



CONSERVATION PLAN FOR
MAUAO HISTORIC RESERVE
2004
VOLUME 1

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EXECUTIVE SUMMARY

Mauao is a steep-sided rhyolitic lava dome rising 232 m above sea level at the main entrance to Tauranga Harbour. It was inhabited for centuries by tangata whenua, who have particularly close links with Mauao and attach a very high priority to ongoing involvement in management.

Visible surface archaeological features cover most of the summit and the southern slopes of Mauao. Mauao is gazetted as a Historic Reserve, administered and managed by Tauranga City Council. The reserve should be managed and conserved in a manner consistent with the cultural and spiritual values of tangata whenua. The archaeological landscape and associated cultural values of the reserve are of particular importance and are the reasons for the classification of the area as historic reserve. The archaeological sites within the reserve are a non-renewable resource, and they cannot be rebuilt or repaired if damaged or lost. The uses approved for historic reserve, under the provisions of the Reserves Act 1977, are passive recreation and education visits.

Mauao comprises a unique volcanic landform in close proximity to the coast and is a regionally significant landscape feature. Although heavily modified by human activity and related fires, Mauao also retains significant ecological values. These include an important remnant of coastal forest and mainland populations of oi (grey-faced petrel) and karora (blue penguin). In the current management plan it is stated that tangata whenua aspirations are "To restore the mana of Mauao by replanting trees and plants naturally occurring in coastal forest, rejuvenate the diversity of birdlife, and generally beautify Mauao." There is considerable scope for ongoing active ecological restoration of Mauao. It has many similarities to some Bay of Plenty islands (c.f. Moutohora - Whale Island) and it offers substantial opportunities for ecological restoration and nature conservation, in conjunction with ongoing high levels of public usage. The reserve is utilised by large numbers of visitors (estimated at c.250,000/year), who traverse the base circuit track or climb to the summit. As such it is also a regionally important recreational asset and complements other local and regional reserves such as the new regional park in the Papamoa Hills.

This plan prescribes maintenance and remedial works to assist in the conservation of the archaeological landscape in the Mauao Historic Reserve. The purpose is to care for the archaeological features so that their meaning and importance is conserved and able to be appreciated and interpreted by present and future generations, and to ensure that the reserve is managed and conserved in a manner consistent with the principles of the ICOMOS New Zealand Charter. It also sets out the management required to protect and enhance the significant ecological values currently and potentially present on Mauao. It is critical that the management of cultural heritage, ecological restoration, recreation, and other activities are addressed in an integrated manner. Tauranga City Council has established an advisory committee to oversee the management of Mauao and this includes representatives of the community, Councillors, tangata whenua, and the Crown. Tangata whenua in particular are active participants in management of the reserve and there is a need for ongoing dialogue and consultation as this plan is implemented.

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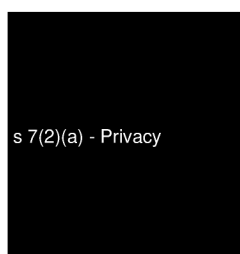
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PROJECT TEAM



- Project management, field assessments, report compilation
- Archaeological management
- Fauna
- Archaeological management, fire management
- Vegetation management
- Landscape evaluation and management

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1. INTRODUCTION

This conservation plan should be considered in conjunction with companion documents, including Phillips (2003) archaeological survey report, and the Mauao Management Plan (1998).

The archaeological features in the Reserve are “archaeological sites”, as defined in the Historic Places Act (1993), and protected under the provisions of sections 10-20 of the Act. It is unlawful to modify damage or destroy any archaeological site without prior authority from the NZ Historic Places Trust (HPT). A recent amendment to the Historic Places Act allows for an archaeological authority to be issued for a period of five years, rather than the previous two year period. Four of the recorded archaeological sites within the Mauao Historic Reserve are Category II registered historic places under s23 of the Act - the summit pa, the western pa and associated terraces and midden, the stone steps, and the stone jetty. The provisions of the Reserves Act (1977) are also applicable because Mauao is a reserve in terms of that Act.

Mauao Historic Reserve is a steep-sided rhyolitic lava dome rising 232 m above sea level at the main entrance to Tauranga Harbour. It is a prominent and iconic landscape feature. Tangata whenua inhabited Mauao for many centuries and it has very special significance to them. Evidence of Maori occupation is widespread on the summit and the southern slopes, and the archaeological landscape and associated cultural values are of particular importance.

Mauao also retains significant ecological values and there is considerable scope for ecological restoration. Protection of archaeological features and cultural values, protection and enhancement of landscape values, and the protection and restoration of ecological values need to be addressed in an integrated manner. This plan provides an integrated approach to these matters, recognising the extremely high levels of ongoing use that Mauao is subject to.

Mauao is administered by Tauranga City Council, with ongoing input from an advisory committee that includes tangata whenua. The reserve is a ‘Conservation Zone’ in the Tauranga City Plan. Permitted activities in this zone include provision and maintenance of public recreational facilities, informal recreational and leisure activities, and temporary activities and commercial uses.

Initial sections in the plan address a vision for management, key resource issues, threats to significant values, and options for future management. This is then followed by sections on management implementation, monitoring, research, and a work plan and timeline. Background resource material, including goals, objectives, and policies from the 1998 management plan, are presented in a separate companion volume.

2. VISION¹

Mauao is preserved as a taonga of exceptional cultural, spiritual, historic, and natural significance.

Mauao shall remain a taonga for all people to enjoy its unique features, while ensuring that impacts are minimised.

The goals, objectives, and policies in the 1998 management plan are still considered to be relevant, and are provided in Volume 2 of this plan.

¹ The vision presented here was developed by tangata whenua and is different to the vision presented in the 1998 Management Plan; which is set out below:

- All historic resources conserved and effectively managed and woven into the conservation of natural features.
- A place where people may visit to admire and enjoy some of the special gifts and cultural history, provided impacts are minimised.

3. HISTORIC HERITAGE DESCRIPTION AND SIGNIFICANCE

3.1 History

Tangata whenua inhabited Mauao for centuries and Ngati Ranginui, Ngaiterangi, Ngati Pukenga, Ngai T;amarawaho, and Waitaha all acknowledge the exceptional cultural importance of Mauao, and the ways in which Mauao provides significance to the lives of the individuals, whanau, and hapu of Tauranga Moana. These relationships are an integral part of the cultural whariki of tangata whenua, are unique to tangata whenua and are not shared – and possibly not fully understood – by other sections of the community. It is this special relationship that must be encapsulated in the management plan and in the management of Mauao (Fisher 1995:8).

The cultural history of Mauao has most recently been discussed in two reports on tangata whenua issues prepared by Fisher (1995) (Ngaiterangi/Ngati Pukenga) and Piahana (1995) (Ngati Ranginui), which form part of the supporting documentation for the 1998 Mauao Management Plan. The information below in this section is from those documents.

It is essential that the deep attachment that the tangata whenua of Tauranga Moana have with Mauao is understood and appreciated. Mauao is steeped in legend and occupies a central and very significant place in the tribal histories of the tangata whenua, and is one of the principal ways by which tribal identity and rohe is confirmed. It is not appropriate that this history is summarised in a few paragraphs within a written report. Tangata whenua have reserved the right to disseminate information relating to the history of Mauao in a manner that recognises and preserves the significance of that history.

Historically, management policies have focussed on the perceived needs of tangata whenua (to have their history, settlement story told) rather than the expressed need (to regain authority, mana and an intrinsic relationship with their ancestral mountain).

3.2 Physical features

An inventory of the archaeological features within the reserve has been prepared by Ken Phillips (2003). A detailed description of each component of the archaeological landscape is also provided in the Phillips report, from which the following brief summary is derived.




3.3 Archaeological sites

Mauao Historic Reserve contains an extensive archaeological landscape that covers approximately 40 hectares - refer to Figure 1 (from Phillips 2003). There are approximately 800-1,000 visible surface archaeological features within the reserve. These surface features include the components of three pa, plus associated pits, terraces, platforms, house floors, and middens. The shell mounds in the reserve are the only known surviving examples of this type of archaeological feature within the Bay of Plenty.

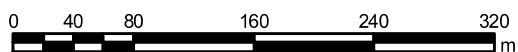
It must be kept in mind that the surface archaeological features are interconnected by extensive buried archaeological deposits, and that Mauao represents a primarily intact archaeological landscape. The spaces between the surface archaeological features are highly likely to contain intact buried archaeological features.



N Legend

-  Walkway
-  Archaeological sites
-  Zone of currently known surface archaeological features

**Figure 1. Archaeological sites on Mauao
(from Phillips 2003)**



Scale: 1:5,000
Date: 17/03/04
Cartographer: RPB

There are also several archaeological features originating from the post contact or post European period¹. Some of these features, such as the reputed ‘military camp’ and the stone steps require further archival and archaeological research before their origins, functions, and significance can be fully understood.

3.4 Assessment of historic values

The New Zealand Historic Places Trust (the Trust) has a statutory role under the Historic Places Act 1993 to identify places of heritage value, and it has statutory authority in relation to this matter. The assessment criteria used by the Trust are from Section 23 of the Act:

Historical, cultural, aesthetic, archaeological, architectural, scientific, social, spiritual, technological and traditional significance or value.

In most cases archaeological sites are assessed primarily on the basis of their historical, cultural, and archaeological significance. These three criteria may contain elements of other assessment criteria. For example, the assessment of archaeological significance generally includes consideration of scientific and technological values. Similarly, the assessment of cultural significance should consider the social, spiritual, and traditional values of a site.

The following sections include discussion about the values which collectively underpin the evaluation of significance. It is possible for elements of significance to conflict. For example, the archaeological significance of a place may be defined by its potential to contribute scientific information through invasive excavation. The archaeological significance may however be the antithesis of the cultural significance of a place. The apparent conflict between significance criteria does not however, detract from the contribution each criterion makes to the overall evaluation of heritage value.

3.5 Historical significance

Mauao Historic Reserve has regional historical significance. It is associated with key historical events and individuals and is an integral part of the traditional oral histories of Tauranga Moana. Ngaiterangi, Ngati Pukenga, Ngati Ranginui, Ngai Tamarawaho, and Waitaha all have connections to Mauao within their whakapapa. To state “Ko Mauao te Maunga” is tantamount to “I am Mauao” –the essential ancestral aspects of an individual’s identity are inextricably tied to Mauao (Piahana, 1995:2).

3.6 Archaeological significance

The archaeological and scientific significance of Mauao lies in its potential to contribute information to further the scientific understanding of the history of human occupation. Mauao is also significant as a physical monument of past human habitation. Mauao, as a very large open settlement complex, which also contains

¹ ‘Post contact’ or ‘post European’ means the archaeological features originate from the period after the arrival of Europeans in New Zealand.

areas of fortification, has the potential to provide archaeological information relating to the history of both the Tauranga and wider Bay of Plenty region.

Mauao has national archaeological significance for its potential to contribute to the greater understanding of the development of human settlement patterns, the date and nature of early human settlement, the development of horticulture, and the form and function of large earthwork structures. The shell middens and shell mounds on Mauao are the largest surviving features of their type in the Bay of Plenty Region.

It is arguable that Mauao has international archaeological significance, particularly in relation to its potential to contribute to the wider understanding of the nature of human settlement within Polynesia. It is likely that many of the archaeological features have considerable antiquity, and occupation of Mauao probably spans the full period of human settlement in New Zealand. In particular, the distinct 'open space' features noted by Phillips on the western slopes (Phillips 2003:15) may provide considerable potential to contribute to the archaeological study of complex social, cultural and political structures.

There has been no systematic archaeological excavation undertaken at Mauao. It is likely that most of the remaining archaeological features are intact and have not suffered major stratigraphic disruption. This adds further to the overall archaeological significance of Mauao.

3.7 Cultural significance

Mauao has cultural, traditional, spiritual and social values closely associated with Ngaiterangi, Ngati Pukenga, Ngati Ranginui, Ngai Tamarawaho, and Waitaha. Features in the reserve must be conserved and managed in a manner consistent with the protection of these values.

To Ngaiterangi, Ngati Ranginui and Ngati Pukenga¹, Mauao is a taonga which has immeasurable value and which symbolises the endurance, the strength, the identity and the uniqueness of each of the iwi. For each of them Mauao is a link between both the metaphysical and the physical worlds, and between the past, the present and the future. The way that Mauao is managed, therefore, is of particular importance to the three² iwi. Mauao Management Plan, 1998:31.

The tangata whenua issues reports prepared for the 1998 Management Plan were written in 1995 and may need to be updated. It was suggested, by tangata whenua, during consultation undertaken during the preparation of this conservation plan, that a formal cultural heritage statement and plan could be prepared for Mauao by tangata whenua. This would provide an up-to-date assessment of cultural issues and input to ongoing management.

¹ And Ngai Tamarawaho and Waitaha.

² Actually five Iwi.

4. THREATS TO ARCHAEOLOGICAL FEATURES

4.1 General

Threats to archaeological features within the Historic Reserve are principally related to natural processes, human activities, livestock grazing, information loss, and loss of reserve integrity and setting. Threats from natural processes are related to fire, erosion, and vegetation development. These processes inevitably interact and cannot be considered in isolation. Human impacts can be grouped as visitor impacts, machinery use, and management impacts.

There have been modifications to the physical evidence of past human occupation and use at Mauao. Modifications have occurred as a result of natural and human processes and the successive phases of occupation have undoubtedly resulted in the partial loss of physical features from earlier phases of occupation. Processes and actions which have resulted in the physical modification of features at Mauao include:

- Modification, destruction or loss of features due to overbuilding or landscape modification in subsequent occupation phases;
- Quarrying of midden;
- Access road formation;
- Water supply installations;
- Fencing and livestock management installations;
- Livestock grazing and trampling;
- Vegetation growth, tree root intrusion, and inappropriate plantings;
- Track formation;
- Installation of visitor facilities;
- Erosion and water run-off;
- Human foot traffic;
- Burrowing by rabbits.

Avoiding unwarranted and undesirable modification of archaeological features within the reserve is a major objective of this plan. Efforts must be focussed on the stabilisation of features wherever practicable and the avoidance of management actions which may result in the further loss of physical features and information.

4.2 Fire

The management of fire is relevant to and important for archaeology, ecological restoration, and all other activities on Mauao. Vegetation fire risk is influenced by a combination of climate, topography, vegetation, and ignition sources.

While a fire may not directly affect archaeological features, subsequent rainfall could damage those features by erosion. Alternatively, strong winds and extended fine weather following a fire is likely to lead to wind erosion. Machinery or fire fighting tactics used in rural fire suppression, e.g. earthmoving machinery and fire line construction, can also damage archaeological features.

The risks and potential impacts of vegetation fires is relevant to all management on Mauao. Public safety, fire prevention, and pre-planning for fire control must be given a very high priority.

There has been a long history of fires on Mauao, and future fires are virtually inevitable. This is due to the combined influences of high public usage, light and highly flammable vegetation, free-draining soils, high summer temperatures, and dry coastal winds.

Flammable vegetation will always be a risk factor on Mauao, although this risk will reduce somewhat as the existing scrub and shrublands develop into secondary forest. There will be further reduction in fire risk as the existing grassland becomes more dominated by kikuyu over time.

Although Mauao is located adjacent to an urban setting, it is in a rural fire area (in the Western Bay Moana Rural Fire District) and it is essential that fire planning is based on rural fire fighting techniques.

4.3 Erosion

Archaeological sites can be lost or eroded by natural erosion (e.g. along the coast) or through erosion triggered by human activities, such as track construction and maintenance. Erosion at the head of the spring gully west of the water reservoir has been triggered by water run-off from the summit access road and overflow from the reservoir.

4.4 Vegetation development

Vegetation, particularly large trees, can damage both surface and sub-surface archaeological features, destroying site information (Bowers 1998). Damage to archaeological features may be caused by root action as trees grow and the roots disrupt the stratigraphic relationship between soil horizons (layers). Damage to surface archaeological features also occurs as trees mature and disrupt the adjacent ground surface. If large trees topple as a result of windthrow. Further damage to archaeological features may be caused if both by the root plate being ripped from the ground, and the impact of the falling tree.

