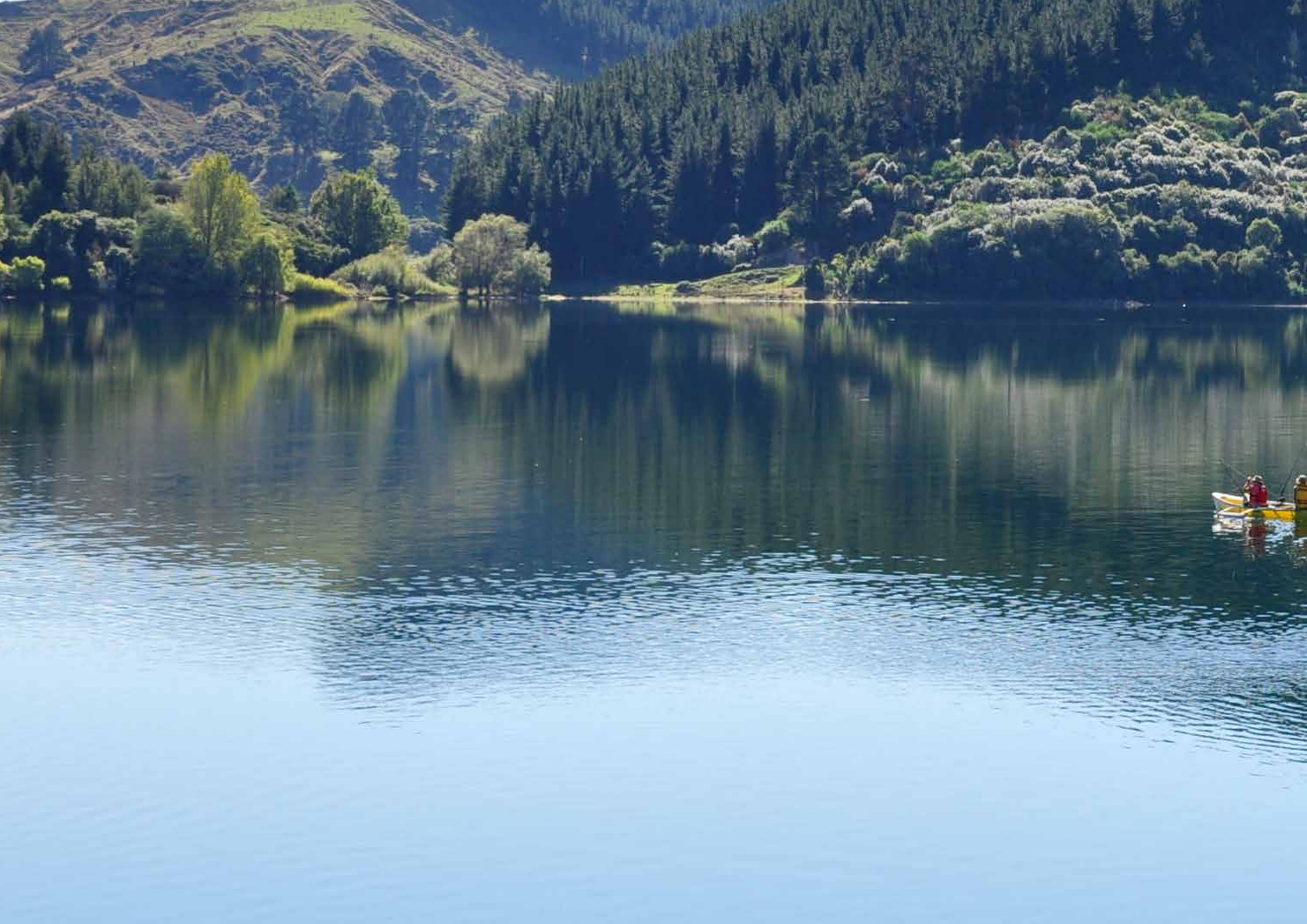
A Short History of Tūtira Country Park



Garth Eyles 2014

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Contents

Facts

	Lake Tūtira	Lake Waikopiro	Tūtira Country Park
Altitude	150m asl	150m asl	494 m above sea level
Mean annual rainfall	1438 mm	1438 mm	1438 mm
Catchment area	32.08 km^2		
Area	1.79 km^2	0.11 km^2	463.729 ha
Maximum water depth	42 m	16 m	
Maximum length	2.4 km	0.5 km	
Maximum breadth	1.2 km	0.25 km	
Water volume	36.1 million m^3		
Water residence time	7 yrs		

Lake information from Page and Trustrum, [1]

1999. Official opening of the Tūtira Country Park by Hawke's Bay Regional Council Chairman Ross Bramwell and Isobel Morgan, a long term Forest and Bird advocate for the lake.

Foreword

In his last years, Guthrie-Smith asked himself whether he should have cleared the bracken and woods to grow wool on Tūtira's hillsides, or have left the land alone to conserve and admire. "Have I then," he mused, "for 60 years desecrated God's earth and dubbed it improvement?"

The clearing of the Tūtira landscape was typical of the development of much of our hill country. It developed a nation but created long term environmental degradation. Lake Tūtira has provided a record of these changes in the sediment it stores. We have seen dramatic increases in soil erosion. Slips appear with almost every storm as farmers battle to stop reversion to bush and increase production. The introduction of the Water and Soil Conservation Act in 1967 saw the introduction of a national programme to reverse this trend.

With erosion comes pollution and Lake Tūtira became the focus of community concern as it is Hawke's Bay's second largest fresh water lake and a major recreation area. Community pressure in the 1970s led to New Zealand's first plan to improve the water quality of a lake through planned land use changes. The Lake Tūtira Catchment Control Scheme was initiated in 1980. For various reasons, mainly economic, this scheme struggled and by the late 1990s little had been achieved.

In 1998 Hawke's Bay Regional Council bought the Guthrie-Smith Trust's land on the eastern side of the lake. The Council then set out to illustrate to the community how this type of land can best be developed to minimise soil and nutrient loss and to develop a great recreational asset in the form of Tūtira Country Park.

I am pleased to see Hawke's Bay Regional Council has chosen to record the early years of development before this history is lost. I am particularly pleased to witness the progress towards developing Tūtira Country Park into a jewel in Hawke's Bay's recreational crown.

Fenton Wilson
Chairman, Hawke's Bay Regional Council

Introduction

In 1998 Hawke's Bay Regional Council bought 463 hectares of land on the eastern side of Lake Tūtira from the Guthrie-Smith Trust and established Tūtira Country Park. It is now appropriate to record a brief history of the Park and its environment before facts become memories and fade into antiquity.

Hawke's Bay Regional Council bought the property as a soil conservation reserve with two objectives: the prime objective was to manage the land to maintain and improve the water quality in the two lakes, Tūtira and Waikopiro; the second objective was to develop a quality outdoor recreation environment for the people of Hawke's Bay.

It is important to recognise that the water quality of the lake has been influenced by the historical use of the land from the whole catchment as the sediment in the lake bed has eroded from the surrounding land.

Development has involved many partnerships. The Department of Conservation has been a close partner in all aspects of development. The Napier Branch of the Royal Forest and Bird Protection Society, Pan Pac Forest Products Ltd, local schools, Hawke's Bay Farm Forestry members, Hawke's Bay Regional Council staff and councillors, the Corrections Department and Honda Tree Fund participants have all assisted with plantings. Organisations, including the NZ Air Force, and international volunteers have assisted with track development. Constant throughout has been the involvement of the caretaker, Blue McMillan.

This short history aims to record the significant historical events and developments in the park and to provide answers to questions frequently asked by visitors. For ease of reading references are numbered, see page 39.

Formation of the Tūtira Lakes

The Tūtira area is part of the East Coast Deformed Belt, uplift of which began in the Pleistocene and still continues. The rate of uplift is about 2 mm per annum. The area is underlain by sandstones and siltstones, interbedded with limestones and conglomerates, with the strata dipping 2-10 degrees Southeast towards Hawke Bay.

The lakes, Tūtira and Waikapiro are believed to have been formed at approximately 7200 years before present (*BP). The evidence for this comes from two radiocarbon dates from wood near the base of a core taken from the swamp at the northern end of Lake Tūtira. Page and Trustrum[1] believed that the cause was landslides, with the most likely origin being earthquakes. This is supported by the presence of landslide materials, the increase in depth of the lake from north to south and the proximity of the natural outlet stream to the main inlet. It is believed the outlet, formed by a large landslide (approx 45 ha), was at the southern end of the lake. A later, smaller landslide blocked the southern outlet, raising the water level, with the result that the present outlet was formed at the northern end of Lake Tūtira. This second landslide may have occurred around 1550 yr B.P. [1]

The area is approximately 100 km south-east of the central volcanic region. Fourteen tephra (ash) layers have been identified in the Tūtira area[4] where volcanic ash is the main component of surface soils. The two most obvious layers are the Taupō tephra, also known as Taupō pumice from an eruption approximately 1850 B.P., which is mixed through the top layers of soil (A and B soil horizons), and the Waimihia tephra from an earlier Taupō eruption (3280 yr B.P.) which is a distinct orange layer with a sandy to gravely texture. Beneath these, on more stable surfaces, is a brown, sandy layer from even older ash showers from volcanic eruptions, which have been mixed and weathered so that layers are unrecognisable. On steeper slopes, however, most tephras have been removed through erosion.

*BP *Before Present years is a time scale used in geology to specify when events in the past occurred. Standard practice uses 1 January 1950 for the start of the time scale, as radiocarbon dating became viable in the 1950s.*

Before Humans

This section is based on two publications: a paper by J. Wilmshurst[2], published in 1997, in which she used a series of sediment cores taken from the bed of Lake Tūtira to study pollen and to interpret land use change over time; and Guthrie-Smith's[3] classic book 'Tūtira *The Story of a New Zealand Sheep Farm*', first published in 1921.

Before human occupation the area was heavily forested by podocarps (predominantly rimu, beech, totara and matai), with a wide range of hardwood trees, shrubs, climbers and ferns. Pollen and charcoal evidence suggest that periodic drought and forest fires were common.

