will respect each other and through shared experiences create a sense of belonging

IMPORTANT SAFETY MESSAGES

Waimangu is unique and fragile - please take care

- **Stay on the footpaths at all times**
- **Supervise children at all times**
- **Plants must not be picked or harmed in any way**
- **No samples of any type may be collected**
- **No stones or sticks to be thrown**
- **Geothermal features must not be broken, walked on, dug, scratched, damaged**
- **Graffiti is unacceptable**
- **Collect and deposit all rubbish in the bins provided, please support our sustainability efforts by recycling**
- **In the event of a siren sounding in the valley please make your way to the nearest bus stop/emergency assembly point**

Points of interest on your walk

1. PANORAMA Dominant on the skyline is Tarawera mountain, a restlessly sleeping volcano which has erupted five times in the last 18,000 years. In the foreground is Waimangu. Before the latest eruption on 10 June 1886, this area was rolling scrub-covered hills with no surface hydrothermal activity. Then, during the night of 10 June 1886, a line of craters from the northern end of Tarawera all the way to the Waimangu Valley was formed by violent eruption. This event completely destroyed all plant, animal, and bird life in the whole of the area visible from this point. All the vegetation you now see has resulted from plant re-colonisation since that date. Three important dates dominate the history of the valley: 1886, the Tarawera eruption; 1900 - 1904 when the world's largest geyser was active 1 kilometre away, just beyond the hot lakelet visible from here; 1917, the Frying Pan Flat eruption which burst out where you see the hot lakelet and sent a surge of steam and debris up to this very place and destroyed an accommodation house (Waimangu House) at this site.

2. SOUTHERN CRATER This southern-most crater formed by the 1886 eruption is about 50 metres deep. It has not been active since immediately after that initial eruption apart from possessing some warm ground and a couple of small mud pools at its north-eastern end. The shallow lake (Emerald Pool) is cold.

3. THE SADDLE A very narrow ridge of land between Southern Crater and the adjoining valley. This walkway dates back to 1917.

4. EMERALD POOL The cold water pool occupying the floor of Southern Crater supports huge mats of algae and sphagnum moss when conditions are right. The native red floating fern Azolla also is sometimes present. At various times the lake has hues of blue, brown and emerald, the reason for these colour changes being evidently due to changes in the state of the various plant species. The lakelet seems largely to be rainwater and its level reflects ground water levels in the surrounding country. Normally its maximum depth is about 2m.

5. ERUPTION DEPOSITS The deposit seen here was formed by the 1917 eruption from Echo Crater. Today Frying Pan Lake occupies the floor of that crater and can be seen steaming behind you. The eruption deposit is typical of those produced by hydrothermal (steam) eruptions containing everything from clay to large boulders. The red discolouration has formed where the deposit is still being warmed. To the left of the path is the first large area of prostrate kanuka growing on heated soils where soil temperature at 5cm depth is about 33°C (91°F).

6. PANORAMA Wonderful views of Echo Crater and Frying Pan Lake. Echo Crater was formed on 10 June 1886 and has been the site of many activities since then. These include the Waimangu Geyser eruptions (1900 to 1904), and April 1915, April 1917, August 1924 and February 1973 hydrothermal eruptions.

7. FRYING PAN LAKE LOOKOUT Follow the roadway for 40m to the top of the rise. On 1 April 1917 the western basin of Echo Crater violently erupted, completely destroying an accommodation house located in front of where the Visitor Centre is today and killing two people. The deepened and enlarged crater quickly accumulated water and formed what is now known as Frying Pan Lake. The lake covers 38,000 square metres, being the world's largest hot spring, with an average depth of six metres (water volume 200,000 cubic metres). The average lake temperature is about 55°C (131°F). Return to the main scenic walkway.

8. ECHO CRATER AND FRYING PAN LAKE Pause here and listen to the eerie sounds coming from the hot springs and fumaroles about Echo Crater and Frying Pan Lake. The lake water is acidic, (average pH 3.5), while the carbon dioxide and hydrogen sulphide gas bubbling up gives the appearance of boiling. In fact in vents on the lake bed real boiling is occurring, but the body of the lake is somewhat cooler because of evaporation, convection and radiation of its heat.