The low, dense grassland that covers most of the archaeological features on the southern and western slopes of Mauao provides ideal protection for surface and sub-surface archaeological features. Threats to the current vegetation cover include loss of that vegetation by fire, erosion, over-grazing, rabbit burrowing, or vegetation changes due to successional processes or weed invasion.

4.5 Visitor impacts

A high number of visitors utilise the reserve (estimated at 250,000 per year) and this is likely to increase in the future with local and regional population growth. Managed recreational use of the reserve is compatible with the conservation of archaeological sites, although many visitor activities have the potential to damage archaeological features. Damage can be caused by informal tracking, vandalism, excavation, bikes, and

activities that concentrate large groups of people at specific points, e.g. sporting events, outdoor gatherings, school visits.

4.6 Machinery use

Machinery used in association with livestock management, fire control, the establishment and maintenance of tracks and roads, and the placement of interpretation panels and track markers may damage archaeological features.

4.7 Reserve management activities

The establishment of tracks, the placement of interpretation panels, track markers, the construction of fence lines and stiles, the placement of troughs for stock water, and inappropriate planting of trees may all inadvertently result in damage to surface or sub-surface archaeological features.

4.8 Grazing

Grazing of livestock, to maintain a protective grass cover on archaeological features, has the potential to seriously damage features through trampling and tracking. Nevertheless, grazing is currently still the most appropriate regime to maintain part of the reserve in a vegetation cover that offers the best protection to archaeological features while also providing for public viewing and appreciation of the surface features. The risk to archaeological features posed by livestock grazing must be balanced carefully against the risk to archaeological features caused by a change in the existing vegetation cover.

Grazing also creates a habitat favourable for rabbits, which damage archaeological features by burrowing. The most significant damage to shell middens within the reserve is currently being caused by rabbit burrowing and scratching which breaks the pasture sward and exposes middens. Sheep then graze, camp, or track over these areas, causing further damage and loss of archaeological material.

Grazing is required on an ongoing basis to maintain the low pasture sward covering most of the archaeological features on the southern and western slopes of Mauao. It is currently the most suitable mechanism to maintain this part of the reserve in a vegetation cover that offers good protection to archaeological features while also providing for public viewing and appreciation of surface features. Management of the grazing and associated fencing is a key requirement to stabilise features and reduce the rate of deterioration of archaeological sites on the southern and western slopes of Mauao. Some degree of ground damage due to stock trampling and tracking is always going to occur as a consequence of using grazing animals to maintain a pasture sward. This risk should be managed to restrict damage to areas where archaeological features are not affected.

Animal husbandry and welfare are also important issues. Livestock condition must be able to be maintained or improved. This is particularly important at Mauao due to the high number of visitors to the reserve, the visibility of the livestock, and likely public concerns about animal welfare.

Damage to archaeological features can be avoided if livestock are managed carefully and monitored closely. Factors that must be considered when grazing livestock on archaeological features include:

- The age, number and species of animals used,
- seasonal influences,
- the duration and timing of grazing,
- placement of fences, gates, stiles, and water troughs,
- animal behaviour (congregation of stock, trampling, tracking),
- length of grazing rotations,
- animal welfare and husbandry.

4.9 Information loss

The loss of archived information such as documents, photographs, and unrecorded oral history constitutes a threat to the sustainable management of archaeological features. This material provides a link with the past and is an integral component of the history of the place. Archaeological information is also being lost due to on-going erosion. As sites are eroded the integrity of the stratigraphic relationship of layers within the archaeological features is destroyed, and the opportunity to recover accurate information is lost.

Archaeological information is also being lost due to the use of shell as a track aggregate, which has occurred over many decades. Originally shell from middens on Mauao was used, and more recently shell has been used from other sources in the region. The shell track aggregate has become mixed with shell midden in the vicinity of the tracks. This means that the archaeological information normally able to be recovered from shell middens (by the use of techniques such as radio-carbon dating or the gathering of dietary information) is now unreliable in this part of the reserve.

Methods to arrest the loss of archaeological information are discussed in Section 10 below.

4.10 Loss of reserve integrity

Intensive urban-based activities adjacent to the reserve may threaten its integrity and setting. The reserve lacks a sense of arrival and a buffer between the adjacent intensive urban landscape and the less modified reserve environment.

Mauao is an historic reserve, yet it is likely that many visitors are unaware of the historic and cultural values and significance of the place. There is significant potential to increase recognition of the historic and cultural values. Mauao could provide an outstanding example of ongoing recreational use managed compatibly with the protection of historic, cultural, and ecological values.

Methods to address threats to the integrity of the reserve setting and use are discussed in the landscape sections of this plan. Increased awareness of the values of the reserve will assist to preserve the integrity of those values. If reserve visitors are made aware of what is 'special' about the reserve, it is likely that most visitors will take greater care to ensure their actions do not threaten those values.

5. ARCHAEOLOGICAL SITE CONDITION REPORTING

Phillips (2003) recently undertook the first systematic archaeological survey of Mauao, identified current threats to the continued protection and preservation of the archaeological landscape, and provided general recommendations for consideration within a conservation plan (Phillips 2003:29). The archaeological survey included GPS mapping of the most visible archaeological features within the reserve. This work provides the basis for regular archaeological site condition monitoring and reporting.

Condition reporting for large earthwork structures that are principally archaeological sites is a technique that has been developed recently. The technique was developed through work undertaken by Jones and Simpson (1995), and has been used mainly for conservation plans prepared for the Department of Conservation. The Department of Conservation has also recently produced guidelines for monitoring the condition of historic places, including archaeological sites (Walton 2003).

It has been found that systematic condition surveys identify the factors causing deterioration of an archaeological site and leads directly to actions required to achieve stabilisation of site features. Condition reporting also documents rates of change and indicates methods appropriate to stabilise sites where detrimental changes are occurring.

5.1 Condition overview - October 2003

Many archaeological features within the reserve are in an unstable condition and appear to be deteriorating. It is not possible to accurately assess the rate of deterioration due to the lack of a previous baseline survey and monitoring of the condition of features. The general impression, however, is that the rate of deterioration is accelerating in some localised sites, such as on the summit and around the perimeter of some of the large shell mounds on the south-western slopes.

Archaeological features within the reserve are most threatened by the consequences of inappropriate reserve management that has been undertaken without specialist archaeological advice:

- Erosion by water run-off from the access road and reservoir,
- Erosion of middens caused by rabbit burrowing and subsequent sheep grazing, camping, and tracking,
- Erosion resulting from the erection of fences around middens in an attempt to prevent stock access - stock now track along the fence lines and, as a result, the erosion surface has simply been moved to the base of the fences,
- Erosion on the summit and southern slopes of Mauao resulting from high levels of human foot traffic, due to the lack of well formed tracks maintained to a high standard,

- Erosion resulting from the formation and maintenance of the base track. There has also been associated loss of archaeological integrity resulting from the use of shell as a track aggregate,
- The loss of archaeological site integrity caused by tree root intrusion resulting from the planting of large trees on archaeological features,
- The loss of archaeological site integrity caused by vegetation successional processes on the southern slopes of Mauao.

6. LANDSCAPE CONTEXT AND MANAGEMENT

Key concepts for the landscape management of Mauao are discussed in this section, including the management of recreational pressure, management of exotic trees, enhancement of indigenous vegetation, management of existing amenity services, and the broad landscape context, which is an essential precursor to further work on landscape protection and enhancement. Future management needs to incorporate all of the identified landscape management issues, along with any others which may assist in the appropriate management of Mauao as a significant archaeological site and recreational destination for residents and visitors to Mount Maunganui.

Broad Landscape Context

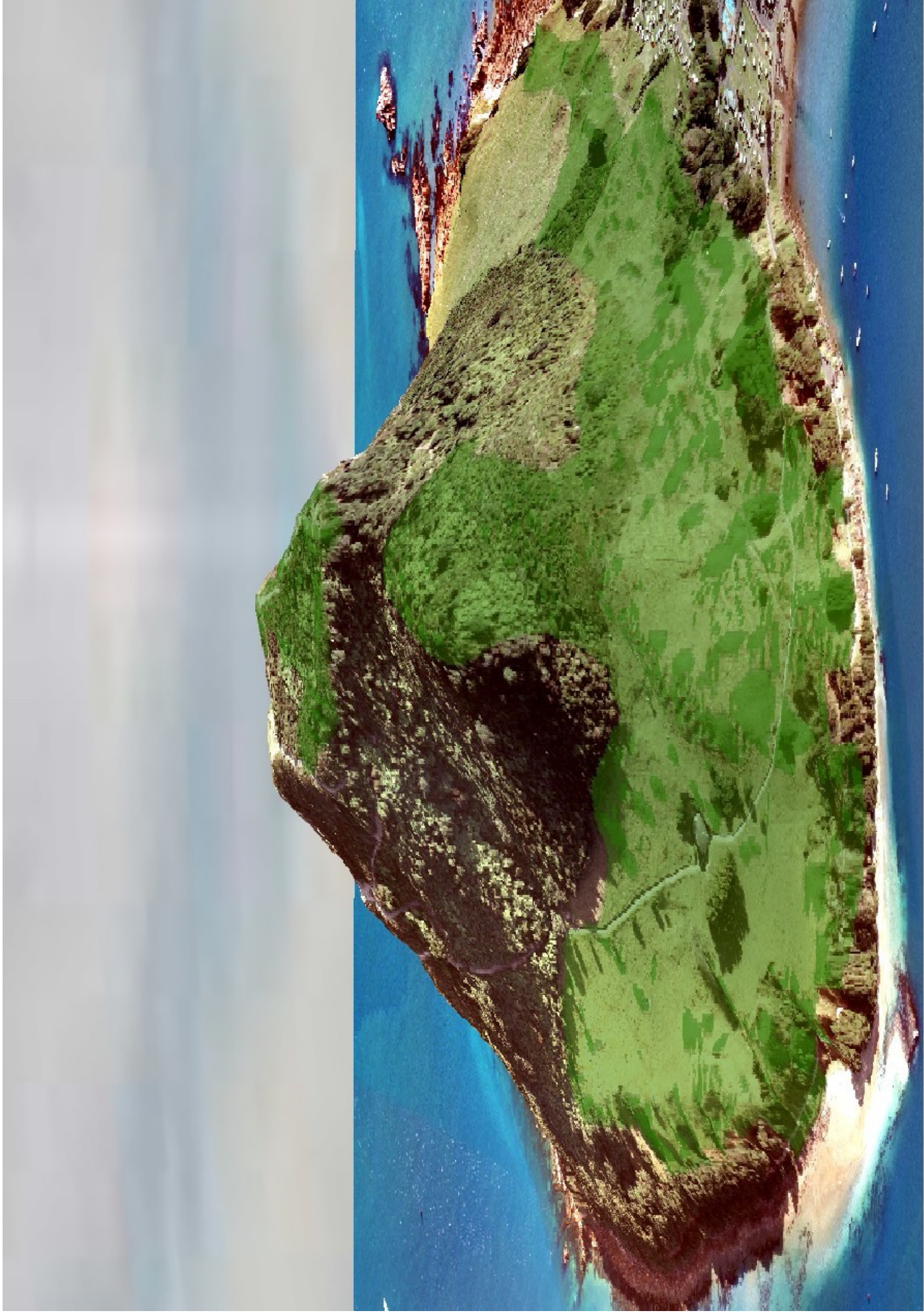
When viewed from almost all directions, the junction between the higher slopes of Mauao covered with indigenous vegetation and the lower pastoral slopes occurs at a similar height - around the 80-100 m contour. This flat line in the landscape creates an artificial line in an otherwise natural contrast to the adjacent built up area. Digital data was used to construct a terrain model of Mauao (refer to Figure 2), showing the current land cover (based on 2002 and 2003 aerial photographs), the location of archaeological features, and adjoining features.

Remnants of indigenous vegetation tend to find more protection, and therefore have more resilience, in valleys and gullies on the slopes of hills. When viewed in a broad context, a landscape with indigenous remnants in gully and valley systems appears more natural. At a local scale, indigenous vegetation remnants also have a greater level of resilience in conjunction with water courses. This is partly due to the often sheltered nature of water courses and the general lack of suitability for long-term sustainability of pasture. The identification of areas in the partially sheltered valleys, gullies and water courses on Mauao will highlight sites which are suitable for indigenous vegetation establishment. An obvious constraint to the establishment of vegetation in these areas is the presence of archaeological features. By partitioning off small areas of gullies and water courses adjacent to the existing indigenous vegetation indigenous vegetation establishment can occur on these sites, leading to a higher level of naturalness and aesthetic coherence in the landscape.

Management Context

As a landscape feature, Mauao is undoubtedly outstanding when assessed in the context of Resource Management Act (1991). Various criteria, listed below, provide a benchmark for the assessment of landscape within the context of the Act:

- natural science factors - the geological, topographical, ecological, and dynamic components of the landscape;
- aesthetic values - including memorability and naturalness;
- expressiveness (legibility) - how obviously the landscape demonstrates the formative processes leading to it;



Legend

Archaeological features

Figure 2. Terrain model, land cover and archaeological features on Mauao

- transient values - occasional presence of wildlife; or its values at certain times of the day or of the year;
- whether the values are shared and recognised;
- value(s) to tangata whenua;
- historical associations.

Many of these criteria are clearly met and have high values on Mauao. It is simply a matter of the relative value of each criterion. In this particular case, though, it is clearly the protection and maintenance of values associated with the archaeological and landscape features which are of primary concern, in tandem with actual and potential ecological values.

The strong contrast between Mauao and the adjacent heavily built up residential and business areas highlight the discrete landform unit as being both outstanding and appropriately well buffered from the adjacent urban centre.

Sound landscape management principles can help to protect existing archaeological features and indigenous vegetation on Mauao. Control of the very high levels of foot traffic on Mauao will be integral to the protection and enhancement of Mauao for ongoing use and appreciation by high numbers of visitors each month.

Recreational Pressure

The c250,000 visitors to Mauao each year are a clear indication of its popularity as a recreation resource within close proximity to a heavily built up urban area. The pressures associated with this level of use are damaging archaeological features that cannot be repaired or replaced. Identification of key pedestrian routes within the reserve means that appropriate design can then be used to protect sensitive areas from unnecessary damage and to channel traffic to sites better suited to high levels of foot traffic.

Much of the degradation of tracks and archaeological sites can be arrested through appropriate track maintenance. Tracks on the summit of Mauao have been worn and eroded to a state where otherwise intact archaeological deposits underneath the track surfaces are being damaged.

Methods that could be utilised for the protection of archaeological features include the use of timber boardwalks to span fragile areas or the use of geotextile membranes, overlaid with aggregate paths. These techniques may reduce the visibility of some features, but they provide for ongoing channelling of foot traffic, reducing impacts on archaeological features.

The nature and extent of the archaeological features will be a key determinant in the protection of those features from the damage which is currently occurring. Each site should be assessed based on specialist archaeological advice, and appropriate landscape management solutions developed.

Impacts on archaeological features caused by the establishment of new tracks on the summit can be minimised by the use of imported track materials and the building up of an artificial track surface, rather than cutting into the existing ground surface.

Exotic Tree Management

The current management plan for Mauao provides a clear intent to protect and enhance the natural character of the reserve. In the context of the Resource Management Act (1991), indigenous plants and fauna are also considered to have a higher level of natural character than exotic equivalents. Historically, exotic vegetation has been used on Mauao for screening existing amenities, for erosion control, and for shelter. Exotic trees may be a faster solution for landscape screening in some situations, however a key management objective is to maintain and enhance the natural character of the reserve and the phasing out of exotic trees and replacement with suitable native species is clearly appropriate. This approach can be used in conjunction with other methods to reduce the prominence of existing amenities, e.g. painting the existing water reservoir a colour more appropriately landscape sensitive.