The patterns of forest clearance recorded in the Tūtira cores are typical of Māori deforestation recorded in other North Island pollen records. Estimates for the timing of the deforestation around Tūtira was about 500 cal yr B.P. which corresponds to estimates of similar burning in Waikato and northern Bay of Plenty forests. This corresponds to the time of Māori settlement. Wilmshurst estimated that deforestation at Tūtira took only about 60 years to complete. The podocarp forest was rapidly replaced by bracken and the shrubs, *Coriaria, Aristotelia* and *Coprosma*. The bracken continued to dominate until the development of Tūtira Station in the 1870s.

The replacement of forest with the highly flammable bracken and shrubs would have only exacerbated the process of clearance by providing an ongoing and highly combustible fuel supply. Once a dense cover of bracken and scrubland had established, soil stability was maintained. Between initial burning and the establishment of this bracken cover the cores indicated increased pulses of sediment.

Wilmshurst comments that bracken rhizomes can penetrate the soil to more than half a metre and form extensive, dense underground networks, providing improved strength and cohesion of the soils. These rhizomes would have survived most fires providing rapid revegetation. The relatively dense canopy of ferns (up to 3-4 m high) and a litter of fronds of half a metre or more would have protected the soils from slope wash (sheet erosion) and the rhizomes would have protected the soils from slip erosion.

Significance for Iwi

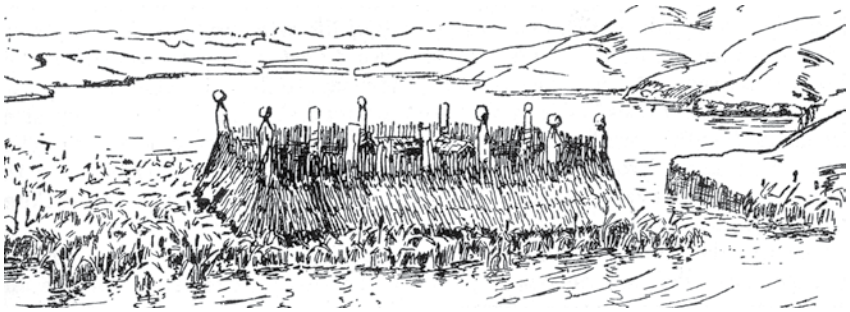
In addition to the landscape values, the area is rich in Māori history. Ngāti Kurumokihi (formerly known as Ngāi Tatara) are the tāngata whenua of the area. Tūtira (as well as the adjoining lakes of Waikopiro and Orakai) are of immense cultural significance to the hapū. Many wāhi tapu and sites of significance are located on the shores or near Lake Tūtira, including the pā sites of Tauranga-koau, Oporae and Te Rewa o Hinetu.

Historically the lake and its tributaries were plentiful in tuna (eels) and kakahi (fresh water mussels) and were an important source of food and materials (such as flax and medicinal plants).

In addition, the lake was a source of spiritual sustenance and was referred to as "ko te waiū o tātou tīpuna" or "the milk of our ancestors".

Tūtira was known as a linking place between coastal settlements and the ranges of the interior. Traditional walkways from Arapaoanui and Tangoio converged at the lake before heading inland to the Maungaharuru ranges or outwards towards the coast.

Source: Tūtira Recreation Opportunity Scoping Study: October 2010[18]



Te Rewa Pa, the fortified pa on the spur dividing Lakes Tūtira and Waikapiro

Blue (Richard) McMillan

One of the characters of the Park is Blue McMillan, the part time caretaker since the park was established. With his characteristic hat and quad bike with dogs on board, whether moving sheep or directing planting groups Blue has always been quietly there.

Blue moved to the area in the 1960s when he was eight years old and his father won a ballot block. Educated at Tūtira School and Napier Boys' High, Blue worked on local farms interspersed with periods in Australia and England, during which time he married Helen. He returned to Tūtira in 1990 to spend most of his time on the Guthrie-Smith Trust block until HBRC acquired Tūtira Country Park.

His encyclopedic knowledge of the local area and its history, his memory of every tree planted in the Park, his keenness to participate in the rehabilitation of the Park's natural features, his ability to provide many hours in addition to his work time and his enthusiasm for making it more accessible to the public have been vital to its successful developments.

Helen and Blue have worked as a team, sharing in the management of Tūtira Country Park. Heartfelt thanks go to Blue and Helen for all the work they have so passionately undertaken.

The Introduction of Pastoral Farming

Permanent European settlement and sheep farming began during the 1870s and started another period of vegetation change. The remaining forest and fern-scrub in the lowlands and hill country were steadily replaced with introduced pastures and grazing land.

Herbert Guthrie-Smith[3] provides a graphic history from the 1870s when he first arrived to manage 60,000 acres, extending to the east from the hill east of Lake Tūtira to the Mohaka River on the west, the Waikoau River to the south and the Waikari River to the north.

> "There were only a few acres of tussock grass, and a few hundred acres of forest and woodland hidden in gorges and ravines, otherwise, the whole station was covered in a sea of bracken. This plant delights in loose humus, sandy soil and pumice grit. It was most luxuriant on eastern and southern slopes where it averaged 5-6 ft high. On hot, dry, northern and western slopes it grew a foot or two less. No dry soil, however, was too bad to nourish bracken. Stunted to a few stiff inches, it covered alike the driest hill tops and the most arid flats.
>
> In early November fronds appear and take some weeks to reach their mature state, following which the plant rests until the following spring. Six or more seasons of crop can be distinguished in the tangled masses of fronds. Over every slope fern lay in swathes, it reached the base of every cliff, it hung like a fringe over every precipice. Development required the conversion of this fern cover to pasture."

The process of conversion involved a hot burn (generally in November when the fronds had matured) followed by heavy grazing with ewes and wethers. Initially, this grazing used every available sheep and, to quote Guthrie-Smith, "it was a compromise between murdering the sheep and making the country." The fire was followed by oversowing with grass and clover (usually of a poor quality) and fern crushing, (also called fern grinding) by sheep. The sheep were mass stocked to eat the fern before the fronds uncurled and became inedible. This process resulted in very large stock losses, e.g., between 1 April 1877 and 31 March 1878 there was a 30% loss in stock on the property. By the end of the second season the area had either been converted to acceptable pasture or it was reverting, requiring a stay until there was sufficient fern to create a hot burn. This process continued until the fern was beaten into submission.

Initially, merino sheep were used to break in the fernland but these animals were not suited to the task as they required short grass, dry ground and wide spaces to browse. Tūtira had a wet environment, rank vegetation and the need to concentrate the animals, hence the large losses. The Merinos were replaced by the Lincoln, but as soil fertility waned they were replaced, in turn, by the hardier Romney Marsh breed.

During this process of development the light soils were compacted and the ground opened to light, allowing manuka to slowly become the main enemy. Before development, manuka was largely confined to the edges of cliffs. On the upper portions of the hill slopes, from which fern had been worn out by the trampling and nibbling of sheep, manuka increased year by year. On the middle slopes, small clumps of manuka would appear and, on the flats single manuka plants. All were spread by millions of seeds carried by the wind and animals or by surface water flow with fires opening the seed capsules. Seedlings appeared in "millions of millions". Following each burn, as the fern became progressively weaker, the manuka became progressively denser. Guthrie-Smith called it a "fire weed", the seed pods following fire bursting open to spread their many thousands of seeds. Instead of being suppressed by the shade of the fern these seeds were able to become established. So for a number of years round the start of the 1900s, the fern and the manuka competed with each other, but with each successive burn the fern became weaker and the manuka stronger until the manuka became the major limitation to development.

Farmers recognised that consolidation or compaction of soils was essential for effective pasture establishment on these light soils. Experience had shown that steep slopes were good ground while easy slopes were barren and infertile. The steep slope soils were on sedimentary material where the ash had been eroded off, while the easy sloped soils were on loose, friable volcanic ash.

As each area was sown, it passed through phases of sudden rapid increase in feeding value, temporary balance, decrease and rapid decrease in food value. Guthrie-Smith believed that by the time his book was written in the 1920s, about 50 years following first development, there was a stable equilibrium developing. The introduction of aerial topdressing would have dramatically altered this sequence creating another stable equilibrium based on the current soil fertility.

Further development included the draining and ploughing of the wetlands around the lake. Before this, these wetlands had supported a stunted growth of flax and spindly raupo. As the land dried and hardened, these species flourished. In one very dry summer near the turn of the 19th century the Kahikanui swamp was burnt then trampled by sheep. A second fire cleaned up the remnants with the result that, when ploughed and harrowed, there were 40 acres of quality cropping land. It took three years of continuous cropping to reduce its fertility.

Pasture species were difficult to maintain as the initial fertility following burning dropped off, and rye grass and clovers did not last. The generally poor quality seeds used to establish pasture (often obtained as tailings and sweepings from the stores of Port Ahuriri) probably did not help. Yorkshire fog, cocksfoot double heads, seconds of rye grass, ratstail and fescue were used. Suckling clover became extremely important as it grew on all aspects and on the pumice providing essential quality and winter fodder.