9. 1973 TRINITY TERRACE ERUPTION SITE The bubbling area about ten metres from the lake shore (to the right of the point below you) was the site of the Trinity Terrace eruption in February 1973. Mud from this 15 minute eruption, which happened during the night, was sprayed over an area more than 100 metres across. This was one of the largest eruptions at Echo Crater since 1917. It is also the most recent. View the sweep of prostrate kanuka on the terrace below which has been re-colonised since the 1973 eruption.

10. CRYSTAL WALL This area of warm ground can grow crystals of sulphur and sulphates (including alum) when conditions are right. The crystals are very fragile and some dissolve in, or are destroyed by, rain.

11. CATHEDRAL ROCKS Originally named Gibraltar Rock because of its resemblance to the historic rock at the western entrance to the Mediterranean Sea, this steaming monolith was completely changed in shape by the Frying Pan Flat eruption of 1 April 1917, and its residual pinnacles afterwards deserved a new name. The massive rhyolitic lava composing it is at least 60,000 years old – much older than Tarawera volcano.

12. WAIMANGU GEYSER (Black Water Geyser) The large basin in front of you, bordered by hills on three sides, was once the basin of Waimangu Geyser. Active between 1900 and 1904, Waimangu was the world's largest known geyser. Erupting sometimes up to 400 metres (1300ft.) high, and hurling black sand, mud and rocks into the air, Waimangu Geyser followed a 36 hour cycle of activity. In August 1903, tourist guide Alf Warbrick launched a rowboat on the geyser's lake as the result of a dare. He and his companion measured the lake depth at only 48 feet (14.6m), but this unexpectedly shallow result evidentally came about because the solid material ejected in the eruptions largely fell back into the vent each time. The geyser lake covered an area 80m x 130m.

13. HOT WATER CREEK AND SPRINGS Frying Pan Lake overflows through this notch at a temperature of about 50°C with a flow of about 110 litres per second. Along its margin the stream forms deposits which contain traces of elements such as antimony, molybdenum, arsenic and tungsten. These minerals, along with blue-green algae, form the spectacular orange, brown, green and yellow colours seen along the edge and about the hot springs.

14. HOT SPRINGS OF MOTHER EARTH (Nga Puia o te Papa)
A cluster of vigorously boiling hot springs building intricate and strikingly coloured miniature silica formations.

15. WHITE CROSS The white cross on the lowest point of the crater rim to the east marks the site from where four tourists, standing at a place which they had been warned was dangerous, were washed to their deaths on 30 August 1903, when the Waimangu Geyser suddenly erupted.

16. TE ARA MOKOROA TERRACE (Long abiding path of Knowledge) These silica terraces have been built by 'Spring N' which suddenly started life in 1975 as a small erupting spring. At the time, because of its site within the old Waimangu Geyser basin, it was felt by scientists that it might be the forerunner to larger events and visitor access to the crater was restricted for a short time. The name of this spring group, bestowed by former guide the late A. Stan Marx, may have been chosen by him to reflect the scientists' attempts to understand nature here.