By phasing out exotic trees and replacing them with indigenous species, the natural character and indigenous restoration efforts will be enhanced. Reducing competition from weed species is an essential prerequisite for the restoration of indigenous vegetation.

The first step to remove all of exotic trees is to identify appropriate areas and trees for removal and to assess the appropriate method of replacement. The most obvious candidate for removal and replacement is the exotic trees currently screening the water reservoir on the south-western slopes. Areas for re-establishment of indigenous vegetation need to be prioritised.

Where large exotic trees are removed and replaced with potentially large indigenous specimens; the replacement tree should be planted in the immediate vicinity of the former tree's root plate. This will reduce the probability of new disturbance to intact archaeological deposits, because new tree root action will be concentrated in the area already disturbed by the growth of the previous tree. Pohutukawa is the most appropriate species to use for this purpose.

Indigenous Vegetation Management

Establishment of indigenous vegetation can assist in the achievement of many of the management objectives for Mauao. Enhancement of natural character is an obvious benefit from the establishment of further indigenous vegetation. Other benefits which aren't so obvious, but are also relevant, include:

- The control of pedestrian traffic;
- The re-establishment of a natural vegetation edge (see Broad Landscape Section above) for existing areas of native vegetation;
- The stabilisation of erosion-prone slopes;

- The screening and enhancement of existing amenities.

Other Landscape Management Issues

The following issues also need to be addressed:

- Screen planting of the farm operational area (the stockyards).
- Removal of the long drop toilet.
- Removal of bath tub water troughs from throughout the reserve and replacement with a more appropriate trough (of a natural colour).
- A circuit track could be completed for Mauao, for which there is considerable demand. This would involve the construction of a new section of track between the campground and the current stock perimeter fence - refer to Figure 4. This would need to be constructed using an imported aggregate and sections of boardwalk may be required.

7. VEGETATION

7.1 Pre-human

Prior to human occupation Mauao would have been covered almost entirely with coastal forest dominated by pohutukawa, puriri (*Vitex lucens*), karaka (*Corynocarpus laevigatus*), ngaio (*Myoporum laetum*), houpara (*Pittosporum crassifolium*), and kanuka (*Kunzea ericoides* var. *ericoides*), and shrubs or small trees of karo (*Pittosporum crassifolium*), houpara, mapou (*Myrsine australis*), whau (*Entelea arborescens*), and nikau (*Rhopalostylis sapida*). There are also likely to have been local occurrences of rimu (*Dacrydium cupressinum*), northern rata (*Metrosideros robusta*), tawa (*Beilschmiedia tawa*), hinau (*Elaeocarpus dentatus*), rewarewa (*Knightia excelsa*), mangeao (*Litsea calicaris*), and kamahi (*Weinmannia racemosa*). Specialist species would have been present on bluffs, beaches, coastal rocks and seepages, such as *Euphorbia glauca*.

7.2 Human-induced change

People lived on Mauao for many centuries and they had a dramatic effect on the vegetation:

"The most elaborate fortified sites in the region were at Maunganui, Mangatawa and on the hills at Papamoa. Maunganui, an isolated mount protected by the sea on all sides except the narrow sandy isthmus to the east, was an ideal site for a large fortified village. The main village was on the south side and the remnants of extensive terracing and numerous middens testify to its long occupation."

(Stokes 1980)

Fire will have been an important factor in the ecology of Mauao since human occupation and there may have been occasional natural fires prior to human arrival. Natural vegetation is rarely static but the frequency of post-human arrival fire has had negative impacts on both vegetation and fauna. The original vegetation will have been cleared at an early stage, and fire would have been used repeatedly to keep Mauao relatively open. Pre-European vegetation was mapped as "fern and manuka scrub" (Stokes 1980). A large fire was reported in November 1842 (Cunningham and Musgrave 1989) and an 1858 illustration shows the southern and western slopes devoid of heavy vegetation (Plate 1 in Wildland Consultants 1999). Oblique photographs of the eastern slopes of Mauao in 1929, 1940s, and 1960 are also presented in Wildland Consultants (1999). In 1929 the vegetation was all low vegetation but by the 1940s pines were well established and were very prominent by 1960.

From analysis of aerial photographs from 1943 to 1999 it is evident that fire has affected the vegetation of parts of Mauao at reasonably regular intervals over the last 60 or so years. Evidence of most recent fire-related vegetation change is confined to the northern flanks of Mauao, with a different extent affected within the same general area by each episode. Most of the indigenous-dominant vegetation on the southern and western slopes has not been affected by fire since 1943, probably reflecting the slightly damper environment on these slopes and the lower flammability of the more

advanced vegetation successions. In the 1943 aerial photograph earlier successional vegetation is evident over a reasonably large area (Wildland Consultants 1999). There is no evidence of fire between 1943 and 1959, as shown by a large increase in the numbers of pines (*Pinus* sp.) in the vicinity of the summit and in the area affected by fire prior to 1943.

From interpretation of aerial photographs taken in 1977 it appears that between 1959 and 1977 only a restricted area on the upper northern slopes was affected by fire. However, Cunningham and Musgrave (1989) noted that "fires in the mid-1960s were particularly severe" and that the road to the summit was constructed in the late 1960s to provide vehicle access for fire fighting.

The 1996 aerial photograph shows evidence of an earlier major fire and this is supported by an article in the Bay of Plenty Times Supplement (26 May 1987) which documents a planting expedition in response to a "disastrous fire early this year". The area affected by this fire was still clearly evident on the 1996 aerial photograph, with a large area of gorse (*Ulex europaeus*)-dominant vegetation. There was a major fire in December 1997 which burnt nearly all of the gorse-dominant vegetation, and also some vegetation that was not burnt in 1987 (refer to Figures 3 and 8).

From comparison of the 1943 and 1999 vegetation maps it is apparent that there have been significant changes to the vegetation over the last 56 years. Major changes are summarised below:

- Much of the scrub on the western and southern slopes in 1943 has developed into treefernland, treeland, and forest.
- The area of pasture has diminished.
- Exotic treeland is no longer present on upper slopes.
- The restricted area of pohutukawa treeland and forest present along the western slopes in 1943 has developed into a larger area of indigenous forest.
- The extent of pohutukawa treeland on the coastal margin has increased.

Recent fires on Mauao, with the notable exception of the two most recent ones, appear to have occurred at 10-15 year intervals (pre-1943, mid-1960s, 1987, 1997, 2003), and have all occurred in the same general area; on the northern slopes. The January 2003 fire destroyed an extensive area of vegetation on the northern slopes. The extent of the 1997 and 2003 fires is shown in Figure 8 in Appendix 3 - vegetation and habitat map.

7.3 Present day vegetation

Existing information (e.g. Gardiner 1995, Beadel 1994, Bishop & Beadel 1997) was collated and assessed in 1999 as the basis of a new vegetation map (Wildland Consultants 1999). Field inspections were then undertaken to describe the vegetation types and refine the boundaries between them. A broad vegetation and habitat map is presented in Figure 3, and a more detailed map, a full list of vegetation and habitat types, and related descriptions, are presented in Appendix 3.



Legend





-  Recently burned
-  Indigenous forest and shrubland
-  Mixed indigenous and exotic trees
-  Pasture

Figure 3. Broad Vegetation and Habitat Pattern - 2003



Scale: 1:3,500
Date: 17/03/04
Cartographer: RPB

7.4 Vegetation succession

In 1999 large dead gorse was present in the understorey of many of the secondary indigenous vegetation types (refer to Appendix 3 - types 3, 12, 13, 14, 15a and 15b), indicating that over time an indigenous canopy has developed through the gorse. It is also evident that a range of indigenous species have established within stands of gorse. If fire can be prevented, natural regeneration and succession will proceed relatively rapidly on sites without domestic stock. The relatively rapid rate of this succession is indicated by the significant degree of change between 1943 and 1999. A key element for the successful revegetation of Mauao is to allow and encourage this naturally rapid rate of vegetation development. Pohutukawa (*Metrosideros excelsa*) should continue to be a prominent element on Mauao and it is a key component in the planting schedules provided in Section 10.10 below.

7.5 Grazing

It is not clear when grazing of domestic stock was first undertaken on Mauao but it was most likely early last century or even the later part of the 1800s. An undated manuscript held in the Tauranga Library ("Taina" - Visions of Boyhood) relates to early childhood and notes that "manuka clad its upper slopes, with many magnificent pohutukawa and karaka in groves, or clinging above the rocky shores". It also records an observation of a "boundary rider whose job was to keep the cattle that grazed the Mount from straying".

A 1930 photograph in Cunningham and Musgrave (1989) appears to show low vegetation only over the eastern slopes, and pasture was present on the lower slopes in the early 1930s (W.T. Davies pers. comm.). At that time the 'scrub line' was apparently similar to the present day, and rabbits were abundant in the grassland.

7.6 Tracks and planting

The summit track was built in 1898 (Bellamy 1982) and there has been a long history of planting, extending back to the 1880s (Cunningham and Musgrave 1989) and the early 1900s (Bellamy 1982). Apparently many of the 1880 plantings were destroyed by fire (Cunningham and Musgrave 1989). These later authors also note that there were regular Arbor Day excursions from Tauranga in the late 1880s to plant trees, including one led by a J.C. Adams who also took scouts to the summit and had them use catapults to scatter karaka berries in all directions!

7.7 Flora

The flora of Mauao includes at least 230 species, of which 101 are indigenous and 129 are adventive. The range of species reflects the wide range of habitats present, ranging from rocky foreshore to gentle slopes and cliffs. Exotic species also occur widely in most of these habitats, because the open character of much of Mauao and also the close proximity to an urban centre. Several of the indigenous species have a limited distribution within the Tauranga Ecological District and, indeed, several are currently known only from Mauao, although they may also be present elsewhere (Wildland Consultants 1999). Of special note are *Psilotum nudum*, *Lepidosperma laterale*, and mangemange (*Lygodium articulatum*). *Psilotum nudum* is present on the

rock bluffs on the north-western side of Mauao, which is one of the few known coastal occurrences of this species in the Bay of Plenty. *Lepidosperma laterale* has also been found on Mauao, this is near its southern limit, and is found at only two other sites in the Bay of Plenty. Mauao is the only site where mangemange has been recorded in the Tauranga Ecological District (Wildland Consultants 1999). Nineteen species are currently known only from Mauao but may be present elsewhere in the Ecological District.

No nationally threatened species (as per Hitchmough 2002) have been recorded, although there is one historic record of *Olearia pachyphylla* (P. de Lange pers. comm.), which is classed as Nationally Endangered (Hitchmough 2002).

Mapping the distribution of all known indigenous species was also undertaken in 1999. The landform and vegetation maps (refer to Appendices 2 and 3) were used to provide a framework for mapping species distributions. Two methods were used. Canopy species were mapped in the field using aerial photographs and binoculars. Many transects were traversed across Mauao to record species present in understoreys. The exact distributions of many herbaceous species could not be determined due to their scattered occurrences and/or inconspicuous character. In this case the average cover of the species was assessed within each vegetation type. Refer to Wildland Consultants (1999) for detailed maps of species distributions.

7.8 Environmental weeds

A survey of environmental weeds on Mauao was undertaken in 1997 (Bishop & Beadel 1997) and forty-six weed species were located and mapped. Distribution maps for each species were prepared, along with brief notes. Five further environmental weed species have been noted on subsequent visits: willow-leaved hakea (near the summit), swan plant (on the cliffs where the *Psilotum nudum* occurs), prickly hakea (one plant below the summit), Italian buckthorn (five scattered individuals), and Kermadec Island pohutukawa (*Metrosideros kermadecensis*). A list of environmental weed species is provided below in Section 10.

7.9 Previous vegetation restoration/enhancement projects

Since the early 20th century there have been numerous attempts to beautify or enhance Mauao by the clearing of “weed” species and the planting of other exotic species. Plantings of hawthorn, several pine species, sycamore, eucalyptus, and poplar have also occurred, although the purpose of most of these plantings is not known (Tauranga District Council 1996). Over the past 120 years there also have been attempts to restore the native vegetation on Mauao, and this has included planting of totara, ngaio, kauri (probably not found naturally on Mauao), and pohutukawa, scattering of karaka berries as well as planting them, and distribution of seed of a variety of species (Wildland Consultants 1999).

The regular occurrence of major fires on Mauao has kept large areas of the northern and eastern slopes open, or covered in a low scrub that is typically dominated by gorse (Wilcox and Ecroyd 1984) and pampas (Wildland Consultants 1999). The prevalence of these two species is due to their ability to spread highly viable seed rapidly, and their tolerance of extremely dry conditions. Over recent years attempts have been

made to clear and restore some of the areas dominated by gorse and pampas, by herbicide treatment of both species and planting the area with natives such as manuka and kanuka, along with a variety of other shrub species. Gorse weevil has also been introduced, but the effects are not yet known (Tauranga District Council 1996).

Possoms and rabbits are the greatest mammalian threats to indigenous vegetation. Possoms damage the crowns and young shoots of established trees, especially vulnerable species such as pohutukawa, as well as browsing seedlings and saplings. Rabbits graze seedlings of any palatable species, especially in open areas (Tauranga District Council 1996).

7.10 Future vegetation management

Vegetation management must be integrated with other key uses of the reserve, such as protection of archaeological features, restoration of areas damaged by fire, landscape management, visitor management, and fauna management. Key issues are:

- Protection of existing areas of indigenous vegetation, while recognising that some local management of vegetation development may be required to protect significant archaeological features.
- Re-establishment of indigenous vegetation on areas recently damaged by fire, without creating increased fire risk.
- Creation of a linked margin of pohutukawa-dominant forest around the base of Mauao.
- Localised planting to ‘soften’ existing straight vegetation boundaries that cut across the mid-slopes of Mauao.
- Retention of pasture in key areas of archaeological landscape.
- The staged removal of planted and wilding exotic trees.
- An ongoing need for the control of a diverse suite of invasive environmental weeds.
- The need for ongoing monitoring of vegetation extent and condition, and weeds.
- The need for ongoing review of vegetation management.

8. FAUNA

The avifauna and mammalian fauna of Mauao are well-known, but the herpetofauna and invertebrate faunas are poorly known.

8.1 Avifauna

Mauao supports a wide range of terrestrial and coastal birds (Appendix 6). Broadly speaking, there are three groups of bird species that utilise the site:

- Seabirds that roost and/or breed on Mauao, e.g. northern blue penguin (karora; *Eudyptula minor iredalei*), grey-faced petrel (oi; *Pterodroma macroptera*) and pied shag (*Phalacrocorax varius varius*).
- Land and bush birds that reside on Mauao, e.g. spur-winged plover (*Vanellus miles*) and North Island fantail (piwakawaka; *Rhipidura fuliginosa placabilis*).
- Seasonal or irregular visitors, e.g. shining cuckoo (pipiwhauraroa *Chrysococcyx lucidus*), pihoihoi (New Zealand pipit; *Anthus novaeseelandiae*), reef heron (*Egretta sacra sacra*), and karearea (New Zealand falcon; *Falco novaeseelandiae*).

Mauao is important for two seabird species that breed here - northern blue penguin and grey-faced petrel. A large colony of several hundred grey-faced petrels breeds on the upper bush-clad slopes. They nest in burrows, which they dig themselves, and lay in winter, with the young fledging in summer (Heather and Robertson 2000). The colony is one of few significant mainland colonies in New Zealand and it has been studied by Hugh Clifford of the Ornithological Society of New Zealand since the early 1990s. That study has shown that chick survival was low (c.30 percent) in the early 1990s, but increased to c.80 percent after predator control using Talon (brodifacoum) and some trapping was implemented. There has been a relatively high rate (30-40 percent) of banded chicks returning to the colony as subadults or adults in later years and banded chicks have also arrived as sub-adults or adults from nearby Motuotau Island and Moutohora (Whale) Island (H. Clifford pers. comm.). Other seabird species nesting on Motuotau Island (e.g. whitefaced storm petrel; *Pelagodroma marina*, diving petrel; *Pelecanoides urinatrix*, and sooty shearwater; *Puffinus griseus*) have not been recorded on Mauao.