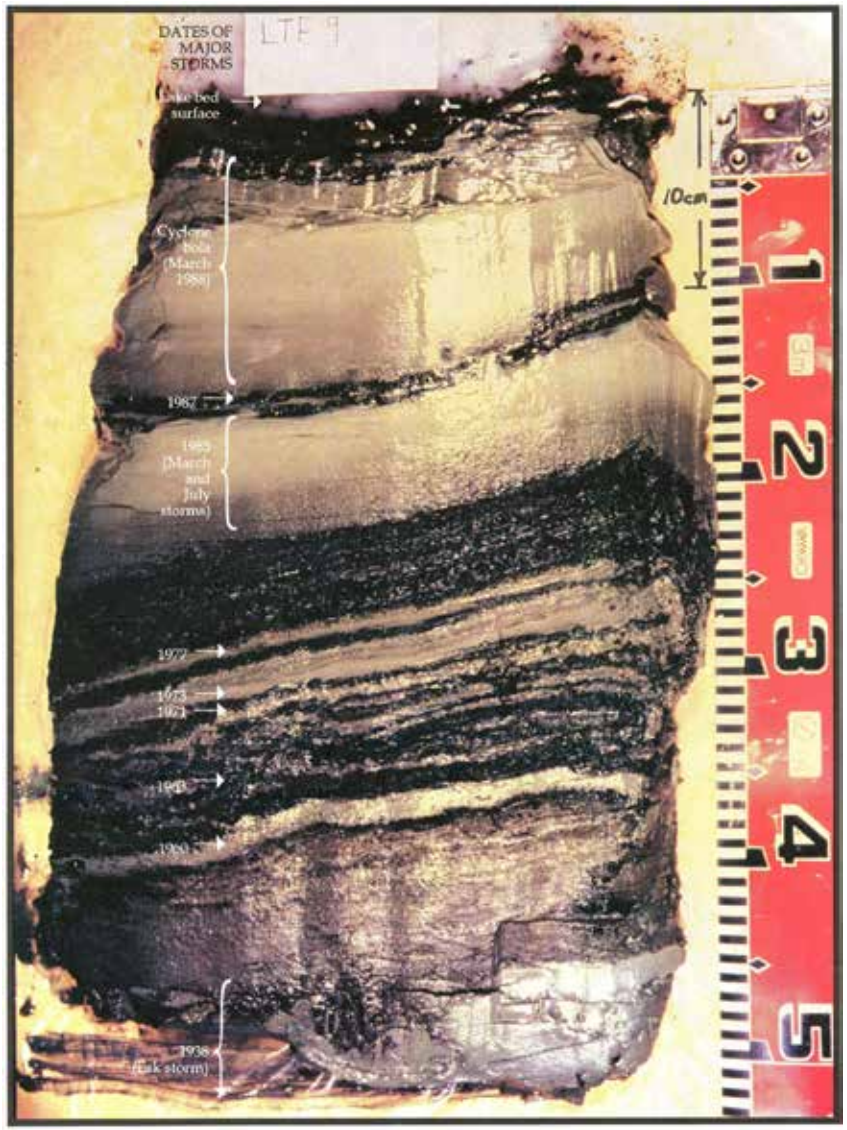
Guthrie-Smith commented that "looking back over half a century, the feature that stands out is the lessened fertility of today's surface soil as compared with that in the early eighties." This trend would have continued until the arrival of aerial topdressing in the 1950s.

Soil Erosion

As with all Tertiary hill country, the development of the Tūtira area into pasture has been accompanied by a significant increase in soil erosion. This increase has been documented by a multi-disciplinary study in the 1990's based on a series of twenty-five drilled cores taken in and around the lake. These cores cut through the sediment deposited on the lake beds or valley bottoms by each erosion event that occurred since the lake was formed.

Based on analyses of these cores (a majority of which were taken from the deep basins in the lake where there were optimum conditions for sediment accumulation) Page and Trustrum[1] have suggested the following sequence of erosion responses accompanied the changes from forest to fern/scrub and from fern/scrub to pasture:

- Under a near complete cover of indigenous forest prior to human occupation, erosion was confined to landsliding and hillslope channel erosion. The majority of sediment was deposited just offshore from the major streams in what were arms of the lake. With progressive infilling, these areas became narrow alluvial flats and continued to trap sediment as the unconfined streams meandered through the swamp and forest vegetation growing on these valley floors.
- Under the fern/scrub vegetation there was a slight to moderate increase in hillslope channel erosion. However, this increase in sediment was largely 'absorbed' by a combination of remnant riparian forest along hillslope channels and swamp and forest vegetation on the valley floors.
- The conversion of fern/scrub to pasture led to a massive increase in landsliding, an increase in hillslope channel erosion and the initiation of sheet and tunnel gully erosion. With the removal of much of the remnant riparian forest and swamp vegetation from the valley floors, the amount of sediment reaching the lake increased, although significant amounts were still deposited across the valley floors. Once the streams were confined and straightened to form drainage ditches, the sites of major deposition were transferred from the valley floors to the lakes.
- After approx 100 years of pastoral farming, progressive stripping of the soils that had accumulated under the previous forest and fern/scrub cover has led to



A 50 cm core from the bed of Lake Tūtira. Light colours are sediment from storm events. Dark colours are organic matter deposited during quiet periods. (Acknowledgement: M T Page, Landcare Research.)

a reduction in landsliding. There is continuing sheet, tunnel gully and hillslope channel erosion, the excavation of colluvium-filled hollows in first order basins and the initiation of channel erosion in the drainage ditches. Although hillslopes are still the major source of sediment, there is now an increasing percentage contributed from the secondary storage areas.

The massive increase in landsliding referred to by Page and Trustrum is confirmed by Guthrie-Smith's comments that

"after 3-4 days of uninterrupted torrential rain, I have counted, on a two mile stretch of hillside, over 200 slips great and small. Seven or eight times since '82 the grasses and sedges of the valleys around the lake have been overlaid by mud, varying in depth from six inches to a couple or three feet. Huge masses of solid hill have slid onto the larger flats."

The erosion was not always confined to the hills. Guthrie-Smith commented that

"in the great flood of 1917 enormous deposits of silt covered Kahikanui flat."

He also commented that

"after years of quiescence the ditch 3ft deep by 2ft wide, amply wide enough for the normal flow of water in the Kahikanui flats, became in a single flood and in a few hours a chasm 40ft wide, 15ft deep, and 300ft long".

There is no evidence of this now, the flat is smooth and contains highly productive pasture. At some stage, the ditch or stream has been relocated to the true right margin on the flats and held there by a bank, the origin of which is unknown. It is visible in aerial photographs dated 1962. Upstream of the Kahikanui flat, Guthrie-Smith recorded

"In the three days of the deluge of 1917 600 yards of Tylee's valley was gutted to the width of a chain and a depth of 20ft."

Blue McMillan comments that there is a small gorge immediately downstream of the waterfall at Tylee's Bush. This is probably the result of that 1917 storm.

Sedimentation rates under pasture are between 8 and 17 times that under forest and 5 to 6 times that under fern and scrub[1].

Climate

The Tūtira area has a very variable climate as indicated by the remarkable 93 years of rainfall records. The mean annual rainfall is 1438 mm (1951-1980) with the lowest being 770 mm in 1964 and the highest 2539 mm in 1938.

This is also a very stormy environment with thirty-one storms dropping in excess of 250 mm of rain in the recording period. Any storm dropping 250 mm over 2-3 days or 100 mm in 24 hrs or 200 mm in 28 hrs is likely to result in significant erosion in landslide prone hill country.

The largest recorded storm was Cyclone Bola which devastated Tūtira and its environs in 1988.

Most of the park is also susceptible to drought due to the predominant westerly aspect, light volcanic soils on the easy hill country and the very shallow soils on the scarps. Only the flats remain green during drought periods.

Image courtesy Gary Clode

Cyclone Bola

The largest rainfall event recorded at Tūtira is Cyclone Bola during which 753 mm of rain fell in March 1988 over 3-4 days, with 320 mm and 329 mm on successive days[5].

Landslides were the dominant erosion type occurring predominantly on slopes greater than 18 degrees and producing 1.184 million m^3 of sediment. Channel erosion (gully erosion) was the second most common, producing 28,000 m^3. The total volume generated is estimated to have been 1.349 m^3. Tunnel and sheet erosion were minor contributors. It is estimated 773,000 m^3 of sediment entered the two lakes. In the southern areas of the lake the sediment was on average 6 cm thick in the middle 27 cm and in the northern area 98 cm, an overall average of 36 cm. It is estimated approximately 51% of the total sediment generated was deposited in the lakes.

During Cyclone Bola the lake level rose 3.5 m and the lake margin extended up the valley floors with sediment being deposited within these temporary lake margins. Stockyards and fences near the present lake margin were buried[1].

In the Tūtira area the repair cost of Bola was estimated at $12 million and over the North Island $120 million[12].

In summary, of the 1,349,000 m^3 of sediment generated during the storm, 576,000 m^3 or 43% remained in storage in the landscape and 773,000 m^3 or 57% entered watercourses to be deposited in the lakes or discharged from the watershed via the lake outlet.

It is interesting to note that 55% of the sediment came from the moderately steep (21-25 degrees) to steep (26 -35 degrees) hill country and only 26% from the escarpments.

The aftermath of Cyclone Bola, looking down the Kahikanui Flats to the Lake. Image courtesy N. Trustrum

The Lake and Water Quality

The waters of Lake Tūtira have been a public concern for many years. The first water quality concerns were recorded by G. A. Gunn, the local Acclimatisation Society Ranger, in 1959. Locals reported that during the 1960s the summer waters were often yellow and stank (R McMillan, 2012). Public concern increased to the extent that, in 1974, the Lake Tūtira Technical Committee was established with the objective of examining the lake problems and to look for a satisfactory solution. Their report in 1978[6] concluded that that "there was no doubt the development of the catchment had resulted in the present low quality of the lake" and that "phosphorous inputs needed to be reduced by a factor of between five and nine times."

The report made the following recommendations:

- The Papakiri stream (Sandy Creek) be diverted and conservation measures applied.
- The lake reserve be fenced.
- Areas of high erosion potential be fenced and the streams retired.
- Stockyards be re-sited to eliminate nutrient runoff.
- A large proportion of the catchment remaining after stream diversion be afforested.
- Management practices be improved in the wider catchment.
- Monitoring of lake water quality be continued.
- A lake shore reserve be established.

The camping ground valley following Cyclone Bola in 1988. Note the extensive slipping and sediment deposited at the mouth of the valley. Image courtesy N. Trustrum.

The camping ground valley in 2012

This was the first case in New Zealand where it was planned to improve the water quality of a lake by planned land use changes. It resulted in a spurt of activity involving plans and works.

These recommendations were followed up by the community, resulting in the Lake Tūtira Catchment Control Scheme being prepared by the Hawke's Bay Catchment Board and implemented in 1980[7]. This provided grants for works within the wider catchment.