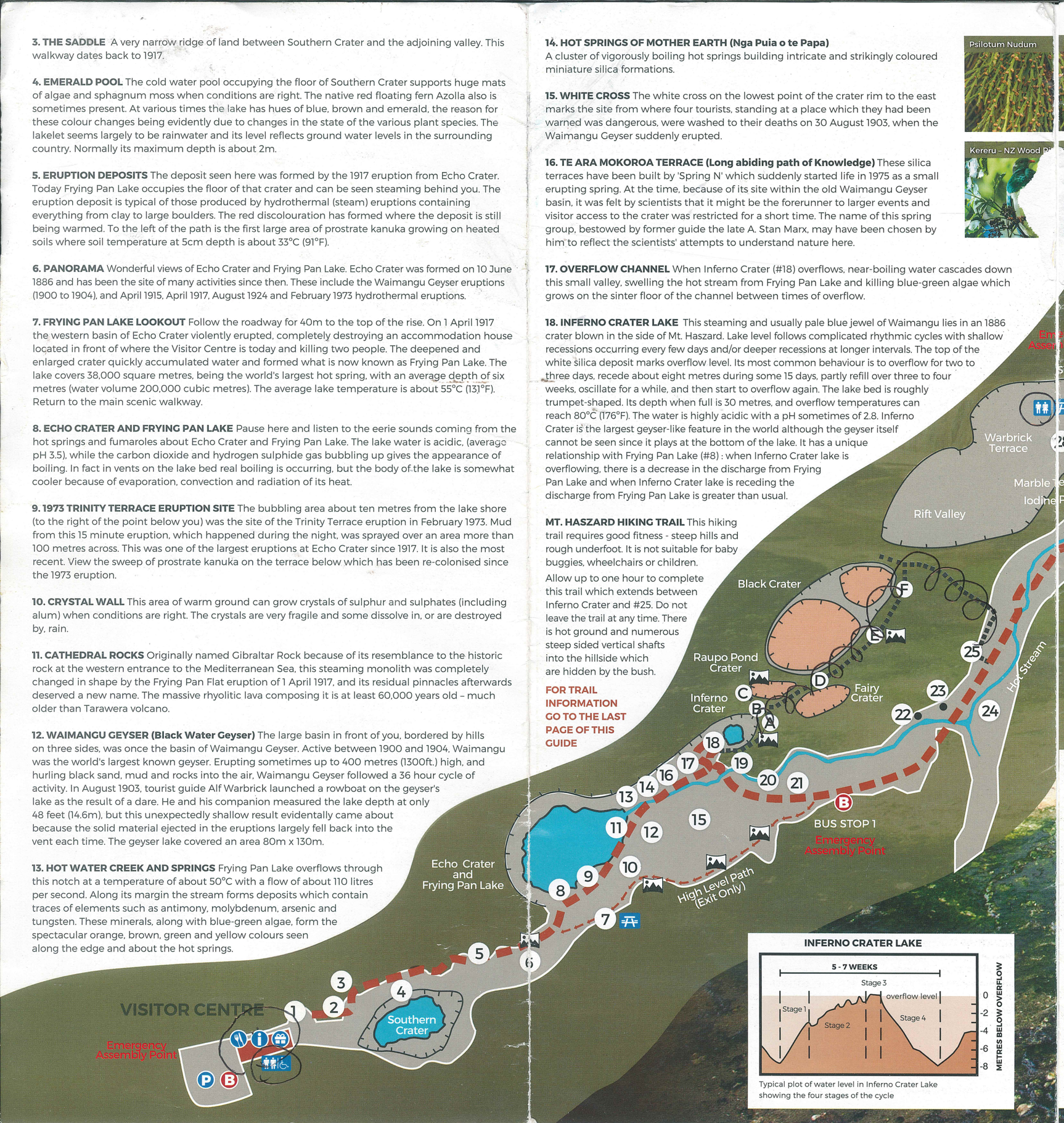
17. OVERFLOW CHANNEL When Inferno Crater (#18) overflows, near-boiling water cascades down this small valley, swelling the hot stream from Frying Pan Lake and killing blue-green algae which grows on the sinter floor of the channel between times of overflow.

18. INFERNO CRATER LAKE This steaming and usually pale blue jewel of Waimangu lies in an 1886 crater blown in the side of Mt. Haszard. Lake level follows complicated rhythmic cycles with shallow recessions occurring every few days and/or deeper recessions at longer intervals. The top of the white silica deposit marks overflow level. Its most common behaviour is to overflow for two to three days, recede about eight metres during some 15 days, partly refill over three to four weeks, oscillate for a while, and then start to overflow again. The lake bed is roughly trumpet-shaped. Its depth when full is 30 metres, and overflow temperatures can reach 80°C (176°F). The water is highly acidic with a pH sometimes of 2.8. Inferno Crater is the largest geyser-like feature in the world although the geyser itself cannot be seen since it plays at the bottom of the lake. It has a unique relationship with Frying Pan Lake (#8) : when Inferno Crater lake is overflowing, there is a decrease in the discharge from Frying Pan Lake and when Inferno Crater lake is receding the discharge from Frying Pan Lake is greater than usual.

MT. HASZARD HIKING TRAIL This hiking trail requires good fitness - steep hills and rough underfoot. It is not suitable for baby buggies, wheelchairs or children.