Blue penguins breed in the period July-March with peak laying in August and November (Heather and Robertson 2000). At Mauao they nest in burrows, crevices and beneath dense vegetation around much of the lower slopes of the reserve, but many also nest in the forest on the upper slopes (H. Clifford pers. comm.). A study was initiated in 2000 by Tauraunga Polytechnic students (Jervis and Davies 2000) and a monitoring programme has since been implemented which has revealed the colony to be one of the largest on the New Zealand mainland (D. Tully, Bay of Plenty Polytechnic, pers. comm.). The penguin colony is productive, with 38 percent of 52 penguins banded in 2000 being juveniles (Jervis and Davies 2000). Dogs, which are a major threat to penguins in other parts of mainland New Zealand, are excluded from Mauao, and cats and mustelids have been controlled in the past.

Some of the bird species that utilise Mauao are nationally threatened species (Hitchmough 2002), as listed below within relevant threat categories:

- Nationally Endangered - reef heron and North Island kaka (*Nestor meridionalis septentrionalis*), both of which are occasional visitors,
- Nationally Vulnerable - New Zealand falcon, an occasional visitor,
- Gradual Decline - northern blue penguin and white-fronted tern (*Sterna striata*), the former nesting on Mauao while the latter sometimes roost on the shoreline,
- Sparse - pied shag which roost in trees on Mauao.

8.2 Herpetofauna

Lizards have not been formally surveyed on Mauao (J. Heaphy, Department of Conservation, pers. comm.). In coastal habitats, such as those at Mauao, copper skink (*Cyclodina aenea*), moco skink (*Oligosoma moco*), shore skink (*Oligosoma smithi*), and possibly the common gecko (*Hoplodactylus maculatus*) may be present. These and possibly other species could be present on Mauao.

8.3 Mammalian fauna

The only indigenous mammal species that occurs regularly at Mauao is the New Zealand fur seal (*Arctocephalus forsteri*). Increasing numbers of seals are using Mauao as a haul out site (C. Summers, Department of Conservation, pers. comm.). Most common introduced mammalian species occur at Mauao, including a range of rodent and mustelid species (refer to Appendix 6), brush-tailed possums (*Trichosurus vulpecula*), feral cats (*Felis catus*), rabbits (*Oryctolagus cuniculus*), and probably hedgehogs (*Erinaceus europaeus*). Cats and mustelids were trapped by the Department of Conservation (DOC) in the early and mid-1990s to protect petrels and penguins (J. Heaphy pers. comm.). Possums and particularly rats have also been targeted in and around the petrel colony in a collaborative effort by DOC, Tauranga City Council, and Environment Bay of Plenty.

9. MANAGEMENT OPTIONS FOR FAUNA

Future management of fauna can be considered under three broad sets of options:

- Protect fur seals and maintain viable breeding colonies of blue penguins and grey-faced petrels by implementing targeted pest control.
- Increase the level of pest control and other management to allow recovery of additional fauna species, e.g. lizards and other seabird species.
- Exclude mammalian pests to allow the recovery of a range of threatened biota no longer present at Mauao and most other mainland sites.

Each of these options is discussed below.

9.1 Protect fur seal numbers and maintain viable colonies of penguins and petrels

Blue penguins and grey-faced petrels are relatively large and aggressive seabirds that can maintain breeding colonies in spite of the presence of some mammalian predators. However, numbers of both are declining at nearly all mainland breeding sites because of the combined effects of dogs, cats, mustelids, rats, and possums, which are driving most colonies to extinction. Mauao is one of very few sites where management in many years has been adequate to protect adults and chicks of both species and so maintain fairly healthy colonies. Grey-faced petrels also have productive colonies on nearby islands from which there is some recruitment to Mauao. The level of use by fur seals will be maintained or increased if disturbance by humans and dogs is minimised.

In order to maintain viable breeding colonies, both of these seabird species require protection during the breeding season (nearly all year for grey-faced petrels) from dogs, mustelids, cats, possums, and rats. Human disturbance is also a potential threat, especially to seals. Management should address the following threats:

- Dogs and human disturbance – dog exclusion throughout the year combined with advocacy and compliance monitoring.
- Cats – trapping using kill-traps and/or cage traps throughout the year.
- Mustelids – Fenn trapping or equivalent throughout the year.
- Possums – control to levels of less than 5 percent Residual Trap Catch (RTC) throughout the year, assessed in Spring.
- Rats – control Norway rats and ship rats to less than 5 percent tracking indices (or trap catch) levels throughout at least the early part of the breeding season (e.g. July-November).

The geography of Mauao provides some strategic advantages if continuous and integrated control of most pest species is adopted. Recolonisation rates of mustelids,

cats and possums are likely to be low, because of the presence of high density urban settlement to the east and the harbour entrance (c.740 m-wide) to the west. It is feasible that stoats could reinvade Mauao either by swimming the harbour channel from Matakana Island or by following the ocean beach from the east, but rates of recolonisation from either direction are likely to be very low and manageable by the careful placement of permanently set traps.

Control of top order predators could result in rodents increasing in numbers, because of reduced predation pressure. Any substantial increase in numbers of ship rats and/or Norway rats could result in significant impacts on some seabirds, land birds, lizards, macroinvertebrates, and some plant species. Rat control, therefore, needs to be integrated with a wider pest mammal control programme.

9.2 Recovery of sensitive fauna populations

The pest control regimes outlined above would also permit the recovery of some other fauna species. Tui and possibly other common forest birds are also likely to respond to improved food supplies and/or reduced predation levels. It is possible that lizards might also respond to reduced predation pressure. However, for lizards and other fauna to recover and/or recolonise the site permanently, it may be necessary to maintain rat numbers to very low levels throughout the year, not just the sensitive part of the seabird breeding season, as outlined above.

Populations of lizards, large invertebrates (e.g. weta and snails), and small seabirds (e.g. diving petrel) are unlikely to recover significantly or recolonise Mauao unless rats are maintained at very low levels (e.g. <5% tracking or trapping indices) throughout the year. Numbers of hedgehogs might also need to be controlled to allow the recovery of affected invertebrate species. All mammalian pests on Mauao, except perhaps mice, are likely to be readily controlled to low levels through sustained trapping and/or poisoning. There is a need to survey the lizard and invertebrate faunas of Mauao to determine species present and help in ongoing decision-making and restoration planning.

Some additional management could be required to achieve particular targets, e.g. the regular use of the area by kaka would require improved food supplies and possibly the provision of nest boxes.

9.3 Recovery of locally extinct fauna species

The reintroduction and/or recolonisation of Mauao by many locally extinct species could only be achieved through the eradication and ongoing exclusion of mammalian pests, including mice and hedgehogs. Complete exclusion of pest mammals would also facilitate the recovery of the coastal forest ecosystem and ecological processes. This would require predator fencing adjacent to Mt Maunganui (a distance of c.650 m) and ongoing monitoring and trapping in order to intercept any arriving pests. Stoats, Norway rats, and pigs could swim to the site and others could still gain access either accidentally or by human assistance. A full feasibility study of this option would need to be undertaken, addressing benefits, physical needs, risks, contingencies, impacts on other values, other constraints, and costs. The management implementation in Section 10 below is not based on the use of a predator fence.

10. MANAGEMENT IMPLEMENTATION

10.1 Archaeological management standards

The following management standards should be applied in the reserve, to ensure the on-going protection, conservation, and appreciation of this very significant cultural landscape.

10.1.1 Standards of conservation

The international organisation which develops cultural heritage conservation policies is ICOMOS, the International Council on Monuments and Sites. All conservation work in the Mauao Historic Reserve should be guided by a plan consistent with the principles of the ICOMOS New Zealand Charter (1993).

10.1.2 Legal requirements

All management and conservation work must comply with the requirements of the Historic Places Act (1993), and the archaeological features in the reserve are protected under the provisions of Sections 10-20 of the Act. It is unlawful to modify, damage or destroy any archaeological sites without prior authority from the NZ Historic Places Trust. Management must also be consistent with the requirements of the Reserves Act (1977).

Tauranga City Council should pursue registration of all of the Mauao Historic Reserve as an historic area through the provisions of the Historic Places Act (1993), in recognition of the significance of the cultural and archaeological landscape. Some of the archaeological sites within the reserve are currently registered under the Historic Places Act as Category II historic places (places of historical or cultural heritage significance or value). Tauranga City Council should pursue the upgrading of the registration status of these sites to Category I (places of special or outstanding historical or cultural heritage significance or value), to reflect the particularly high significance of Mauao in terms of both historic and cultural values..

Mauao Historic Reserve should also be proposed for World Heritage Site status in recognition of its significant archaeological, cultural, and historic values. The process for proposing World Heritage Sites is currently being developed by the Department of Conservation.

10.1.3 Specialist advice

Planning for conservation work should be based on adequate and reliable information being first obtained and critically analysed. Specific projects and work within the reserve will require input from people with specialist skills. Skills or knowledge of particular relevance include: tangata whenua, archaeology, conservation of historic stone structures, agricultural and livestock management, archival research, visitor management, interpretation, structural engineering, rural fire management, plant ecology (including in-depth knowledge of invasive weeds), and fauna ecology (including ecological restoration).

10.1.4 Intervention

All reserve management activities (including grazing) should be undertaken to ensure the minimum possible intervention with archaeological features, as they presently exist. Increasing levels of intervention are defined by ICOMOS as: maintenance, stabilisation, repair, restoration, reconstruction, and adaptation.

Any new elements that are introduced into the ground subsurface, such as new fence post holes, should be clearly identified to avoid future confusion with earlier archaeological features. The use of a marker layer, such as fine gravel, should be used to distinguish features such as farm fences. Fine gravel should be placed in fence post holes, prior to infilling, when fences are removed. Geotextile or fine gravel should also be used as a base marker layer when material is imported to build up track surfaces. The introduction of additional material to the reserve should only occur after assessment and approval by Tauranga City Council, NZ Historic Places Trust, and tangata whenua.

10.1.5 Approved uses

Mauao is a Historic Reserve, open for public visits. The uses approved for historic reserves, under the provisions of the Reserves Act 1977, are passive recreation and educational visits. Any potential change to approved uses should be reviewed in the light of changed impacts and financial viability, and may require changes to this plan.

10.1.6 Documentation of work

All management work undertaken on Mauao, except for minor general maintenance, should be documented with notes and photographs, and records should be retained on TCC files. A document bank should be established to hold information relating to the conservation and management of the reserve. This could be held (and managed) by relevant TCC reserve management staff or a separate section could be established in the internal TCC file/library system.

10.2 Interpretation

Interpretation information would improve visitor appreciation and understanding of Mauao. It should highlight the outstanding cultural heritage features and significant ecological values of the reserve, as well as drawing attention to any cultural restrictions (e.g. eating while on pa sites) and safety issues. Consideration should be given to preparing brief explanatory panels for the reserve entrance.

Ngati Ranginui, Ngaiterangi, and Ngati Pukenga have previously stated that the most appropriate way for information about the cultural significance of Mauao to be conveyed to reserve visitors is by direct contact with tangata whenua. They favour the establishment of an information pavilion at the base of Mauao as a way of conveying information to the general public. They do not wish this to be a general tourism information centre (Fisher 1995).

The reserve also provides an ideal opportunity for the development and use of a self-guiding pamphlet and a historic, cultural and ecological educational resource kit.

10.3 Publicity

Appropriate publicity opportunities, in local and national media, should be utilised to heighten public awareness and appreciation of the significance of the Mauao cultural landscape and ecological values. Although high visitor numbers present a potential threat to archaeological features in the reserve, appropriate management of those visitors would minimise that threat. High visitor use of the reserve presents an opportunity to increase awareness of historic heritage values. Media coverage should be sought for all conservation works (archaeological and ecological) carried out in the reserve.

10.4 Specifications for archaeological sites

Work is required to enhance the management of the cultural and archaeological landscape within the reserve. The following will require prior consent from the Historic Places Trust under the provisions of Section 11 of the Historic Places Act (1993). The outline of this work has been discussed with the Bay of Plenty regional archaeologist for the NZ Historic Places Trust during the preparation of this plan.

1. Development and implementation of a revised fencing plan to enable better control of livestock grazing on archaeological features - refer to text below on Grazing and to Figure 4.
2. Establishment of indigenous vegetation in selected areas to stabilise archaeological features where grazing is not an appropriate site management practice - refer to relevant sections below.
3. Upgrading and development of the tracks on the summit and southern slopes of Mauao. Track hardening and other tracking options such as the selective use of board walks, must be considered to prevent further erosion of archaeological deposits. A landscape concept has been prepared for the summit - refer to Section 10.5 and Figure 5.
4. A review of water run-off management from the summit access road and overflow from the reservoir - refer to section below.

In addition, the following work is required which will not need prior Historic Places Trust consent unless ground disturbance is necessary.

5. The removal of trees planted on archaeological features within the grazed parts of the reserve.
6. Manipulation and selected removal of trees on the southern slopes of Mauao which are causing damage to intact archaeological features. This should be carried out following an archaeological inspection every three years.
7. Trimming and/or removal of tree saplings, from the area of the stone-faced landing platform associated with the iron jetty on the southern margin of Mauao. This should be carried out following an archaeological inspection every three years.

8. Control of rabbits, as they are currently causing significant damage to archaeological features
9. Cessation of the use of shell material as track aggregate.

Regular maintenance of water run-off systems, track formations, and fencing will minimise the risk of accidental damage to archaeological features. The primary function of regular maintenance is to ensure early identification and remedying of problems. Regular rabbit control is essential to ensure that disturbance to archaeological material caused by burrowing activity is minimised.

Any ground disturbance as a result of regular maintenance will require an authority from the Historic Places Trust.

Vegetation Management to Protect Archaeological Features

10. Trees planted recently on archaeological features and the large trees well established on archaeological features should be removed to prevent further loss of archaeological information. Large trees will need to be removed in a staged fashion.
11. The selected removal of indigenous trees on archaeological features within the area of regenerating vegetation on the southern slopes of Mauao is also required, to prevent the loss of currently intact archaeological material. Tree species that are vulnerable to windthrow, or have a growth habit that is particularly disruptive to the ground surface (e.g. rewarewa and mahoe) need to be removed as they become established on archaeological features. The position of particular trees and the potential for root development and expansion are the key points of concern for site stability. This part of the reserve should be inspected every three years by an archaeologist with vegetation and site management expertise, so that undesirable saplings can be identified and removed.
12. Periodic trimming and/or removal of saplings will be required adjacent to the stone-faced landing platform associated with the iron jetty on the southern margin of Mauao, in order to conserve this historic feature. This work should be undertaken with advice from a suitably experienced archaeologist and could be completed in conjunction with archaeological inspections of indigenous vegetation on the southern slopes of Mauao.
13. It is appropriate to establish vegetation other than grazed pasture on archaeological features in parts of the reserve where continued livestock grazing is not desirable for archaeological site protection or other reserve management purposes. In these areas, continued grazing is having a detrimental effect on slope stability and is contributing to the loss of archaeological sites. While establishment of a vegetation cover other than grazed pasture may lead to some loss of archaeological information, on the whole that loss will be less than that caused by on-going erosion.

The areas to be retired from grazing include the escarpment (that is subject to erosion) adjacent to the base track on the eastern, western, and southern sides of Mauao; the seaward side of the base track; and the spring-fed gully below the reservoir on the southern side of Mauao. Pohuehue (*Muehlenbeckia complexa*) is suitable to establish on these sites, to stabilise and protect the archaeological features. The planting of scattered pohutukawa (*Metrosideros excelsa*) where visible archaeological features are absent would assist to establish a vegetation cover that will reduce weed invasion over time. Ongoing periodic weed control will be required in the interim for areas retired from livestock grazing.