The Tūtira Recreation Reserve Board approved a lake shore reserve and a management plan in 1981[8]. The reserve aimed to ensure all stock were removed from the lake margin, denser ground cover in this margin would be maintained to filter nutrient and sediment, and erosion control works would minimise the risk of slips and gullies. The plan involved fencing the eastern side of the lake and planting the retired areas in native plants.

The scheme was reviewed in 1986[7], by which time Sandy Creek had been diverted and the stream retired, most of the lake had been fenced and erosion control plantings were being undertaken in the immediate lake area. However, the on-farm works in the larger catchment had not been so successful and it was anticipated this situation would continue until farm incomes rose.

A further five years of funding was allocated in 1986 to improve the Sandy Creek diversion and retire the waterway to allow regeneration. This included conservation plantings on 200 ha on the eastern side of the lake, completing 10 ha of native planting within the fenced off area around the lake, continuing on-farm space planting and relocating the two woolsheds.

In 1989, a Water Quality Study noted that the Sandy Creek diversion had prevented 70% of the creek's annual discharge from entering the lake and that an estimated 32% of the water entering Lake Tūtira was from overland flow or ground seepage, but that there was no information on the quality of these waters.

The introduction of the Resource Management Act in 1991, the changes in direction of the new Hawke's Bay Regional Council (HBRC), and the continued depressed rural economy resulted in little work being undertaken in the wider catchment[14]. Works around the lakes were not maintained. The introduction of the Regional Landcare Scheme by HBRC in 1993 resulted in increased riparian protection, wetland establishment and erosion control plantings in the wider catchment, but no systematic programme was undertaken.

Despite more than 30 years of control measures, water quality continues to be a concern with frequent algal blooms and consequent restrictions on swimming.

Management of the two lakes is the responsibility of the Department of Conservation. However, as the health of the lakes is affected by the land use within the catchment, a summary of the two main issues, the control of Hydrilla and algal blooms, will be briefly discussed.

Hydrilla eradication programme

The discovery of Hydrilla in 1963 has been an added complication due to the risk of accidental transfer of these plants to the hydro lakes.

Hydrilla (*Hydrilla verticiliata*) is an invasive aquatic weed that has earned worldwide notoriety as one of the worst submerged aquatic weeds. It is currently found in only three lakes in New Zealand, lakes Tūtira, Waikopiro and Opouahi, all in Hawke's Bay. In Lake Tūtira, Hydrilla was first identified in 1963 at which time it had formed extensive weed beds occupying an estimated 25 ha of lake bottom, excluding native vegetation from 1.5 to 7 m depth[13]. In 2008, the Ministry of Agriculture and Fisheries (MAF) and Biosecurity New Zealand initiated a Hydrilla eradication programme. This involved the release of grass carp (*Ctenopharyngodon idella*) in December 2008 into the three lakes.

As part of the Hydrilla eradication programme, MAF, Biosecurity NZ and HBRC have planned ongoing monitoring of water quality in the lakes for the next thirty years, by which time it is anticipated the Hydrilla will have been exterminated The monitoring programme aims to assess the effectiveness of grass carp on the eradication of Hydrilla and on the water quality and ecology of the lakes. Sampling alternates from a monthly monitoring programme for two years to a quarterly

programme for four years returning to monthly monitoring for a further two years. September 2010 was the end of the first 2-yearly period of monthly monitoring. The initial data showed the lake to be in good condition with the trophic (enrichment) level of the lake termed mesotrophic to eutrophic and conditions to be similar (or slightly improved) to those that were present during the 1980s.

As part of this programme, HBRC manages a lake water quality monitoring buoy, (the orange structure floating in the middle of the lake). The buoy measures a number of parameters at fifteen minute intervals - meteorological conditions, surface and deep water dissolved oxygen, water temperature throughout the water column and surface algae and turbidity levels. The data is transmitted to the Regional Council in real-time and allows for detailed assessments of stratification dynamics and lake condition.

Algal Blooms

Algal blooms are common in hill country lakes. Algae are naturally in the water but can increase rapidly ('bloom') during times of excess nutrient availability such as in autumn and spring.

Algal blooms are associated with specific ratios of phosphorous and nitrogen concentrations. They require certain light, temperature and nutrient levels and these conditions only occur down to the 1% light level. During the summer and autumn months the lake often becomes stratified (layered) when there is little movement in the waters and surface water nutrients are depleted. Periodically the lake 'turns over', in other words the layers break up due to wind movement or a gas bubble rising from the lake bed as a result of organic matter decomposition, or the lake warms uniformly. When this occurs the nutrients from the bottom waters get mixed through to the surface and this burst of nutrient can cause an algal bloom.

Cyanobacteria are very competitive algae. They have a number of advantages over other species. They can fix nitrogen from the atmosphere, which means they are able to remain productive in low nitrogen levels and they can adjust their buoyancy, which enables them to move through the water layers to the best nutrient/light/temperature conditions.

View of lake's Waikapiro and Tutira with the UMF manuka plantings in the foreground 2013.

Cyanobacteria produce toxins that are harmful to humans and animals if swallowed or through contact with skin (such as may occur when swimming, fishing or kayaking). Health risks include skin rashes, stomach upsets, nausea, tingling and numbness around the mouth or tips of fingers. Animals eating the algae are at risk.

The monitoring process has a ten day turn around time with the lab analysis so is therefore not appropriate for instant warnings. The algal bloom can be absent at the time the sample is taken but bloom within two hours.

Not all cyanobacterial blooms are visible to the naked eye and toxins can persist after the bloom has disappeared. Cyanobacterial concentrations can change quickly with changing environmental conditions such as wind. If the water is cloudy, discoloured, or has small globules suspended in it, people are advised to avoid all contact.

Napier Branch of the Royal Forest and Bird Protection Society of New Zealand

Forest and Bird has a continuing partnership with the lake and the immediate catchment having undertaken plantings in the vicinity of the lake most winters since 1982. Under the initial leadership of Sheila Cunningham plantings were undertaken on the Oporae and Taupunga headlands using a mix of natives and exotic plantings. In 1982 the strip from Oporae to Taupunga between the lake and the track was retired and planted in natives with the area above the track first planted the next year. Each following winter has seen volunteers planting in the Lucerne Block, the wetlands and riparian strips as these have been retired from grazing and the shoreline once the willows were removed.

This continuing partnership has been of great benefit to the lake and its immediate catchment.

Autumn Toa planting flax

The Rotary Club of Greenmeadows

The Rotary Club of Greenmeadows has had an association with the Park since 1999. Members have planted the Kahikanui wetland and assisted with planting the Saddle wetland, the Honda, Lucerne and Kauri blocks as well as releasing various plantings.

Author Garth Eyles with the Greenmeadows Rotary Club team planting the Kahikanui wetland

Management of Tutira Country Park 1998 – 2014

Hawke's Bay Regional Council purchased Tūtira Country Park in 1998. The objectives were to maintain and improve the water quality of the lake and provide an enhanced recreational environment for the public of Hawke's Bay. Where possible, proposals approved in the 1978 Technical Committee Report were to be implemented.

The vision was to have the steep hills that form the backdrop to the lake reverting to native vegetation, the low hills facing the lake in pasture with erosion control space planted trees as an arboretum, the remaining low hills being converted to closed canopy forest, either *Pinus radiata* or native. Highly erodible areas were to be reverted or planted in native vegetation and all waterways were to be retired and planted in natives. Walking tracks and camping areas were to provide both recreational and educational experiences for the public of Hawke's Bay.

It was understood this would take many years to achieve and implementation would be based on a succession of five year management plans. Community groups and organisations would be encouraged to develop their participation in planting programmes. Close cooperation was to be maintained with the Department of Conservation which was responsible for the maintenance and development of the lake (a Wildlife Refuge) and its immediate surrounds (a Recreational Reserve), the area between the two lakes, and the Table Mountain walkway.

Management has been based on a series of three five year management plans. Each plan identifies the priorities for that period, and documents the annual work programmes and costings.

In the first plan[9] from 1998 to 2004 emphasis was given to establishing the infrastructure necessary for future development and continuing the previous erosion control plantings with both native and exotic vegetation. Minimising sediment transfer to the lake was a priority. The plan encouraged public access by establishing a camping area and beginning a network of walking tracks.

Tūtira Country Park Boundary

Erosion prone areas exposed to high public pressures would continue to be grazed to minimise fire risk but would be space planted with exotic trees as an arboretum. The second plan[10] from 2004 to 2009 concentrated on removing the ageing willows from waterways and wetland areas, fencing all waterways and planting the riparian lengths with natives. Continued arboretum plantings, wetland constructions, animal and plant pest control programmes and interpretation signage continued the development programme.

By the third management plan[11] from 2009 to 2014 most of the major construction and development tasks had been completed and maintenance and enhancement became the priority. A review of fencing indicated a need to replace and repair most of the park's fences especially around retired areas. In 2012 HBRC decided to plant the escarpment and top lands in manuka as a trial joint venture with Comvita NZ Ltd. to both reduce erosion potential and produce high UMF honey.

Water supply

A major limitation to the development of the Park has been a secure water supply. In 1998, when HBRC acquired the property, stock was watered by having access to the lake and the streams flowing into it, from troughs supplied by tapped springs, and from dams.

The water supply for the public came from the Guthrie-Smith Trust by pipe from a spring on the western boundary above the cowshed, under SH2 and beside the track between the two lakes, with tap outlets. Even though this pipe was buried, blockages at the inlet, and frequent leaks (mainly caused by tent pegs) were a continuing concern.

In 1999 the pipe between the two lakes was re-laid at a greater depth and extended around the lake to the new camping ground. In 2004 a UV filtration unit and water treatment system was introduced at the cowshed to conform with Health Department guidelines.

As the Guthrie-Smith Trust's water requirements were increasing it became necessary to look at alternative water sources so that summer campers would have a secure supply in the future. In 2011 a bore was drilled behind Mr McMillan's residence, south of Lake Waikopiro at a site with electricity. Water is now pumped from this bore to the existing lake pipe and the previous Guthrie-Smith Trust access closed off.