Allow up to one hour to complete this trail which extends between Inferno Crater and #25. Do not leave the trail at any time. There is hot ground and numerous steep sided vertical shafts into the hillside which are hidden by the bush.

FOR TRAIL INFORMATION GO TO THE LAST PAGE OF THIS GUIDE



Psilotum Nudum


Green & Golden Bell Frog


Koromiko

Kereru - NZ Wood Pigeon


Weweia - NZ Dabchick

KEY

- Main Valley Walkway
- Mt. Haszard Hiking Trail
- Panoramic View
- Points of interest
- Picnic Area
- Jetty
- Bus stop

GUIDE TO WAIMANGU WALKS

From - to	Distance	Approx. time	Difficulty
Entrance to Bus Stop 1	1.5kms	1 hour	Moderate downhill and flat. Steps up to Inferno Crater.
Bus Stop 1 to Bus Stop 2	1.3kms	35 min.	Downhill steps, otherwise easy or flat.
Inferno Crater to Bus Stop 2 via Mt. Haszard Hiking Trail	1.8kms	1 hour	Steep hills either end. Easy walking across summit.
Bus Stop 2 to Bus Stop 3	0.8kms	15 min.	Flat.

BUS & BOAT TIME TABLE

Bus To Lake				BOAT DEPARTS	Bus From Lake			
SHOP	Bus Stop 1	Bus Stop 2	Bus Stop 3		Bus Stop 3	Bus Stop 2	Bus Stop 1	SHOP
9.05	9.10	9.15	9.20		9.30	9.40	9.45	9.50
10.05	10.10	10.15	10.20	10.25	10.30	10.40	10.45	10.50
11.05	11.10	11.15	11.20	11.25	11.35	11.40	11.45	11.50
12.20	12.25	12.30	12.35		12.35	12.40	12.45	12.50
12.55	1.00	1.05	1.10	1.10	1.15	1.20	1.25	1.30
1.35	1.40	1.45	1.50	2.00	2.10	2.15	2.20	2.25
2.30	2.35	2.40	2.45	2.50	3.00	3.05	3.10	3.15
3.15	3.20	3.25	3.30	3.40	3.50	3.55	4.00	4.05
4.05	4.10	4.15	4.20		4.35	4.40	4.45	4.50

INFERNO CRATER LAKE

Typical plot of water level in Inferno Crater Lake showing the four stages of the cycle

WORLD-WIDE SIGNIFICANCE Waimangu is the only hydrothermal system in the world the commencement of whose surface activity can be pinned down to an exact day, namely 10 June 1886. On that day a violent volcanic eruption punctured the country in this locality with a series of craters and allowed geothermal fluid already present underground direct passage to the surface of the Earth. Since the time of their formation, developments of the new geothermal features have been recorded.

GEOLOGICAL SETTING The Rotorua-Taupo region ('Taupo Volcanic Zone') is characterised by spectacular volcanic and geothermal features that are a result of its lying on the Pacific 'Ring of Fire'. This Ring of Fire marks in New Zealand the boundary between the Pacific and the India/Australia tectonic plates. Tarawera volcano, Rotomahana lake basin and craters of the Waimangu Volcanic Valley, all lying along one of the great Earth fractures above this boundary, are the sites of the largest eruption that has occurred within the span of New Zealand's written history.

CONSERVATION Waimangu is protected as a Scenic Reserve. Many of its geothermal features are ranked as Category A extremely important, of international significance. The developing local native forest is also very important as the only current New Zealand example of a bio-system re-establishing in an area following complete devastation by a volcanic eruption. It is home to a wide range of unusual thermally adapted plants and micro organisms. The operators of Waimangu have a strong commitment to preservation and education and also to public access, safety and enjoyment – aims which are being achieved by sustainable management practices.

WILDLIFE Waimangu Valley is home to a range of introduced and native birds and animals. Native birds include Wood Pigeons, Tuis, Fantails, Bellbirds and Pukeko; those that are introduced are Swans, Mynahs and Magpie, Shining Cuckoo, Finch and Sparrow. Introduced animal species unfortunately include the Opossum, the Rat, Stoat, Weasel, Feral Cat, Wallaby, Deer and Pig.