Visitor Management

14. A visitor management programme should be developed and monitoring and visitor surveys should be undertaken to determine visitor activities, seasonal patterns of use, and more precise visitor levels. It would also be useful to examine why people are visiting the reserve – is it for the outdoor experience, physical exercise, views obtained from the site, archaeological features, or perhaps a combination of these experiences? User surveys would help to guide future reserve management and interpretation.
15. Tracks should be clearly defined, well maintained, and signposted to ensure that informal tracking does not increase. Track hardening, the use of artificial surfaces and the selected use of board walks are all options worth considering as visitor numbers increase. The summit of Mauao requires particular attention (to tracking), to arrest damage to archaeological features resulting from foot traffic - this is addressed in Section 10.5. The use of shell as a track aggregate is causing on-going loss of archaeological integrity and should be discontinued. Alternative materials could include crushed rhyolite, compacted pumice, or ignimbrite.
16. Tangata whenua could be encouraged to provide guided walks for large groups. This would enhance visitor experiences, draw attention to the reserves historic and cultural status, and reduce the risk of accidental damage to archaeological features. A programme of guided walks would also provide a valuable learning experience for visiting groups. This opportunity is discussed further below.
17. The use of the reserve for open air gatherings, ceremonies or similar activities should be discussed with tangata whenua as part of the decision-making process, to ensure that such events are appropriate for the setting. Provision must be made for the protection of archaeological features – particularly when these events occur on the summit of Mauao.

Machinery

18. No earthmoving machinery, or machinery likely to cause ground disturbance during normal operation, should be used in the reserve without prior approval from the NZ Historic Places Trust. This must also include emergency situations such as fire fighting.

19. The 4WD access track is maintained regularly, and the use of machinery for this purpose should be supervised closely. If any ground disturbance is likely to occur in any area that is not already clearly part of the established 4WD track – for example, the establishment of additional culverts – the proposed work should be discussed with the NZ Historic Places Trust to determine if an Authority to Modify is required.

Reserve Management Activities

20. Archaeological advice should be sought prior to any management activities being undertaken in the reserve likely to cause ground disturbance, to ensure that archaeological features are not at risk.
21. The maintenance of vehicle access to the summit needs to be assessed carefully in relation to impacts on archaeological features. Run-off from the road and the subsequent translocation of archaeological material is currently a significant issue. Options include establishment of a berm to divert water off the road into areas where archaeological features are absent, and/or the downscaling of the road above the reservoir to an access track for ‘quads’. It is recommended that the vehicle access track on the summit is either closed or scaled down to a quad track. The latter may be the better option as it would still allow vehicle access to the summit for emergency vehicles (for fire fighting) and ceremonies of national significance (as provided for in the 1998 Management Plan, e.g. Waitangi Day), but would assist in eliminating damage to archaeological features, particularly on the summit.
22. Water needs to be diverted off tracks at regular intervals. The existing culvert spacing on the 4WD access track is adequate, but intervention is necessary to reduce water velocity where it discharges from the culverts. This run-off is currently causing localised channelling and erosion of archaeological features. Reduction of the velocity would ensure that run-off is dissipated over the ground surface, thus preventing channelling. This could be achieved by placing rocks or geotextile at the culvert exits. The results of such intervention would need to be monitored closely, to ensure that scouring does not occur around any new velocity ‘barrier’.
23. Water run-off from the reservoir overflow has also caused significant erosion of the gully head below the reservoir. This is continuing to destroy archaeological deposits located at the head of the gully. An alternative reservoir overflow needs to be established that will not impact on archaeological features. An appropriate method may be to flume the overflow to a point further down the gully, where existing obstructions in the stream bed will reduce the velocity of the flows. The dumping of high volumes of water into the stream bed over short periods, such as draining of the reservoir, should be avoided. The removal of collapsing exotic vegetation from the gully head, retirement of the area from livestock grazing, and planting with appropriate indigenous species, will also assist stabilisation of this area.

Grazing

24. The key to minimising ground damage is to use livestock to graze each area lightly for short durations. This can be achieved by ensuring that there is a series of secure paddocks available, which livestock can be moved between for short periods. Stock should spend 5-7 days in each paddock, depending on seasonal grass growth and stock numbers. A grazing rotation that averaged seven days, over five paddocks, would provide a rest period for each paddock in the order of 28-30 days.
25. The implementation of a well-managed rotational grazing programme will result in a reduction of erosion because sheep will not be tracking and camping in particular areas for extended periods of time. The amount of stock trampling and tracking that can occur in any one area will be minimised. Regular breaks from grazing will ensure that the pasture sward has time to establish over exposed archaeological features. In this instance, kikuyu grass is a desirable species as it will establish a robust ground cover that persists during dry conditions. It may be desirable to encourage the establishment of kikuyu (which is common in the existing pasture sward), by the placement of plugs on areas of exposed and eroding midden immediately adjacent to the 4WD access track in the vicinity of the reservoir. Periodic topdressing with fertiliser will also assist with the maintenance of the pasture sward.
26. The development of a rotational grazing programme will require adjustment and renovation of the fences within the grazed part of the reserve. A proposed new fence layout is shown in Figure 4. A stock-proof perimeter fence needs to be established around the grazed part of the reserve – the exact alignment of which will need to be worked out in the field with direct archaeological input. One internal subdivision fence will need to be moved in order to establish a better balance of paddock size and to improve the management of archaeological features in the vicinity of Kinonui's Pa. The alignment of the new fence will also need to be established with direct archaeological supervision. The fences that have been placed around middens within the reserve should be removed as they are ineffective as a site conservation measure and, in places, have exacerbated the erosion problem. This includes the removal of the three areas of permanent fencing, as well as numerous standard and wire fences throughout the reserve.
27. Revision of the fence alignment will require prior consent from the New Zealand Historic Places Trust (HPT) under the provisions of Section 11 of the Historic Places Act (1993) – refer to Appendix 8 in Volume 2 for information relating to the required HPT authority process. All ground disturbance associated with the fencing programme will need to be subject to direct archaeological supervision and monitoring.
28. The establishment of the proposed new fences will have minimal effects on archaeological sites, provided that fence alignments avoid visible features or areas likely to contain buried archaeological deposits wherever possible (this will be subject to direct archaeological supervision).



NOTE:
 1) Approximate alignments only - exact alignment to be determined by direct archaeological supervision.
 2) Existing fencelines will be utilised to form sections of the perimeter fence.

N Legend





-  Approximate alignment of new fence to be erected
-  Existing Fences to be retained
-  Existing Fences to be Removed
-  New circuit track

Figure 4. Proposed Fence Alterations and New Circuit Track



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Scale: 1:3,500
Date: 04/06/04
Cartographer: RPB

29. Fence posts that are removed should be marked in the ground with a layer of fine gravel placed in the fence post holes prior to them being backfilled. This will ensure that these fence post holes are not confused with earlier archaeological features if future archaeological investigations are undertaken.
30. The grassed area on the eastern slopes of Mauao has become difficult to manage with sheep because it has not been possible to contain the sheep in a small enough area to control rapid grass growth during peak growing periods. Kikuyu grass has formed a dense mat and sheep are unable to effectively graze this area. This is reducing the lengths of time that sheep are able to be retained in this area, and subsequently placing greater grazing pressure on other parts of the reserve that contain visible surface archaeological features. It is desirable for both archaeological site and livestock management purposes that the eastern area of grazing is managed more efficiently. To achieve this it will probably be necessary to graze with cattle for a short period (3-4 weeks depending on the number of cattle used) in order to reduce the density of the kikuyu to a point where it is able to be more effectively grazed by sheep. Cattle grazing should only be permitted in the summer months, for short durations. They should be monitored closely (daily) and should be removed immediately if any ground pugging or other damage occurs. Dry dairy cattle should be used as they are less likely to cause ground damage and tend to be more efficient grazers of marginal pasture. The area should be strip grazed with temporary electric fencing, but care will be needed to ensure the area is not under such grazing pressure that the grass sward is broken. An alternative to cattle grazing may be topping or mowing of the kikuyu, although this may prove impractical due to the density of the kikuyu sward and the presence of a large number of rocks in this part of the reserve.
31. Artificial ground hardening, using pumice or cement, is not currently required in areas where stock congregation occurs – for example in gateways and around water troughs. The present low stocking rate has maintained an intact pasture sward around troughs. Damage to intact areas of pasture should be avoided, for example when replacing troughs or when temporary cattle grazing is being undertaken. Tracking around gate ways can be avoided by moving stock regularly to new areas and only permitting stock to have access to one paddock at a time. Gates between paddocks should be closed when not in use for stock movement.
32. The short pasture sward has created a habitat favourable for rabbits, with related damage to middens as a result of burrowing. Rabbit numbers in the reserve are presently very high. If rabbit numbers are not reduced in the near future the damage to archaeological features will continue to accelerate. It is anticipated that, if rabbit numbers are reduced, and a programme of rotational grazing is instigated, the condition of archaeological features in the grazed area will generally stabilise. It is likely that rotational grazing will also improve the productivity of the available grazing area and this will benefit livestock condition.
33. Monitoring of the revised livestock management regime will be required in order to assess its effectiveness.

Information Management

34. The establishment of a document bank would help to combat the loss of information associated with the history and management of Mauao. This could also provide a repository for all written information accumulated associated with any management action within the reserve.

10.5 Integrity of setting and landscape management

Overall Management Theme

1. Mauao Historic Reserve presents a dramatic cultural landscape on the margin of a large urban population, yet there is currently no ‘sense of arrival’, and much could be done to improve the reserve entrance. Intensive urban activities adjacent to the reserve poses potential risks to the archaeological features, due to the likelihood of inappropriate activities occurring in the reserve. The creation of a buffer between the reserve and the adjacent urban landscape is desirable. Such a buffer could be created by a physical barrier or structure to mark the boundary and entrance to the reserve. Given the national significance of the archaeological features, a redesigned reserve entrance is justified. A suitably qualified landscape architect should prepare a carefully designed entrance and car park, which draws in the appropriate design elements of the reserve and the relationship of tangata whenua to the land.
2. It is critical for a landscape as high profile and significant as Mauao, that coherency and consistence is established and maintained in high quality landscape detailing around the tracks and recreation areas. Standard stock control fences are appropriate in some areas. High profile sites, such as the summit and the walking tracks, require standardised facilities, a robust brand, including design details, and materials (a logo or ‘brand’ could possibly be generated specifically for Mauao). The brand should be developed in conjunction with tangata whenua, so that appropriate signals are sent to visitors about the history and significance of the area. The brand should be both natural and solid to allow for the appropriate image and landscape detailing, necessary for such a significant and popular area.
3. The concept of requiring no significant footings on facilities is a key requirement for the protection of archaeological sites. Suggestions for appropriate seating and details for Mauao are provided in the Landscape Concept for the Summit in Figure 5.
4. The Landscape Concept (Figure 5) addresses key landscape management issues for one of the most pressured areas on Mauao. Visitor facilities should maximise the quality of the visitor experience while avoiding any adverse impacts on archaeological features. Existing tracks and other recreational facilities, such as seats, are showing very high levels of wear and degradation. Provision and maintenance of appropriate facilities is imperative to the protection of Mauao. Specific management of facilities and key areas on Mauao are discussed in the sections below.

Mauao Summit

Summit Pa Landscape Concept



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Project: MAUAO CONSERVATION PLAN

Drawings: SUMMIT PA LANDSCAPE CONCEPT

Client: TAIARANGA ENERGY COUNCIL

Sheet: ONE

Date: OCTOBER 2003

Scale: 1:500 @ A1

Report No: 290

Drawn:

Figure 5:



LOOKOUT

The edges of the summit outlook are defined using rocks and low profile planting. The area may be used for seating and picnic tables. This makes the summit area a significant lookout for pedestrians given the very steep slopes close to the lookout areas.

Rocks can be placed with minimal disturbance to the ground surface, and no ground surface is required. Localized benches could be used where an archaeological site area is present.

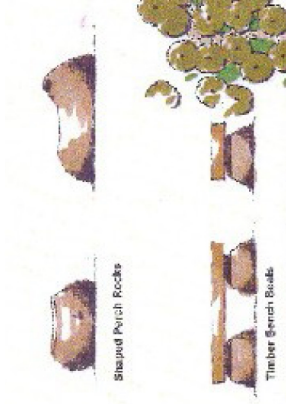
Materials used for furniture on the summit should be consistent with the rest of Mauao.

LEGEND

- Mapped archaeological site boundaries
- Extent of archaeological sites
- Existing pedestrian tracks to be integrated with archaeological sites
- Planting to be aligned with new look-out areas, archaeological sites, look-out areas, and tracks
- Street and understorey plantings
- Roads and plantings to provide edges for look-out areas and tracks. Roads also to be used for walk and parking
- Pedestrian tracks
- Native grass and plantings
- Amenity grass



Rocks and low profile planting to be strategically placed to define the perimeter of the lookout area. Seating and picnic tables to be placed along the edges. Open spaces to be defined using rocks, planting and grass. Initial pedestrian count may be required using fencing standards and workflow.



SEATING

Picnic rocks and natural timber seating to be provided on the landscape. Picnic rocks can be placed in the open area for people to rest. Carved logs for picnic tables can be incorporated into the design to strengthen the landscape concept for Mauao.

Bench seats can be provided using rocks and timber. A set of picnic tables can be provided in the open area, without disturbance or excavation of the surface, but once they are fixed into place the rocks are less likely to move, unless damaged.

Existing track through benches to be released to avoid pedestrian traffic. Seating to be placed in the location by pedestrians.

TRACK SIDE SEATING

Picnic rocks and natural timber seating to be provided in the shade of trees along the edge of tracks leading to and from the summit. All rocks to be placed on site so seating can be accessed without the need for excavation.



STEEP SLOPES BELOW

STEEP SLOPES BELOW

SUMMIT ROAD

5. Vegetation can be used to manage key areas of significance on the summit of Mauao. The planting and maintenance of indigenous grasses will provide non-destructive vegetation cover to come of the more prominent archaeological sites. Low profile indigenous grasses can offer an appropriate cover to some of the more legible sites, such as the ‘amphitheatre’ areas adjacent to the main lookout. Existing indigenous vegetation should be rationalised to make these features more legible, but also protected with resilient cover. Some of these currently have tracks through some very sensitive areas. Plantings of tree and shrub species can be used to control pedestrian traffic.

Tracks

6. Track surfaces on Mauao are currently maintained variously using shells, crushed rhyolite, or exposed earth. Much of the shell was previously obtained from archaeological deposits. Crushed rhyolite has good wearing properties and is a suitable natural material for track surfaces. If drainage is appropriately managed, rhyolite can provide a sustainable track surface for Mauao, particularly on the summit. It is locally available.
7. Where heavy pedestrian use is resulting in loss and export of the track surface, maintenance standards must be improved to ensure that exposure of bare earth and archaeological deposits does not occur. Two currently bare earth tracks on the summit cross archaeological features, which is leading to site degradation. These tracks, on the north-eastern and north-western sides of the summit, are shown on the landscape concept (Figure 5). In both cases the existing tracks locations are to be protected with non-destructive indigenous planting, and alternative track alignments are to be promoted. Pedestrians may need to be discouraged from existing tracks through the use of standard (warratah) fences, rocks, and/or planting. Edges of tracks should be defined through the use of natural materials such as rocks and natural timber seats. These are detailed in the landscape concept for the summit. A high level of monitoring and maintenance will be required in these places, to ensure that appropriate track locations come to be preferred by pedestrians.
8. The circuit track should be completed - refer to Figure 4. This may require a section of boardwalk to avoid damage to archaeological features. Track hardening will also be required.