Public access

The predominant users of the Park have been campers, anglers, picnickers, walkers, conservationists and wildlife enthusiasts. Developments have endeavoured to improve the environment for each of these. Camping had been restricted to the narrow margin around the lake and the front area between the two lakes. In 1998 development of the camping ground was initiated on the eastern side of the lake in the outlet of one of the valleys. The objective was to provide a remote camping area serviced with tap water and toilets, with rubbish removal only during peak periods. Experience was that continued rubbish collection resulted in local use of the collection facility. To reduce the flood risk to campers a stopbank was built on the waterway on the true right side, and a drain was formed down the left side.

Development of the Camping Ground.

Following Cyclone Bola in 1988.

During development in 1998. Note: Floodway on either side and the fenced 'wetland' at the bottom of the photo.

Fully developed in 2008.

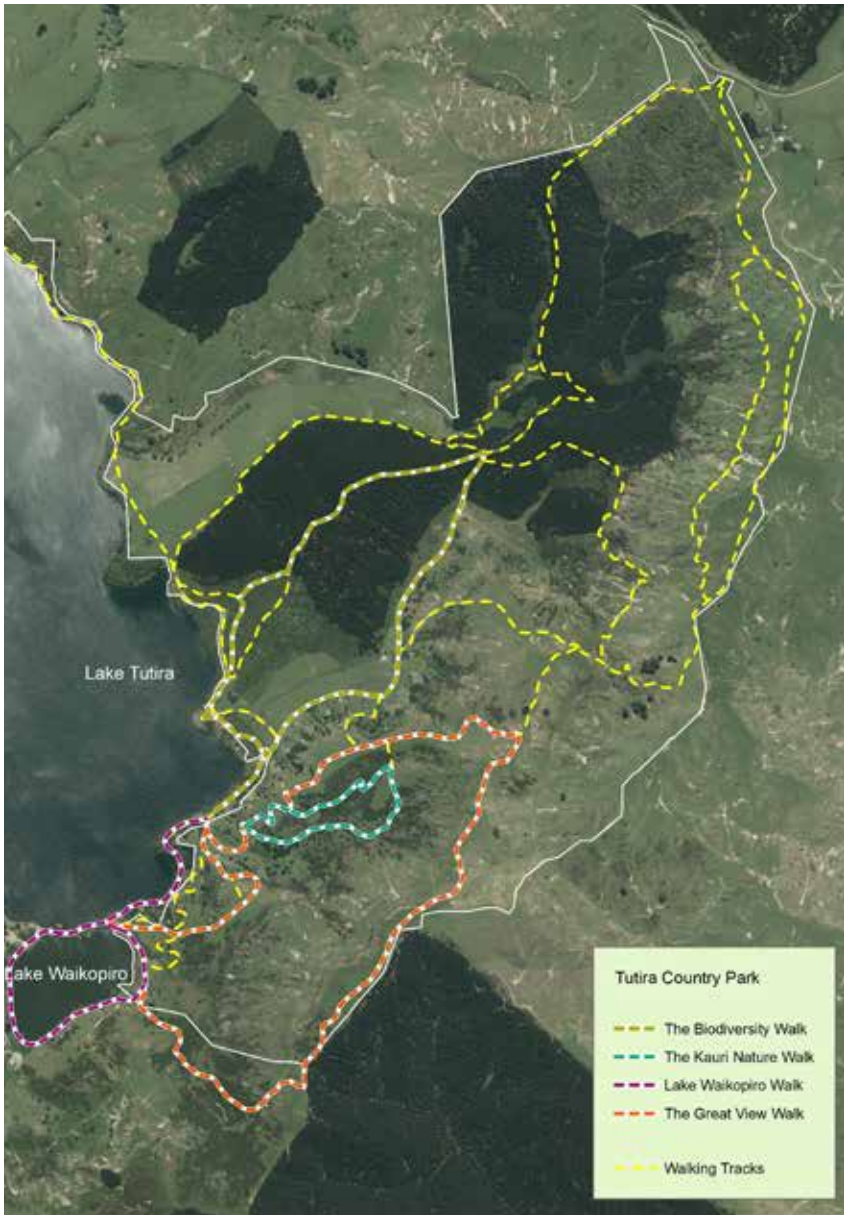
Upstream of the camping area a 'wetland' was created and planted in flaxes and wetland shrub spp. The objective of this was to trap sediment before it covered the camping area in any future storm event.

In cooperation with DoC seven toilets were installed. Due to the proximity to the lake these were all sealed units. They are serviced by DoC on an 'as required' basis with contract cleaning during the Christmas camping period. Unfortunately there is frequent vandalism of these facilities, which require regular repairs.

Walking Tracks

Walking tracks and interpretive signs have been progressively developed. In 2012 track signs and markers were established to make the walking experience more enjoyable. A picnic shelter as a 'challenge for the unfit' has been constructed on the low hills north of the camping ground. This has fabulous views to the west over the lake.

There are four main walking tracks - the Biodiversity Walk, Kauri Nature Walk, Lake Waikopiro Walk, the Great View Walk- which can be used in combination. Some of these tracks have been formed by outside groups, with one built by staff from Ohakea Airforce Base as a team building experience. Tracks have been developed to cater for a variety of experiences, from the Table Mountain walk, a 5 hr hike round the highest points, to easy walks in regenerating bush and flat walks around the lake margin.



Walking Tracks.

The Department of Conservation.

The Department and HBRC have been close partners in the continuing planning and development of the Park. With the lakes (Wildlife Refuges) and their immediate surrounds (Recreational Reserve) administered by DoC, this partnership has been both necessary and beneficial. The main areas of cooperation have been in relation to the public with responsibilities shared.

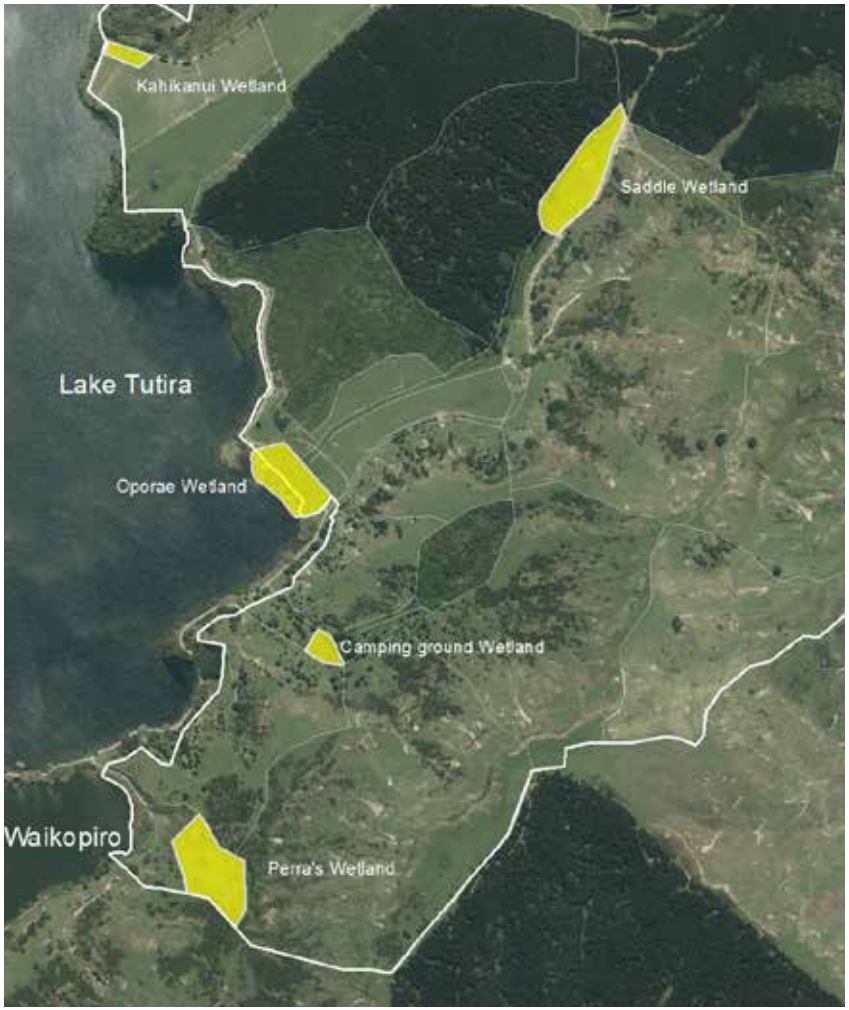
- HBRC has been responsible for the roading and most of the tracking (DoC looks after the Table Mountain and Pera's tracks).
- The composting toilets have been jointly funded, with maintenance by DoC staff except for the Christmas holiday period when HBRC contracts a cleaner.
- Rubbish collection has been the responsibility of HBRC during the Christmas holiday period with the rubbish bins being removed outside that time frame, after which campers are expected to remove their own rubbish.
- Water is provided by HBRC .
- Signage is generally a shared responsibility.
- Retirement planting of natives is a shared responsibility.

Any donations are shared by the two organisations.
This continuing partnership has allowed each organisation to continue with its core responsibilities with the additional benefits of shared efficiencies to the benefit of both organisations.

Alan Lee, Department of Conservation Services Ranger, helping St Mary's School students to plant a wetland

Wetlands

Minimising the risk of sediment entering the lakes during the next large storm event was a priority of the first plan. This was to be achieved through the construction of wetlands across the valleys of the four waterways entering the lakes.



Wetlands

Oporae wetland This was the first wetland developed by HBRC. It was formed across the mouth of the Te Whatu-Whewhe valley in 1998. This three hectare block was planted by school children during Conservation Week and by Forest and Bird volunteers, with periodic blanking since then. In 2007 the willows fronting the lake were cut and the margins of the lake planted with wetland plants. By 2012 the area was a mosaic of shrub species with a range of canopy trees including kahikatea, kowhai and cabbage trees. Blackberry has been a continuing problem.

The Te Whatu-Whewhe Valley mouth in 1998.