Look-Out Edges

9. Recent fires have opened up the main lookout area and the edges of many tracks to very steep drops below. Previous vegetation cover was effective in keeping pedestrians back from the edge, but the lack of vegetation now presents a hazard to pedestrians on the summit, and a risk for the reserve managers. The presence of archaeological sites means that heavy fencing, typically associated with steep-edged lookouts, is inappropriate, given the potential damage which would be caused by the placement of posts. A temporary fence was constructed, for safety reasons, on the summit following the fire in 2003. Although reducing the risk of an accident, it does not remove the risk as people climb over fences and other barriers.

10. A more natural solution is required for the control and identification of pedestrian areas, without the use of foundation holes.
11. Natural rocks can be inter-planted, or grouped together, to provide an effective pedestrian barrier, without compromising the views which have been opened up on the summit. Tree planting should punctuate the sweeping views to provide some shelter for visitors to the summit. The landscape concept (Figure 5) provides an indication of the appropriate placement of rocks, low plantings and planting of trees on the edges of tracks and look out areas.

Seating

12. As with the pedestrian control techniques, seating should be natural, low key, and should not use footings which may result in damage to archaeological sites. Some preliminary concepts based on the use of rocks and timber slabs for seating are provided in the landscape concept for the summit. The seats should be placed appropriately to allow for resting places in the shade on the summit, and on other tracks on Mauao. A consistent theme, or brand, for seating, fencing, and pedestrian control is crucial to the overall landscape concept for Mauao.

Other Facilities

13. Establish screen planting (of pohutukawa) adjacent to the stock yards.
14. Remove the long drop toilet adjacent to the stock yards.
15. Remove bath tub water troughs and replace with dark coloured plastic industry standard troughs.

10.6 Fire

The reserve is in the Western Bay Moana Rural Fire District and there is a requirement to have an approved fireplan by 1 October each year.

The primary fire management objective for rural fire authorities is to minimise risk of fire while retaining sufficient resources to rapidly extinguish any outbreak of fire that does occur. Fire management on Mauao needs to focus on fire prevention, pre-planning for fire control, and public safety. The risk of fire can be reduced considerably through the implementation of a well publicised active fire prevention programme. This programme should include:

1. Establishment of a year round total fire ban (including cigarettes).
2. Daily assessment of fire risk using established Rural Fire Authority standard FDR ratings.
3. Establishment of a standard rural fire rating signs that show the level of daily fire risk: extreme, high, moderate, or low.

4. Radio and newspaper advertising of fire risk, to educate reserve users about fire prevention measures, fire risk, and public safety issues. Publicity should increase as the risk increases.
5. Visits to local schools, community groups (e.g. Lions, Rotary) and user groups (e.g. running clubs) to publicise the risk.
6. Analysis of the causes of previous fires (e.g. arson, camp fires) can help determine where prevention activities should be focused.
7. Maintain a high level of fire suppression readiness.
8. Reduce levels of management activities and public access as the fire risk rises. A total ban on public access should be considered during periods of extreme fire risk (this has been used in similar situations but should only be a last resort, in very extreme situations).

Pre-planning for fire suppression can significantly reduce the potential spread of fire. Pre-planning focuses on early detection, initial fire attack procedures, pre-arranged fire control strategies, call out procedures, and training of fire fighting personnel. Pre-planning should include the following elements:

1. Establishment of a network of observers and publicised fire reporting procedures. Observers can include residents with clear views of Mauao, boaties, aero clubs, and regular users.
2. Close liaison with other fire management agencies, e.g. New Zealand Fire Service and the Department of Conservation. Joint training exercises should be undertaken on Mauao, to ensure that initial attack, in the event of a real fire, is both rapid and effective.
3. Regular (at least annual) training of TCC staff and volunteers in fire control strategies, undertaken to industry standards.
4. Preparation of a fire plan for the district and a specific action plan, including fire control strategies, for Mauao. The Mauao plan should be reviewed annually. Public safety should be addressed specifically in the fire plan and action plan for Mauao. Priority must be given to the evacuation of reserve users immediately following the outbreak of fire.
5. Establishment of ample water supplies for firefighting. These supplies should be strategically placed to allow aerial access, ready vehicle access, and safety of fire fighting personnel. They should be established in clear open areas with vegetation of low flammability (e.g. kikuyu grass), on the lower slopes of the reserve.

The greatest fire risk is associated with areas of early successional scrub on the northern slopes. Planting on Mauao should avoid the use of flammable species such as manuka. This is very suitable for revegetation but other species are less likely to

carry fire; e.g. karamu and ngaio. Reducing the fuel loadings of vegetation can significantly reduce the intensity of a fire, thus making it easier to control and reducing the risk of it spreading. Reduction of fuel loadings at Mauao can be achieved by using appropriate species during planting programmes in combination with maintaining a short pasture sward where grazing is to be continued.

10.7 Weed control priorities

A strategic approach to weed control on Mauao has been developed, based on recent management practices and relative priorities for future management. Environmental weed species have been assigned to one of five categories of relative priority for control. Class One species are total control pest plants identified by Environment BOP. Assignment of species to Classes Two to Six was based on assessments of the relative level of threat to the ecological values of the study area, the relative vulnerability of the vegetation and habitats, and the relative size of the current infestations.

Ongoing weed control will be required following initial control operations for each species for which control is undertaken.

Class One

Class One species are environmental weeds that are total control plant pests identified by Environment BOP in their Plant Pest Management Strategy for the Bay of Plenty prepared under the Biosecurity Act 1993. Total control pest plants have a restricted abundance and land occupiers are required to undertake control (Environment BOP 1998).

- Boneseed (*Chrysanthemoides monolifera*)
- White-edged nightshade (*Solanum marginatum*)
- Woolly nightshade (*Solanum mauritianum*)

Class Two

Class Two comprises species present in low numbers for which total control is feasible on Mauao, and those species that are potential or actual threats to the ecological processes or values of the site. These species tend to be in small, localised infestations, and control should be instigated before they expand. The history of successful control programmes and related economic analyses and scientific studies indicate the greatest returns for expenditure of money and effort are derived from controlling pest plants at the early stages of invasion (Williams 1997). Pest plants for which there is little or no information on their ecological role, but which may pose a threat (based on field observations), have also been included in this class.

- Acanthus (*Acanthus mollis*)
- Apple of Sodom (*Solanum linnaeanum*)
- Barberry (*Berberis glaucocarpa*)
- Boxthorn (*Lycium ferocissimum*)
- Chinese privet (*Ligustrum sinense*)
- Climbing dock (*Rumex sagittatus*)

- Cotoneaster (*Cotoneaster glaucophyllus*)
- Himalaya fairy grass (*Miscanthus nepalensis*)
- Italian arum (*Arum italicum*)
- Italian buckthorn (*Rhamnus alaternus*)
- Japanese spindle tree (*Euonymus japonicus*)
- Kahili ginger (*Hedychium gardnerianum*)
- Kauri (*Agathis australis*)
- Kermedec Island pohutukawa (*Metrosideros kermadecensis*)
- Mexican daisy (*Erigeron karvinskianus*)
- Mignonette vine (*Anredera cordifolia*)
- Mile-a-minute (*Dipogon lignosus*)
- Phoenix palm (*Phoenix canariensis*)
- Prickly hakea (*Hakea sericea*)
- Shrub balsam (*Impatiens sodenii*)
- Sweet brier (*Rosa rubiginosa*)
- Sydney golden wattle (*Racosperma longifolia*, *R. sophorae*)
- Taro (*Colocasia esculenta*)
- Tradescantia (*Tradescantia fluminensis*)
- Tree of heaven (*Ailanthus altissima*)
- Tree privet (*Ligustrum lucidum*)
- Velvet groundsel (*Senecio petasitis*)
- Willow-leaved hakea (*Hakea salicifolia*)

Class Three

These tend to be larger or more widely spread infestations of species that are potential or actual threats to the ecological processes or values of the site. Initial control efforts should concentrate on the prevention of further spread of these species.

- Brush wattle (*Paraserianthes lophantha*) and black wattle (*Acacia mearnsii*)
- Climbing asparagus (*Asparagus scandens*)
- Fan palm (*Trachycarpus fortunei*)
- German ivy (*Senecio mikanioides*)
- Hawthorn (*Crataegus monogyna*)
- Ivy (*Hedera helix*)
- Ixia (*Ixia maculata*)
- Japanese honeysuckle (*Lonicera japonica*)
- Nasturtium (*Tropaeolum majus*)
- Pampas (*Cortaderia selloana*, *C. jubata*)
- Radiata pine (*Pinus radiata*) and maritime pine (*Pinus pinaster*)
- Silver poplar (*Populus alba* cv. Nivea)
- Smilax (*Asparagus asparagoides*)
- Sycamore (*Acer pseudoplatanus*)
- Vine (*Vitis* sp.?)

It is important that large pines are removed otherwise they will continue to disperse seed across Mauao on an ongoing basis.

Class Four

These are small infestations of weeds that are of little or no threat to ecological processes and values, but which might from an aesthetic point of view be worthy of control, particularly if other control measures are being undertaken in their vicinity.

- Primrose jasmine (*Jasminum mesnyi*)
- Teucrium (*Teucrium fruticans*)

Class Five

These are species which are widespread on Mauao but are a threat to plantings and require control in areas which are being planted.

- Kikuyu grass (*Pennisetum clandestinum*)
- Gorse (*Ulex europaeus*)

Class Six

These species are not a threat to ecological values and should not be controlled for that reason, although they may be agricultural weeds.

- Spanish heath (*Erica lusitanica*)
- Blackberry (*Rubus fruticosus* agg.)

10.8 Weed control programme

Year 1

- The following species should be controlled in Year 1:

Category 1 species - boneseed, woolly nightshade, and white-edged nightshade.

Category 2 species - mignonette vine, barberry, boxthorn, Chinese privet, Himalaya fairy grass, Italian arum, Italian buckthorn, kahili ginger, kauri, mile-a-minute, prickly hakea, shrub balsam, sweet brier, Sydney golden wattle, tree of heaven, tree privet, velvet groundsel, willow-leaved hakea, apple of Sodom, Kermedec Island pohutukawa, and swan plant, climbing dock, and cotoneaster (in Management Unit 4 only).

- Considerable effort has already been expended recently on the control of pampas on Mauao, and this should be continued and intensified. Large plants should be sprayed with glyphosate and resprayed a year later; smaller plants should be controlled every six months as they establish November/December and then again in April/May. TCC has also been actively controlling tree of heaven, and this should continue.

Year 2

- Follow up control of all weed species controlled in Year 1 - boneseed, woolly nightshade, apple of Sodom, mignonette vine, barberry, boxthorn, Chinese privet, Himalaya fairy grass, Italian arum, Italian buckthorn, kahili ginger, kauri, mile-a-minute, prickly hakea, shrub balsam, sweet brier, Sydney golden wattle, tree of heaven, tree privet, velvet groundsel, willow-leaved hakea, white-edged nightshade, Kermedec Island pohutukawa, swan plant, climbing dock, and cotoneaster (in Management Unit 4 only).
- Control climbing asparagus.
- Control radiata pine and maritime pine.

Year 3

- Follow up control of weed species controlled in Years 1 and 2 - boneseed, woolly nightshade, apple of Sodom, mignonette vine, barberry, boxthorn, Chinese privet, Himalaya fairy grass, Italian arum, Italian buckthorn, kahili ginger, kauri, mile-a-minute, prickly hakea, shrub balsam, sweet brier, Sydney golden wattle, tree of heaven, tree privet, velvet groundsel, willow-leaved hakea, white-edged nightshade, Kermedec Island pohutukawa, swan plant, climbing dock, and cotoneaster (Management Unit 4 only), climbing asparagus, radiata pine, maritime pine.
- Targeted control of Japanese honeysuckle in proposed or actual planting areas and adjacent to tracks.
- Re-map pest plant distributions and assess priorities for future weed control operations, e.g. smilax, hawthorn, Japanese honeysuckle.

Year 4

- Follow up control of weeds controlled in Years 1, 2 and 3.
- Control of weeds in Management Unit 9 - climbing dock, ivy, taro, tradescantia, acanthus, fan palm, German ivy, nasturtium, Phoenix palm, sycamore, vine, primrose jasmine, teucrium.
- Preliminary objectives for Year 4 (to be reviewed following pest plant management strategy review the previous year) are control smilax and hawthorn.

Year 5

- Follow up control of all weed species controlled in Years 1-4.

10.9 Revegetation guidelines

Key factors in the successful establishment of indigenous vegetation on Mauao are:

- species selection
- site preparation
- planting techniques
- maintenance of plantings
- ongoing weed control

Various broad proposed planting zones have been mapped in Figure 6. This provides an indicative outline of the timing of planting and some key elements of the proposed planting are also provided for selected areas (in the map legend). Note that this map needs to be considered in conjunction with Figure 7 (Management Units) and related text. Figure 7 is the key map, while Figure 6 simply provides a timeline and some key elements in the proposed planting.

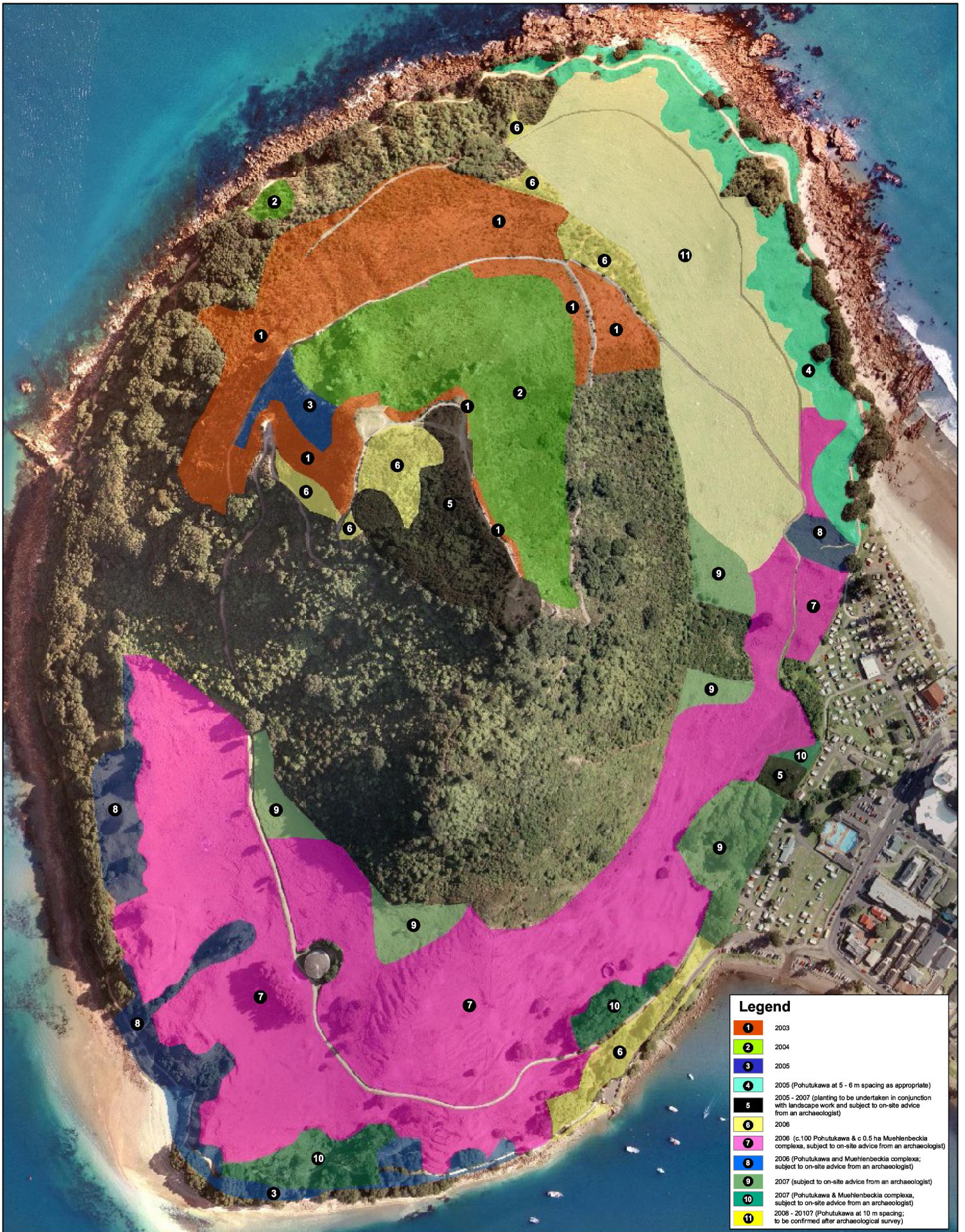
10.9.1 Species selection

Plant species have been selected that would occur naturally on the types of sites present on Mauao. The overall aim of the revegetation/restoration work is fundamentally important. Pohutukawa is a key element on Mauao (and along the Bay of Plenty coast in general) and should continue to be a key species on Mauao. Another particularly important consideration is the relative flammability of species (some species planted prior to 2003 are considered to be highly flammable and this has been an important consideration when selecting species since the 2003 fire). A list of species and their relative flammability is provided in Appendix 5. Other issues considered include the overall appearance of the mountain and requirements for low maintenance.

A preliminary plant schedule is presented in a section below but suites of species should be selected to suit individual sites. A list of plant species potentially suitable for inclusion in plantings on Mauao is presented in Appendix 5. All plants should be sourced from Tauranga or local Bay of Plenty genetic stock, and should generally be grown from seed.

Most species will need to be grown in PB2 or PB3 planter bags. However, root trainer stock would be suitable for some species (e.g. manuka, ti kouka, wharariki, koromiko, and karamu), however where cover is required to quickly establish (e.g. track margins) it would be appropriate to use PB stock for these species as well. Plant stock should be ordered one to three years prior to planting to allow suppliers adequate time to source seed and grow stock. Early orders also attract lower prices.¹

¹ Most root trainer stock will be easily obtained the October prior to planting, but some species may require a longer lead-in time, e.g. up to two years.



Legend	
1	2003
2	2004
3	2005
4	2005 (Pohutukawa at 5 - 6 m spacing as appropriate)
5	2005 - 2007 (planting to be undertaken in conjunction with landscape work and subject to on-site advice from an archaeologist)
6	2006
7	2006 (c.100 Pohutukawa & c 0.5 ha Muehlenbeckia complex, subject to on-site advice from an archaeologist)
8	2006 (Pohutukawa and Muehlenbeckia complex; subject to on-site advice from an archaeologist)
9	2007 (subject to on-site advice from an archaeologist)
10	2007 (Pohutukawa & Muehlenbeckia complex, subject to on-site advice from an archaeologist)
11	2008 - 2010? (Pohutukawa at 10 m spacing; to be confirmed after archaeological survey)

Figure 6. Proposed Planting Zones

Note - boundaries subject to change when fencelines finalised
 - refer also to Figure 7 and related text



10.10 Species schedules

Various complements of indigenous species are suggested for planting in each of the management units, as set out below.

Species	Management Unit					
	1	3	5	6	8	9
pohutukawa (<i>Metrosideros excelsa</i>)	2	2	1	1	1	1
puriri (<i>Vitex lucens</i>)	2	2	-	-	-	1
ngaio (<i>Myoporum laetum</i>)	2	2	1	1	1	1
taupata (<i>Coprosma repens</i>)	2	2	1	1	1	1
karamu (<i>Coprosma robusta</i>)	2	2	1	1	1	1
karo (<i>Pittosporum crassifolium</i>)	2	2	1	1	1	1
wharariki (<i>Phormium cookianum</i>)	2	2	1	1	1	1
ti kouka (<i>Cordyline australis</i>)	2	2	2	2	2	2
houpara (<i>Pseudopanax lessonii</i>)	2	2	1	1	1	1
<i>Melicytus novae-zelandiae</i>	2	2	2	1	1	2
akeake (<i>Dodonea viscosa</i>)	2	2	1	1	1	1
whau (<i>Entelea arborescens</i>)	-	2	-	-	-	1
meadow rice grass (<i>Microlaena stipoides</i>)	1	-	-	-	-	-

Key

1. These species should comprise the bulk of the plantings.
2. To be used in low numbers.

The restoration area includes opportunities for cultural plantings and options for cultural plantings should be considered when planning the restoration of individual areas.

10.10.1 Site preparation for planting

Pasture/exotic grasses and herbs

- Planting sites that are pasture, or where exotic grasses and herbs have established following tree felling, clearance of debris, or spraying of weeds will require spot-spraying or blanket spraying with herbicide prior to planting.

Areas with exotic trees¹

Priorities for site preparation in these areas are listed below:

- Fell large exotic trees and mulch or remove debris.
- Cut all other small exotic trees and shrubs (remove debris), and swab stumps with herbicide.
- Knapsack spray or cut, and stump swab other weeds as appropriate (e.g. tradescantia). This will need to be undertaken more than once, in the summer months, with approximately 8-12 weeks between herbicide applications.

¹ For example within Management Unit 9 - see Section below.

- Blanket spray 2-3 weeks prior to planting.

10.10.2 Plant spacings

- Plant spacings when using PB stock should be *c.* 1.5 m, and *c.* 1.2 m for root trainer stock. This will ensure that canopy closure is achieved relatively quickly and reduce opportunities for weed establishment.

10.10.3 Planting

- During planting, individual planting sites with a dense grass/herb cover should be screefed (i.e. remove plant material and roots from an area about 0.35 m in diameter), plants should then be planted in the centre of these cleared micro-sites.

10.10.4 Timing

- Planting should be undertaken in the winter, preferably in early winter (e.g. May) to allow plants to become well established before summer.

10.10.5 Maintenance

- Plantings will need to be released from all weed competition two or three times during the first year following planting, and 1-2 times in the following two or three years until plants have become established. Only aggressive woody weeds (e.g. gorse, blackberry, and pampas) will need further control until canopy closure is achieved. Some parts of the planting sites may be able to be left unreleased after 18 months if plants are well established.
- Plants that die in the first year should be replaced (by infill planting), particularly where their absence would allow growth of aggressive weeds.
- This management approach should be maintained for successive new plantings over the next 5-6 years, then assessed to determine if it is appropriate and modified to correct any inadequacies.

10.11 Management of threatened and local plant species

- The flora of Mauao reflects the diverse character of the habitats present. The distribution and relative abundance of various species will change as vegetation succession proceeds. It is also likely that more indigenous species will continue to establish naturally (weed species as well).
- If track construction or other development is considered in, or near, habitats where *Psilotum nudum*, *Lepidosperma laterale*, and mangemange occur, these species should first be located and protected. All sites potentially affected should be inspected prior to any future track construction or re-alignment, to determine if any populations of threatened or local species are present.

- One of the *Psilotum nudum* populations was located in an area used for recreational climbing. However not all cliffs were surveyed intensively and further populations are likely to be present. The population on the climbing site should be monitored. If *Psilotum nudum* becomes threatened by increased climbing activity it may become necessary to survey other parts of Mauao to ensure that the species is secure. The cliffs have also been affected by fire and are somewhat unstable. This may also pose a risk for *Psilotum* and other cliff species.
- Several nationally threatened or local species that occur naturally in coastal areas in the Bay of Plenty Region may have been present previously on Mauao and consideration could be given to the establishment of locally-sourced populations. Potentially suitable species and the appropriate habitats for establishment are listed below. Small scale planting trials should be considered, as the causal factors of decline may still be operating and hence re-establishment may not be successful. Any plantings should be monitored.

Beaches

Austrofestuca littoralis (hinarepe, sand tussock)
Desmoschoenus spiralis (pingao)
Euphorbia glauca (Waiu-o-Kahakura)
Lepidium oleraceum (Nau, Cook's scurvey grass)
Pimelea arenaria (sand daphne)
Tetragonia tetaganoides (NZ spinach)

Shrubland and secondary forest

Pimelea tomentosa
Olearia pachyphylla
Carmichaelia williamsii

Forest

Marrattia salicina (para; king fern)
Nestegis apetala (coastal maire)
Pisonia brunoniana (parapara)

10.12 Pest animal control

Specific pest control regimes reflect the overall objectives of fauna management (see Section 9 above). A methodology to address each objective is outlined below.

Protection of Fur Seals, Penguins and Grey-faced Petrels

- Dog exclusion throughout the year.
- Identify specific seal haul-out areas and prevent human disturbance at these sites.
- Year round cat control – continuous cat-trapping should occur throughout the reserve. Trap sites should focus on prime cat travel routes and hunting areas, such

as the coastal margin and paddock/bush edges. Options for traps include certified kill traps (e.g. Timms traps, Conibears) or live-capture approaches such as cage traps. Each approach has advantages and disadvantages, e.g. kill traps enable continuous and efficient trapping, but sites would need to be selected carefully (elevated off the ground, away from seabird colonies) to minimize capture of non-target species, especially seabirds. Cage traps enable non-target species to be released, but they also require daily servicing. Mauao would be suited to a combination of these two trapping methods. Baiting should vary between rabbit and fish meat.

- Year round mustelid control is needed throughout the reserve, involving continuous trapping for ferrets, stoats, and weasels, aimed at the interception of invading animals soon after they arrive and preventing them from breeding locally. Trapping with Mark 6 Fenn traps is currently the most cost-effective method. Trapping should target sites similar to those for cat control, particularly sites where different habitat features intersect, such as fencelines, bush edges, banks, and streams. Traps should be located mainly under vegetative cover, throughout the management units. Two-trap sets are recommended with long-life bait (salted/freeze-dried rabbit, egg), elevated off the ground between the traps. Cover with a DOC-approved wooden tunnel with a built-in floor and with entrance holes no greater than 70 mm in diameter. The floor prevents captures of non-target species in the event of a tunnel being rolled over by people or livestock, while the narrow entrance minimizes the chances of entry by non-target species. Check and rebait fortnightly during the main stoat dispersal period (typically November-March) and monthly during rest of year.
- Possum control should be pulsed throughout the year aimed at suppressing possum numbers to below 5% residual trap catch (or bait take) at all times. Management should be adaptive, utilizing the most cost-effective and environmentally acceptable methods available. Depending on baseline possum levels, numbers could be depressed initially by poisoning (potassium cyanide - Feratox would be ideal but would need to check legality and practicality of use in a high use public area). Alternatively, trapping pulses could be implemented using Conibear traps and/or Timms traps, the latter when possum densities are low. Possum numbers should be indexed annually initially, then possibly use bioindicators (e.g. mahoe and pohutukawa) to index possum population levels (refer to Payton *et al.* 1999; Handford 2000).
- Seasonal rat control should aim to reduce tracking levels of Norway rats and ship rats to 5 percent or less during at least the early part of the breeding season for seabirds (July-November). This approach will also increase the nesting success of small forest passerines, such as piwakawaka (fantail). Management needs to be adaptive. Alternative approaches include poisoning on a grid c.100 m x 150 m, using diphacinone or other available toxins should they be required. More potent and environmentally persistent toxins should be avoided. Methods of rat control are improving continually. Cholicalciferol (if prefed) is currently achieving effective control of ship rats (N. Miller, DOC, pers. comm.). Grid-based rat trapping would also be an effective alternative approach in an area of this scale if toxins were not used. Several trapping baits could be used, including almonds, chocolate buttons, and peanut butter. Rat populations should be indexed at least

twice a year, including immediately prior to the first period of control each year in June-July.

Recovery of populations of sensitive fauna

- Implement the regimes described above plus year round control of rats to a population level of less than 5 percent tracking index. This approach will provide added benefits for lizards, invertebrates, small birds, and possibly small seabirds, if control of large predators and possums is also effective. Control of hedgehogs and mice to low levels would provide additional benefits for invertebrate fauna.

Recovery of locally extinct fauna species

- See Section 9 above.

Control of Browsing Pests

- Control of browsing pests should be undertaken prior to planting, each season, in order to ensure low numbers of rabbits, possums, and hares. Rabbit eradication could be achieved by using a combination of poisoning, trapping, and dogging.
- Pest animal control should be undertaken in conjunction with Environment BOP pest control officers.

11. MONITORING

11.1 Archaeological site condition

A condition monitoring programme should be established for the archaeological features within the reserve, using methods recently published by the Department of Conservation (Walton 2003). Comprehensive monitoring is required in order to:

- Assess the effectiveness of the grazing regime - to determine the most suitable grazing regime to maintain the pasture sward without causing damage to archaeological features. Monitoring should include fence lines, gates, and water troughs, and should be carried out at pre-determined intervals. For example, it would be useful to monitor the site following heavy rainfall or during prolonged dry spells, when ground damage from livestock is most likely to occur;
- Determine whether visitors or other reserve management activities are having detrimental impacts - simple regular walk-through surveys can be used to monitor impacts of visitors and other management activities. The checklist of effects to be monitored should include graffiti/vandalism, damage to archaeological features by vehicles used in site management, damage caused by track and/or road maintenance and water run-off, damage caused by informal tracking, deterioration or damage to structures, and safety issues related to structures or reserve features. The checklist should include recording of the remedial actions required and the person responsible for them. In addition to these surveys, informal monitoring should be undertaken during any site visit or after specific management actions;
- Detect changes in vegetation that may lead to detrimental impacts on archaeological features.

11.2 Vegetation

- A series of photopoints should be established to monitor vegetation change on Mauao. These should include views of all side slopes and of the main vegetation/habitat types. Photographs should be taken at regular intervals, say every 1-3 years.
- It is also recommended that long term monitoring be established to check for new weed infestations and to monitor the rate of spread, or otherwise, of current infestations.
- A series of permanent vegetation monitoring plots should also be established and remeasured every 3-5 years.
- Foliar Browse Index (FBI) should be used to assess possum impacts on sensitive species, e.g. pohutukawa.
- It is important that plantings are monitored regularly, to determine survival of different species, and relative growth rates.

11.3 Fauna

The following monitoring should be implemented for key pest species and selected indigenous species:

- Annual possum monitoring (at least initially) using standard repeatable approaches (e.g. residual trap catch using ethically-certified leg hold traps, or bait take using wax blocks). The small size of Mauao would favour the latter method. Subsequently outcome monitoring of sensitive tree species (e.g. pohutukawa and mahoe) should be undertaken annually (c.f. Payton *et al.* 1999).
- Rat monitoring should be undertaken at least biannually including in the early part of the seabird breeding season (June/July) and in summer. Either tracking tunnels could be used or wax blocks (c.f. Handford 2000).
- Mustelids and cats are not easily indexed, particularly in small areas. Operational monitoring should comprise a comparison of inter-year trap catch, a database of sightings compared between years, and assessment of breeding success and causes of failure of seabird species (see below). If mustelids and/or cats persist, use predator dogs to gauge the extent of the problem, and potentially to hunt and/or kill pest animals.
- Seabird monitoring – annual monitoring initially (and then every three years) of burrow occupancy and breeding success of blue penguins and grey-faced petrels. Compare annual results with past studies (e.g. Jervis and Davies 2000 and H. Clifford pers. comm.). The current OSNZ monitoring should be maintained. For dead birds, determine likely cause(s) of death by examining the scene for sign, including searching for predator bite marks and scats.
- Fur seal numbers – undertake regular counts of haul-out areas at set times of the year to determine trends in numbers. Monitoring of human behaviour around these sites is also recommended.
- Visiting birds – keep a database of threatened species visiting the reserve, e.g. karearea (New Zealand falcon) and North Island kaka.
- Lizard diversity and abundance - an initial survey is needed to determine diversity of species present, from which a monitoring programme can be derived.

11.4 Human use

A baseline visitor survey should be undertaken to establish the number of visitors and the types and patterns of use. A survey could include the following elements: background research, development of a field survey, field survey, and data analysis. A field survey could be undertaken using personnel positioned at key locations in the reserve. Surveys could be repeated at five-yearly intervals.