2002, three years following fencing and planting by primary school children during Conversation Week.

2012. Note: The wall of willows by the lake has been removed.

Kahikanui wetland A small wetland was at the outlet of the Kahikanui stream in a location where it was anticipated flooding would occur. The planting was undertaken in partnership with Greenmeadows Rotary volunteers. With the headwaters planted in *Pinus radiata* the risk of sediment would be reduced and so there was no need to have a wetland covering all the mouth of the valley.

Camping ground wetland This was formed immediately upstream of the camping ground across the valley floor. It was planted with flaxes, cabbage trees and scrub hardwoods.

The valley in 1998 following Cyclone Bola.

The camping ground wetland in 2002, two years following planting.

The same area in 2012.

Pera's wetland The head of the valley had been planted with concentric rows of willow and flax to trap sediment following Cyclone Bola as a camping ground was planned for the lower catchment. By 2007 the willows were collapsing and the flax was shaded out. All this material was removed and either burnt or chipped, the left side of the valley retired from grazing, three ponds constructed and wetland species planted by school children and Forest and Bird volunteers.

Looking across Lake Waikapiro to Peras Flat in 2001.

The same area in 2007, following willow clearance.

Retired and planted in 2012.

Saddle wetlands The upper portion of the catchment contained a natural wetland area which had been planted in willows prior to Cyclone Bola. This was modified to become a sediment trap. This modification comprised removing a willow plantation and creating a series of ponds along the flat with swamp vegetation between. Pond creation and planting has been progressive with plantings by the Honda Tree Fund volunteers, Greenmeadows Rotary, Forest and Bird volunteers and school groups. The success of this wetland complex was confirmed in 2012 when storm induced sediment filled a number of the wetlands requiring these to be excavated and new outlets were formed while no sediment travelled to the lake.

Removing the willows in 2001.

Creating the ponds in 2003.

Construction completed 2008.

Riparian protection

The second management plan made the clearing of willows from waterways a priority, followed by retirement and native planting in these areas. This was an expensive, but necessary, exercise with the willow clearance costing around $180,000 and illustrated the consequence of not carrying out regular maintenance.

By 2012 all the waterways entering the lake had been cleared of willows, fenced and planted with natives. This initiated a new stage of management in which the constricted waterways begin either degrading or meandering or both. These natural processes will need to be managed to minimise the loss of fences and the collapse of stream banks.

Riparian Protection.

Te Whatu-Whewhe Stream in December 2002 before willow clearance.

In July 2007 following willow clearance and new retirement fencing.

In August 2012 following plantings by school children in Conservation Week and Honda Treefund volunteers.

Planting and protection of native vegetation

When the property was purchased, it contained only one area of native bush and a few small areas of regenerating scrub, mainly in south facing sub-catchments. These scrub areas were encouraged to continue regenerating with the objective of retiring these at a later date.

Tylee's Bush. This is the only area of original native bush on the property. Its survival was most probably due to its southerly aspect which meant it was damp and did not easily burn. In the 1960s there was a camp in the bush used by workers splitting posts, indicating the bush has been modified with the removal of large trees. It has been further modified over the years by sheep and cattle grazing which continued until HBRC bought the property. Since then, the occasional goat, deer and pig have been the only tenants. Some under planting occurred in the early 2000s and the bush was re-fenced in 2011.

Tylee's Bush.

The Lucerne Block. The valley fronting the lake was recommended for retirement from grazing in the 1978 Technical Report[6]. The lower side of the track was planted by Forest and Bird in 1982. In 1990 the valley above the track was planted in natives by the Landcare Foundation and the Napier Branch of Forest and Bird. A very poor survival rate resulted in the area being replanted, this time using tree lucerne as a nurse crop. Surviving natives grew on through the tree lucerne canopy.

Rehabilitation of Native Vegetation Areas.

1998, Oporae Pa in the centre by the lake, with lucerne, upper left, acting as a nurse crop for native plantings.

2005, native tree plantings are beginning to thicken up.

By August 2012, the cover is complete.

Since then, annual plantings of 50 to 100 native tree seedlings have been undertaken, a never ending job. In 1999 walking tracks were cut through the area, with wooden seats and wooden path sections provided by HBRC staff during team building days. Intense possum control has meant an explosion of bird life with bell birds, tuis and wood pigeons making so much noise during the tree lucerne flowering season it is hard to hear. Blackberry and, more recently, Japanese honeysuckle have become major pests, requiring careful control to protect the natives.

In 1994 the south side of the ridge was planted in natives using school groups, the Napier Branch of Forest and Bird and Periodic Detention workers. Some 10,000 root trainer stock were planted, with varying success. Continued plantings have resulted in an effective cover today. Willows, space planted immediately after Cyclone Bola, have been poisoned as have wilding pines. A spring has been tapped to provide troughed stock water on the flats. In 1995-96 a block of Kahikatea was planted behind the Scinde Fishing club.

The Kauri Block. This block comprises the south-facing head of a valley system which drains through the camping ground and has a series of small springs along the western side. While it was predominantly scrub, there was a significant amount of hardwood regeneration which warranted protection. The area was fenced in 1999 with planting the following year. Planting was carried out by school groups during Conservation Week programmes, and by Forest and Bird and Greenmeadows Rotary volunteers. Four Kauri were planted and are thriving. Periodic underplantings have infilled losses and increased the number of potential canopy trees. On the southern boundary the stream had been planted in willows as a gully block after Cyclone Bola. By 2005 these were falling over and were removed, together with the pair-planted willows down the stream.

In 2007 a walking track was cut through the Kauri Block to join with another track to the camping ground making an enjoyable walk.

Two years after planting (2002), looking from west to east.

The Kauri Block in the middle right of the photo. 2004, 4 years after planting.

The same view as Photo 2 in 2012.

The Honda Block. The head of the Te Whatu-Whewhe catchment had been riparian planted in willows, to prevent post-Bola gullying, and in *Pinus Radiata*. The pines were harvested in 2006 and the willows cleared. After re-fencing, the lower catchment areas have been successively established in native vegetation funded by the Honda TreeFund and planted mainly by Honda purchasers.

Honda TreeFund

In 2004 Honda New Zealand introduced the Honda TreeFund in which, for every new car sold, money was granted for the planting of native trees. As a result of this commitment, by 2012 Russell Greer Motors had donated in excess of $82,000 worth of native plants. These plants were planted in the Te Whatu-Whewhe sub catchment which enters the lake near the Scinde Fishing Club hut. The project fitted well with the earlier clearing of a pine plantation on the upper valley terrace and low hills and the riparian area recently cleared of willows.

Each winter, weather permitting, Russell Greer hosted the year's new car owners to a planting day and barbeque on site. The result has been the completed planting of the riparian margins, the saddle wetland complex planted in native grasses, shrubs and wetland tree species and a Kahikatea plantation on the upper terraces with mixed podocarp hardwoods on the upper slopes.

The fund is now being shared with Pakowhai Country Park and Poukawa Stream.

This has been a great contribution by a Hawke's Bay business and indicates the potential of commercial partnerships in improving our natural environment. Our thanks go to Honda NZ and Russell Greer Motors.

Upper valley of the Te Whatu-Whewhe catchment in 1987, illustrating the erosion control willow and Pinus Radiata plantations.

Five years after planting, the comprosmas provide shelter for the canopy trees. Photo 2009.

Kahikanui Block. In 2006, 2.1ha of steepland and wetland along the northern border was acquired from Mr Turnbull. The area was infested with Old Man's Beard and, to a lesser extent, gorse and blackberry. Once the boundary was fenced, intensive Old Man's Beard and gorse control was undertaken and the steepland was planted in podocarps during 2007/8. Once retired from grazing, the wetland areas have regenerated nicely.

Erosion control forestry

The 1978 Technical Report [6] emphasised the need to afforest and retire land within the total catchment to reduce nutrient runoff. Priority areas identified were those close to the lake and areas with significant erosion.

In 1992 the Landcare Foundation and the Guthrie-Smith Trust established a Forestry Joint Venture covering 83.3 ha, planting three *Pinus radiata* blocks on the low hills in the Kahikanui catchment and adjacent Te Whatu-Whewhe catchment. These areas had produced more sediment during Cyclone Bola than the steep hills at the head of the catchment [1]. A plan called 'The Eastern Tūtira Block Management Plan 1993' [17] set out the intended management.

Using the best available improved breeds, the trees were to be planted at 800 to 1000 stems/ha and pruned to at least 6.5 m with about 300 stems/ha being high pruned. The responsibility for the management was vested in a commercial forest management committee (strictly concerned with the commercial forest) with two members appointed by the Guthrie-Smith Trust Board and two by the Landcare Trust.

In 1998, following the purchase of the Park, HBRC acquired the Guthrie-Smith portion of the joint venture and proceeded to complete the silviculture to a consistent standard. Later in that year HBRC planted a further 36 ha, completing the close planted tree cover of the lower hills in the Kahikanui catchment owned by HBRC.

The Kahikanui Valley Forest in 2014.

Erosion control forestry.

The arboretum

The low hills surrounding the lake were the major source of sediment during Cyclone Bola, but they are also productive hill country environments. Owing to the summer fire risk from the public having access to the hills close to the lake, these areas were not converted to closed canopy forest. Instead, space planted trees were used, with grazing to control the fire risk.

A planting plan for a predominantly exotic arboretum was developed by Alan Titchener in 1998 and Council staff and councillors planted the slopes in the following two winters. Each tree was individually protected with steel mesh which remained in place until the trees were large enough to withstand sheep predation. Plant survivals have identified the species that grow best and these have been used as replacements over the years. Plantings continued each winter so that, by 2008, over 700 trees covered the 34 ha. The appendix on page 44 gives a full list of tree species.

Steeper and hard sites have been planted in kanuka and poplars have been planted to give rapid protection. By 2010 these poplars were at least twice as tall as any species except redwoods and the English oak. Practice has been to begin removing the poplars when the slower growing trees have developed root systems that will protect the slopes from erosion. It is anticipated the poplars will be removed during the next 5 to10 years. Himalayan Oaks, donated by David Cranwell, have grown well in the Tūtira environment.

HBRC staff planting the arboretum in 2000.

The arboretum in 2008.

The arboretum in 2010.

The steepland

The three management plans have consistently encouraged the steepland areas to regenerate. Light grazing (with cattle in winter to break the turf mat) has seen manuka/kanuka scrub beginning to spread out from the steeper drainage lines onto the faces. In 2011 it was decided to use these areas as a demonstration of an alternative land use to pasture.

HBRC had been looking at economic alternatives for similar hard hill country and decided to use the steepland areas as a demonstration of the potential for high UMF manuka (*Leptospermum scoparium*) as a multi purpose plant. This manuka is a native and an effective erosion control plant, is able to accumulate carbon credits and produces high quality honey. UMF (Ultra Manuka Factor) is essentially a measure of the antibacterial potency of the manuka honey. The high UMF honey commands much higher prices and when this is shared between the apiarist and land owner, the decision to 'farm' manuka rather than trees or grass /animals becomes an attractive alternative. Native species provided a sequestration rate of 8 tonnes Carbon /ha/yr in 2012.

Following discussions between HBRC and Comvita NZ Ltd, the Council commissioned Hardwood Management to establish a trial. The trial was planted in 2011 and this has led to the progressive planting of 136 ha between 2012 and 2014.

Management has encouraged the regeneration of the steepland areas. This photo illustrates the manuka/ kanuka regeneration in 2002.

The same area in 2012. Note the increased cover of manuka/ kanuka and the rows of white dots where high UMF manuka was planted during the winter.

The steepland.

The pastured flats

Kahikanui Flat. This area has been either cropped or grazed since Guthrie-Smith developed it. A 1941 oblique aerial photo shows a series of old stream lines across the valley. In the 1962 aerial photos, cultivation had removed these and the stream had been restricted to the northern boundary, protected by a stopbank.

Ridgemount and Blue Paddocks. Deep, volcanic ash mantles the easy slopes making cultivation for pasture renewal a calculated risk as wind erosion can occur. The higher rainfall on these sites does, however, provide alternatives for grazing during dry periods.

Te Whatu-Whewhe Flat. The 1944 aerial photos indicate the flats had been drained. It is believed the drain was hand-channelled by an old shepherd. This drain gradually opened up so that today it is 3 m deep in places. The 1978 Technical Report [6] recommended this stream be retired and the stock yards, which were located close to the lake, shifted. The stream was retired in 1983 and planted in willows. By 2008, these willows were collapsing over the fences and were removed in 2009 with the fences replaced and the stream planted in natives. The planting was made possible by annual donations from the Honda Treefund. Plantings were undertaken by school groups, Greenmeadows Rotary, Napier Branch of Forest and Bird and clients of Honda Hawke's Bay.

Pera's Flat. In 2007 the northern (true right side) of the waterway was retired from grazing. The remainder of the flat remains in pasture with mature shade trees providing a relaxing section of the Lake Waikapiro and Table mountain walkways.

The Moeangiangi catchment

This catchment does not flow into Lake Tūtira but is the source of the Moeangiangi stream which flows out at Ridgemount. As a consequence its protection has had a lower priority than the lake catchments. Emphasis has been given to gorse control and maintenance of pasture to provide a sufficiently large grazing area to maintain a flock permanently in the Park. This area has been planted in manuka.

Pan Pac Forest Products Ltd. Planting for Conservation Week

In 2012 the 20th anniversary of a partnership between Pan Pac, the Department of Conservation and Hawke's Bay Regional Council was celebrated at Tūtira. This partnership has involved over 4,500 schoolchildren taking part in an annual Conservation Week activity since 1992. During this time about 10,000 plants have been added to the Tūtira landscape.

On each day during that week, year 5/6 schoolchildren are taken to White Pine Bush and Lake Tūtira. The schools are chosen on a rotating basis. At White Pine Bush, the children are shown New Zealand as it used to be and see how important trees are for conservation. At Lake Tūtira the history of the lake and the effect of soil erosion on its water quality are explained. The day finishes with the children planting native trees at Lake Tūtira which provides a life long memory for them.

This activity has been an excellent example of collaboration between organisations to get a great outcome.

Bird Life

Guthrie-Smith enthused that there was a very 'exuberant bird life' on the station in the 1880s due to the extensive tree cover. In the Tūtira woods there were tuis, wood pigeons, thousands of wax eyes, warblers and fantails. The rivers and lakes were plentifully stocked with cormorants (shags) and 800 - 900 scaup. There was one species of native bat.

The native bird mix changed over the years as the food sources diminished with the reduction in native cover and increase in pasture. Three new native species arrived with development: the banded dotterel, the pied stilt and the paradise shelduck. The native pipit (ground lark) also benefitted from development, as did the pukeko, harrier and falcon. The kingfisher and morepork prospered and while the grey warbler, the wax-eye and the fantail reduced in number, they were still prospering in the 1920s.

"The country under my regime has been shorn of its fleece; in time to come it will be flayed of its very skin; yet in spite of himself, perhaps against his wishes, the settler of the future must on land of this type help perforce in the preservation of wildlife." Guthrie-Smith[3]

Tui feeding on kowhai

Of the water birds, Guthrie-Smith was concerned with the scaup as this has a specialised nesting environment – the nest must be hidden beneath many seasons' accumulation of rotting flax blades, close to the water's edge. The little grebe (NZ dabchick) was considered to be secure as, like the scaup, it had a large lake bottom to feed from and had a very well-hidden nest.

Guthrie-Smith believed that many birds, such as the kiwi and weka, would be eternally safe in the many gorge environments around the station. Unfortunately, this prediction did not eventuate and weka were lost from the area by the mid 1950s and the kiwi in the mid 1990s. He lamented the arrival of mammalian predators, such as mustelids and cats, which he believed could create havoc with the native birds. He emphasised the importance of fencing off areas of natural habitat (gorges, steep faces, swamps and boggy creeks) to reduce stock losses from misadventure and to conserve areas of "covert" to provide valuable refuge areas for native birds.

"The only sure and certain cure of that evil is fencing. If the smallholder is to prosper and thrive, cliff and bog alike must be secured from trespass of stock. There will be conserved, therefore , on either side of each gorge and boggy creek on Tūtira, a strip of covert. Above the rims of the cliffs will flourish manuka, bracken, certain heaths and dry-country plants; along the sides of the boggy creeks will grow flax, nigger-head, raupo, and rank sedges. Without gorge or bog such narrow belts of wild land would be of little avail; as additions to the natural refuge-grounds they will prove invaluable." Guthrie Smith[3]

Since Guthrie-Smith's time, changes to the bird life have continued as more land was developed for agriculture and farming practices changed (e.g., on-going bush clearance, the aerial application of fertilisers, more intensive stocking rates, the introduction of cattle and dairy farming and exotic pine forestry). In addition, the introduced rabbit, possum, goat, pig and deer all increased dramatically in number and along with the further damaging numbers of ship and Norwegian rats, ferret, stoat, weasel, feral and domestic cats, dogs, and mice, all conspired against the native fauna. This has resulted in the complete disappearance of brown teal, kaka, parakeet, the crakes and rails, bittern and weka, and the drastic reduction in numbers of many others.

The introduction of Grass Carp into Lake Tūtira in late 2008 to control the invasive exotic weed Hydrilla has also had an affect on birdlife. The Grass Carp's voracious appetite for aquatic plants has severely impacted on food sources for species like NZ scaup, Australian coot and black swan. All three species used to appear here in their hundreds but scaup are the only species of the three seen in any number today. Pukeko numbers are also declining which could be linked to the grass carp feeding

Wood pigeon (kereru). Image courtesy of Dick Porter

on emergent rush and raupo beds as they eat out other preferred aquatic plant species. Hopefully, these species will increase in number at the lake once Hydrilla has been eliminated, the grass carp die out (anticipated to be in about 10-20 years) and the lake's native macrophyte beds recover.

Although fernbird still occur in small pockets of shrubland and wetland vegetation, it is likely they are far less common than in Guthrie-Smith's day. The rails (banded rail, spotless and marsh crake) and the bittern are no longer seen and it is unlikely that any of them remain. Brown teal probably disappeared early last century and white-eyed duck probably only ever visited as storm-blown itinerants. NZ dabchick still occur in low numbers and kaka, white heron, banded dotterel, black-bellied storm petrel and bar-tailed godwit are rare visitors. New species common here now include the three Aussie immigrants: welcome swallow, spur-winged plover and the white-faced heron.

The development of Poutiri Ao ō Tāne, a landscape-scale restoration project in the Tūtira basin, augurs well for the future of those native birds that have suffered in the past as a result of human activities. This is a combined community, iwi, local body and Government supported initiative, with considerable private funding. The objective is to connect the existing reserves and natural areas in the basin with corridors of native bush, retire from grazing and restore land not economical for conventional farming practices, fence off streams, undertake intensive pest control, and re-introduce bird species previously found in this area.

Hydro Electric Potential

Between 1976 and 1980, the Hawke's Bay Electric Power Board studied the possibility of an electric power scheme for Lake Tūtira. What was envisaged was an intake at either Lake Tūtira or Lake Waikopiro with a short tunnel to Lake Orakai. Water would be taken from Lake Orakai, either by pipe or canal, to penstocks leading to a power house near the confluence of the Waikoau River and Lake Orakai stream outlet. A working variation of 0.4 m of lake level was used. The study considered that a more thorough investigation would be worthwhile but nothing has eventuated.

The Future

No history is complete without a brief look into the future. Development has been based on a series of plans with the third covering 2009-2014. These plans have continued the vision approved in the first plan which established three outcomes to be achieved: water quality protection for the lakes, biodiversity enhancement and public recreation.

Most of the recommendations of the 1978 Technical Committee Report applying to Tūtira Country Park have now been implemented and are being maintained.

- The low hills have either been close planted in *Pinus radiata*, or in space planted trees where recreation or fire control has required pasture to be maintained. When the *Pinus radiata* are harvested, a decision will be needed as to whether these areas could be replanted in pines or converted to a native production/protection forest.
- The escarpment, providing the eastern backdrop to the lake, has been encouraged to regenerate into native scrub and eventually bush by a process of light grazing, predominantly with sheep but with cattle used for short periods to break the turf mat and speed up the regeneration. This cover will provide a long term reminder of what the steep hill country probably looked like prior to human occupation. This process has been sped up by HBRC progressively close planting the escarpment in manuka.
- A series of walking tracks of varying difficulty have been created, providing access to all areas of the park and into each of the landforms and vegetation types. These will need to be upgraded as the recreational population grows.
- All the streams have been retired from grazing and planted.

Hawke's Bay Regional Council's ability to maintain a consistent development policy will ensure Tūtira Country Park remains a jewel in the region's crown and develops into a nationally desirable recreational asset. In 2014 the Country Park was put under the umbrella of the HB Regional Park Network Plan and renamed Tutira Regional Park.

Acknowledgements

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Appendices

Chronology of the Development of Tūtira Country Park

The history of the Park is also the history of the Guthrie-Smith property until 1998 when the Hawke's Bay Regional Council acquired the area from the Guthrie-Smith Trust.

1873 Tūtira was leased by 40 natives to T. K. Newton for 21 years at £150 pa.

1882 The lease was sold to W. Cunningham Smith. This was on behalf of H. Guthrie-Smith and Arthur M'Tier Cunningham, who were, at that time, minors.

1883 H. Guthrie-Smith became the sole owner.

1925 Guthrie-Smith undertook a bathymetric survey of Lake Tūtira.

1929 The Government acquired the greater part of the block for soldier resettlements.

1929 Part of the block was made a sanctuary for imported and native game.

1940 Mr Guthrie-Smith died.

1942 The block was transferred, by Guthrie-Smith's daughter, to the Guthrie-Smith Trust, as a public park.

1957 The sanctuary was created a Wildlife Refuge.

1959 The first documented concerns about the water quality of the lake were recorded by the Acclimatisation Society Ranger.

1963 A bathymetric survey of Lake Tūtira, when compared with the 1925 survey undertaken by Guthrie-Smith, showed the mean lake depth had decreased by 1.1 m in 38 years[15]. This represented an input of 1.9 million cubic metres of sediment from the catchment[5].

1964 The Crown owned portion of Lake Tūtira, together with Lakes Waikopiro and Orakai and a strip of Crown Land around these lakes, was reserved by the Crown for recreational purposes. A strip of land with width varying from 20 m to 125 m and following the shore line of all three lakes except between Lakes Tūtira and Waikopiro also formed part of the reserve. The area between these two lakes had the status of a county road.

1974 The Lake Tūtira Technical Committee was established to examine lake water quality problems and to identify a satisfactory solution.

1978 The Tūtira Technical Committee Report was completed, in which recommendations were made for the management of Lake Tūtira and its catchment.

1980 The Hawke's Bay Catchment Board approved the Tūtira Catchment Control Scheme which aimed to provide a long term solution to the water quality problems of the lakes.

1981 A weir was installed in the outlet reducing the rate at which water could leave the lake. The margin of Lake Waikopiro was fenced and planted but it was not maintained and consequently both the fence and most of the plants were destroyed.

1985 The Sandy Creek diversion was constructed by the Hawke's Bay Catchment Board.

1987 The Landcare Foundation was established. One of its aims was to promote the planting of woodlots and natives around the eastern side of Lake Tūtira.

1987 Table Mountain walkway was opened from Ridgemount Rd to the lake along the eastern escarpment. This is maintained by the Department of Conservation.

1988 Cyclone Bola. Between 6-9 March 753 of mm rain was recorded near the lake with 320 mm and 329 mm on successive days. The resulting flooding overwhelmed most of the existing works.

1989 A Lake Tūtira Water Quality Study was undertaken by the the Hawke's Bay Catchment Board to provide a data base against which long term trends could be compared.

1985-88 The storms in 1985 and 1988 overwhelmed, to a greater or lesser degree, all the work that had been carried out to that date. Sandy Creek diversion was filled with sediment and most riparian fences were buried, with goats eating the subsidised plantings. Only Sandy Creek and a few of the other works were reinstated.

1984-98 Changing finances following 1984 meant that very little soil conservation work was carried out.

1989 The formation of the Hawke's Bay Regional Council (HBRC).

1992 Landcare Foundation and the Guthrie-Smith Trust planted three *Pinus radiata* woodlots, covering 83 ha, as a Forestry Joint Venture.

1997 An archaeological survey of the Tūtira Country Park area was completed [16].

1997 Consultants developed a four year management plan for the Park (Titchener et al., 1997).

1998 HBRC purchased 463.7 ha on the eastern side of the lake from the Guthrie-Smith Trust.

1998 HBRC bought from the Landcare Foundation their 50% portion of the Forest Joint Venture.

1998 The Scinde Fishing Club hut was relocated from the front of the camping ground area to its present site.

1999 The Tūtira Country Park was officially opened on Saturday 20 March. A commemorative plaque was unveiled by Isobel Morgan, a longtime Forest and Bird advocate for the lake and its environs.

2001 An easement between the two lakes was granted to HBRC by the Department of Conservation, for access from SH2 to the Park.

2004 The second management plan for the property (2004-2009) was approved by HBRC.

2005 In November a 35 year less one day lease was signed with Mr Turnbull for a strip along the lake margin connecting the Park with the northern end of the lake.

2006 An area of 2.1 ha along the northern boundary of the property was acquired from the landowner, Mr Turnbull.

2006 The Park was gazetted as a soil conservation and river control reserve and was vested in HBRC on 16 March.

2009 The third five year management plan for the property (2009-2014) was prepared.

2009 A shared water supply bore for the Park was completed in cooperation with Mr McMillan.

2011 A trial planting of high UMF manuka on a 5 ha plot of steepland was completed, in a venture with Comvita Ltd.

2013 HBRC established Hawke's Bay Regional Parks Network incorporating Tūtira Country Park, renamed Tūtira Regional Park.

2012-14 A further 136ha of steepland was planted in high UMF manuka.

Tūtira Regional Park - Aboretum Tree List as at May 2014

Ref	Botanical Name	Common Name	Number
1	*Acer rubrum*	Canadian Maple	10
2	*Acer spp.*	Maple	3
3	*Aesculus indica*	Indian or Himalayan Horse Chestnut	7
4	*Alectryon excelsus*	Titoki	3
5	*Alnus spp.*	Alder	1
6	*Cedrus deodara*	Himalayan Cedar	16
7	*Cornus florida*	Dogwood	6
8	*Corokia cotoneaster*	Korokia	1
9	*Corynocarpus laevigatus*	Karaka	38
10	*Fraxinus angustifolia oxycarpa 'Raywoodii'*	Claret Ash	20
11	*Fraxinus excelsior*	Common Ash	29
12	*Fraxinus excelsior 'Jaspidea'*	Golden Ash	17
13	*Ginkgo biloba*	Ginko	28
14	*Gleditsia spp.*	Gleditsia	36
15	*Liquidamber styraciflua*	Liquid Amber (Sweet Gum)	55
16	*Liriodendron tulipifera*	Tulip Tree	8
17	*Pittosporum crassifolium*	Karo	4
18	*Pittosporum eugenioides*	Tarata (Lemonwood)	5
19	*Podocarpus totara*	Totara	19
20	*Pseudotsuga menziesii*	Douglas Fir	5
21	*Quercus coccinea*	Scarlet Oak	60
22	*Quercus leucotrichophora*	Himalayan Oak	105
23	*Quercus palustris*	Pin Oak	26
24	*Quercus robur*	English Oak	87
25	*Quercus rubra*	Red Oak	35
26	*Quercus spp.*	Oak Hybrid	9
27	*Sequoia sempervirens*	Redwood	33
28	*Sophora tetraptera*	Kowhai	6
29	*Taxodium distichum*	Swamp Cypress	32
30	*Tilia cordata*	Linden (lime)	3
31	*Ulmus glabra 'Lutescens'*	Golden Elm	2
32	*Betula pendua*	Silver Birch	6
33	*Pyrus spp.*	Ornamental pear	6
			721

Farm Forestry Association

Members of the Hawke's Bay Branch of the NZ Farm Forestry Assn have provided valuable expertise and manpower both in removing exotic trees in native plant areas, clearing blackberry, pruning and cleaning up in planted areas.

They have provided expert manpower to plant trees in areas planned for native enhancement. They have found this volunteering to be a pleasant break from their own 'farm forestry' doing the same thing somewhere different.

The Author

Garth Eyles

Born in Takapau, Garth spent his early years at Ashley Clinton where his father was the school teacher - the first Hawke's Bay connection. After university, he joined the Water and Soil Division of Ministry of Works and Development where he was tasked with 'doing the science' for the Catchment Boards. Hawke's Bay, again, featured as a place to live for two years while the Ranfurly Shield was in the province.

Garth was involved with two national resource surveys: one of erosion potential and the other the New Zealand Land Resource Inventory (NZLRI). These allowed him the luxury of travelling the country from North Cape to Stewart Island, West Cape to East Cape by foot, horse, Landrover, Holden Belmont, helicopter, quad bike and plane, all in the name of work.

His work also included a number of international Overseas Development Aid contracts applying both mapping techniques and soil conservation methodologies to catchments in Indonesia, the Pacific and Brazil.

With his passion for the environment and promoting sustainable land use and practices, the opportunity to see this develop at 'grassroots' was realised when he returned to Hawke's Bay in 1993 to work as the Manager, Land Management at Hawke's Bay Regional Council. At last a chance to make a difference at the coal face with farmers and the community. The foresight and policies of the Council at that time allowed Garth to thoroughly enjoy the next 15 years until his retirement in 2008.

Of particular pleasure was the purchase and development of Tūtira Country Park. Our whole family has participated in the growth of this asset for Hawke's Bay, planting trees and walking the tracks, and we hope the community will experience the same pleasure we have for many years to come.

Mary Anne Eyles
Manager