12. RESEARCH

The need for further research in the following areas became apparent during the preparation of the conservation plan:

- Archaeological research to determine whether buried archaeological features are present within the grazed portion of the reserve on the eastern slopes of Mauao.
- Archival and archaeological research to determine the nature and origin of the archaeological features associated with the stone steps.
- Conservation advice¹ and assessment of the stone steps and stone jetty in order to determine what conservation treatment is required and/or appropriate. It is possible that the stone structures have been so heavily modified by ‘repairs’ carried out in the past that there is little or no original fabric remaining.

¹ Advice should be sought from a specialist formally qualified in the conservation of historic stone structures. It is important that an appropriate person is identified because this is a highly specialised area. In order to identify the appropriate person, advice should be obtained from Jeremy Salmond, of Salmond & Reed Architects in Auckland. Mr Salmond is a leading New Zealand Conservation Architect.

13. MANAGEMENT UNITS

Mauao has been subdivided into nine management units and management guidelines are provided below to underpin future management in each unit. Refer to Figure 7. Potential planting sites have been identified, to increase the area of indigenous vegetation. This would provide a larger area of habitat for indigenous plants and animals, and support tangata whenua aspirations for Mauao.

A simple objective and set of key issues has been identified for each management unit. Management Units 1, 2, 3, 7, and about 50 percent of Unit 9 are to be managed primarily for the protection of cultural heritage landscape, while Units 4, 5, 6, 8, and 9 are to be managed primarily for ecological restoration. Note that Unit 2 is to be retained in indigenous vegetation and that further archaeological investigation is required in Units 6 and 7.

Management Unit 1

Protect archaeological values and views while supporting a high level of public visitation to the summit.

- Implement the landscape concept plan.

Management Unit 2

Manage indigenous vegetation development to protect archaeological features.

- Maintain indigenous vegetation cover.
- Regular maintenance and manipulation of vegetation will be required to protect archaeological features.
- Undertake control of damaging environmental weeds, if required.
- Ongoing control of mustelids and cats and pulsed control of possums and rats.

Management Unit 3

To be maintained mostly in grazed pasture to protect archaeological features.

- Adjustments to boundary between indigenous vegetation (Management Unit 4) to develop a more natural, uneven boundary.
- Implement revised fencing plan.
- Revise management of middens.
- Review stormwater management.



Legend



Management units
(refer to text)

Figure 7. Proposed Management Units 2003



Scale: 1:3,500
Date: 17/03/04
Cartographer: s 7(2)(a) - Privacy

- Establish five paddocks of similar size and ensure that they have stock proof boundary fences.
- Selective retirement from grazing, and planting of selected species to stabilise eroding archaeological features.
- Weed control in areas retired from grazing.
- Selective removal of exotic trees.
- Paint reservoir.
- Remove area of silver poplar (*Populus alba* c.v. Nivea).
- Control rabbits and maintain permanent control of mustelids and cats.

Management Unit 4

To be retained in indigenous vegetation.

- Selective control of invasive weeds.
- Local planting (mainly pohutukawa) on margins (e.g. small open sites adjacent to western side of Management Unit 3).
- Review stormwater management, especially in relation to petrel burrows.
- Maintain permanent control of mustelids and cats and pulsed control of possums and rats.

Management Unit 5

The long term aim for this area is to establish pohutukawa forest; the short term aim is to establish a vegetation cover that is relatively resistant to fire.

- This area was burnt in 1997 and January 2003. Parts were planted in June 2003.
- Many of the plants that were burnt are resprouting, particularly near the margins of the fire scar. Wharariki is being planted adjacent to tracks, along with lesser amounts of taupata and ngaio. Other species suitable for planting are pohutukawa, karaka, karamu, houpara, akeake, koromiko, manuka, *Melicytus novae-zelandiae*, karo, and lesser amounts of ti kouka. Several of these species are suitable for planting in root trainers, which leads to cost savings in plant stock and planting cost - wharariki, karamu, koromiko, manuka, and ti kouka. It may be advisable to continue to use PB stock adjacent to tracks where the establishment of a dense fire resistant cover within as short a time as possible is desirable. A list of species and relative flammabilities is provided in Appendix 5.
- Maintain control of invasive pest plant species such as boneseed and pampas.

- Maintain permanent control of mustelids and cats and pulsed control of possums and rats.

Management Unit 6

Retain as grazed pasture in the short term, undertake further archaeological investigation and, subject to results from that investigation, either retain as pasture or plant with indigenous trees and shrubs.

- This area is currently grazed pasture, dominated by kikuyu.
- Consider planting this area in the future, particularly the steeper slopes, to re-establish indigenous vegetation. Prior archaeological research would be required in order to determine if this area contains buried archaeological features. If this area is part of the archaeological landscape it should remain in grazed pasture.
- The long term aim could be to re-establish tall forest, dominated by pohutukawa; the short term aim is to re-establish vegetation cover which is relatively fire resistant. Pohutukawa, taupata, koromiko, ngaio, karamu, wharariki, karo, and houpara should form the bulk of the plantings.
- Establish control of invasive pest plant species such as boneseed and pampas if grazing is removed.
- Remove rabbits and maintain permanent control of mustelids and cats.

Management Unit 7

Retain as grazed pasture. Improve management of pasture to increase productivity and to enable area to be effectively grazed by sheep. Long term aim is to develop pohutukawa forest, subject to the results of further archaeological investigation.

- Undertake or encourage archaeological research to determine if the area contains cultivated soils or buried archaeological features. This research will determine whether it is necessary to maintain this area in grazing.
- Establish scattered plantings of pohutukawa if this is determined to be appropriate following archaeological investigation.
- Remove rabbits.

Management Unit 8

Re-establish a corridor of pohutukawa linking up with existing forested remnants around the base of Mauao.

- This area currently comprises scattered pohutukawa over a lower cover comprising mainly exotic grasses.
- Establishment of a continuous strip of pohutukawa-dominant forest could be achieved in one of two ways - blanket planting the area with a mixture of pohutukawa (at 5-6 m spacings), ngaio, wharariki, and taupata, or to reduce cost, planting pohutukawa only at 5-6 m spacings.
- Permanent fence to exclude livestock.
- Establish a continuous or nearly continuous strip of pohutukawa forest adjacent to the track around the base of Mauao.
- This area contains some evidence of shell middens and is likely to contain buried archaeological features. Planting is required to stabilise the eroding escarpment. Planting will require prior consent from the Historic Places Trust.
- Maintain permanent control of mustelids and cats and pulsed control of possums and rats.

Management Unit 9

Exotic trees occur throughout this unit, interspersed with indigenous trees, and the aim is to re-establish pohutukawa-dominant forest.

- This unit comprises a mixture of exotic trees, karaka, and pohutukawa, which should be maintained.
- The long term aim for this area should be to fell and remove the exotic trees, and control pest plant species growing beneath the trees.
- Planted to re-establish tall forest of pohutukawa, karaka, and puriri. Plantings should include pohutukawa, karaka, akeke, houpara, ngaio, karo, tuapata, whaririki, koromiko, karamu, ti kouka, and *Melicytus novae-zelandiae*, with lesser amounts of whau. Puriri can be planted in sheltered areas.
- Planting in this area will require the prior consent of the Historic Places Trust as it is highly likely to contain buried archaeological features.
- Maintain permanent control of mustelids and cats and pulsed control of possums and rats.

14. WORK PLAN AND TIMELINE

All costs are indicative cost estimates only; GST exclusive; not inflation adjusted. It will be necessary to obtain quotes from potential suppliers for many of the tasks listed below. Until this is done it will not be possible to assign exact costs.

Key:

MU = Management Unit

Yes = Will be a cost but not able to be estimated without detailed site inspection or report.
 Year 1 = 1 July 2004 - 30 June 2004 (and so on).

Tasks	Notes	2004 Year 1	2005 Year 2	2006 Year 3	2007 Year 4	2008 Year 5	2009 Year 6	2010 Year 7	2011 Year 8	2012 Year 9	2013 Year 10	Total
Archaeology												
1	Archaeological inspection, to include: <ul style="list-style-type: none"> assessment of livestock management; MU2 - identify trees for removal; determine exact fence alignment; identify trees for removal on archaeological features with grazed sections of the reserve; identify tree saplings for trimming/removal from the area of the stone-faced landing platform associated with the iron jetty on the southern margin; assess whether cattle grazing/topping/mowing is appropriate on the eastern slopes. 											
2	Implement archaeological condition monitoring programme.											
3	Obtain archaeological advice prior to any management activities being undertaken in the reserve likely to cause ground disturbance, to ensure that archaeological features are not at risk (refer to Section 10.4, bullet point 20).											
4	Archaeological monitoring/advice related to the summit restoration and track work.											
5	Conservation treatment for stone steps and stone jetty.											
Planting^{1,2}												
6	Ecological advice <ul style="list-style-type: none"> Confirm Year 1 & 2 planting areas. Finalise plant schedules (include infill and blanking plants). 											
7	Order plants.											
8	Site preparation (generally only covers spot spray immediately prior to planting; other weed control/site preparation covered under weed control).											
9	Maintain 2002-2004 plantings - covered under existing contracts.											
10	Plants and delivery (as per Figure 9) ⁴ .											
11	Planting and plant layout.											
12	Materials (fertiliser and fences).											
13	Maintenance of Year 4 to 10 plantings (for three years)											

s 7(2)(b)(ii) - Commercial Position

1 Excludes cost of 2004 plantings; planting on Mauao should avoid the use of flammable species such as manuka.
 2 Two small planting jobs are costed in the landscape section.
 3 Covered under existing contracts.
 4 Based on 1.5 m spacings for PB stock and 1.2 m spacings for root trainer stock.
 5 Based on fences and planting

Section 14: Work Plan and Timeline

Tasks	Notes	2004 Year 1	2005 Year 2	2006 Year 3	2007 Year 4	2008 Year 5	2009 Year 6	2010 Year 7	2011 Year 8	2012 Year 9	2013 Year 10	Total
14	following planting). Small-scale plantings of nationally threatened and local plant species - plants and maintenance.											
15	Infill planting (site preparation, plants, and planting).											
Ecological Advice												
16	Obtain ecological advice re specific activities and review specific ecological restoration activities with an experienced restoration ecologist.											
Pest Animal Control												
17	Year round rabbit control.											
18	Exclude all dogs.											
19	Year round cat and mustelid control.											
20	Possum control (pulsed throughout the year) and year round rat control.											
21	Control of hedgehogs and mice ² .											
Indigenous Fauna												
22	Identify specific seal haul-out areas.											
23	Prevent human disturbance at seal haul-out areas.											
24	Undertake a lizard diversity and abundance survey.											
Fire												
25	Prepare a fire plan for the district (to include a specific action plan including fire control strategies for Mauao (see Section 10.6).											
26	Review fire plan annually.											
27	Establish a year round total fire ban (including cigarettes).											
28	Maintain year round total fire ban.											
29	Daily assessment of fire risk using established Rural Fire Authority standard FDR ratings.											
30	Establishment of a standard rural fire rating signs that show the level of daily fire risk: extreme, high, moderate, or low. <ul style="list-style-type: none"> • Organise; • Physical cost of signs and erection. 											
31	Radio and newspaper advertising of fire risk, to educate reserve users about fire prevention measures, fire risk, and public safety issues. Publicity should increase as the risk increases. <ul style="list-style-type: none"> • Prepare ads • Advertising costs 											
32	Visits to local schools, community groups (e.g. Lions, Rotary) and user groups (e.g. running clubs) to publicise the risk.											
33	Analyse the causes of previous fires (e.g. arson, camp fires) to help determine where prevention activities should be focused.											
34	Maintain a high level of fire suppression readiness.											

s 7(2)(b)(ii) - Commercial Position

1 Based on using cyanide in 'toggles' and on year round cat and mustelid control being undertaken.
 2 Note requirement for control of hedgehogs and mice will be assessed following the lizard survey (although hedgehogs will be partially controlled as part of the mustelid control operations).

Section 14: Work Plan and Timeline

Tasks	Notes	2004 Year 1	2005 Year 2	2006 Year 3	2007 Year 4	2008 Year 5	2009 Year 6	2010 Year 7	2011 Year 8	2012 Year 9	2013 Year 10	Total
35	Reduce levels of management activities and public access as the fire risk rises. (A total ban on public access should be considered during periods of extreme fire risk (this has been used in similar situations but should only be a last resort, in extreme situations.)	TCC to implement, in-house costs										
36	Regular (at least annual) training of TCC staff and volunteers in fire control strategies, undertaken to industry standards.	§ 7(2)(b)(ii) - Commercial Position										
37	Establishment of a network of observers and publicised fire reporting procedures. Observers can include residents with clear views of Mauao, boats, aero clubs, and regular users.	TCC to implement, in-house costs										
38	Close liaison with other fire management agencies, e.g. New Zealand Fire Service and the Department of Conservation. Joint training exercises should be undertaken on Mauao, to ensure that initial attack, in the event of a real fire, is both rapid and effective.	TCC to implement, in-house costs										
39	Establish ample water supplies for firefighting. (These supplies should be strategically placed to allow aerial access, ready vehicle access, and safety of fire fighting personnel. They should be established in clear open areas with vegetation of low flammability (e.g. kikuyu grass), on the lower slopes of the reserve.)	Currently subject to separate evaluation by Harrison-Grierson on behalf of TCC.										
Removal of Trees (N.B. Consents may be needed for some of these actions, e.g. any ground disturbance as a result of regular maintenance will require an authority from the Historic Places Trust)												
40	Remove selected trees identified in MU2 (see Task 1)	Costs cannot be estimated until scope of task identified (see Task 1 above).										
41	Remove saplings identified in MU2 (see Task 1).	Costs cannot be estimated until scope of task identified (see Task 1 above).										
42	Remove trees planted on archaeological features within grazed sections for the reserve.	A fixed price quote will need to be obtained for this work; cost will be affected by whether limbing or clean up is required and what issues are present re health and safety.										
43	Remove exotic trees in MU9.											
Weed Control												
44	Control and follow-up control of Class One and Two weed species, pampas, and tree of heaven. (See Section 10.7.)	§ 7(2)(b)(ii) - Commercial Position										
45	Control and follow-up control of <i>Pinus radiata</i> , <i>Pinus pinaster</i> , and climbing asparagus (includes 2 hours helicopter time)											
46	Targeted control of Japanese honeysuckle in planting areas (including proposed planting areas) and adjacent to tracks.											
47	Control of weeds in MU9 - climbing dock, ivy, taro, tradescantia, acanthus, fan palm, German ivy, nasturtium,											

1 Costs may be more if removal of debris is required.

Section 14: Work Plan and Timeline

Tasks	Notes	2004 Year 1	2005 Year 2	2006 Year 3	2007 Year 4	2008 Year 5	2009 Year 6	2010 Year 7	2011 Year 8	2012 Year 9	2013 Year 10	Total
48	Phoenix palm, sycamore, vine, primrose jasmine, teucrium.											
49	Remove silver poplar. Re-map pest plant distributions and assess priorities for future weed control operations, e.g. smilax, hawthorn, Japanese honeysuckle.											
50	Ongoing weed control in sites where pohuehue planted (see Figure 9).											
Consents												
51	Obtain consent from Historic Places Trust to plant pohutukawa in MU8.											
52	Obtain consent from Historic Places Trust to plant in MU9.											
Landscape												
53	Landscape brand development for Mauao.											
54	Entrance and carpark design (in conjunction with new brand).											
55	Entrance and carpark upgrade implementation.											
56	Rationalisation of lookout edges (as per Summit Landscape Concept: see Figure 5).											
57	Seating and tracks on summit (as per Summit Landscape Concept: see Figure 5).											
58	Planting around summit (seating, track rationalisation, summit margins) (including protection works for planting).											
59	Remove long drop toilet adjacent to stock yards.											
60	Remove five tub troughs and replace with dark coloured plastics.											
61	Establish screen planting (pohutukawa) adjacent to stock yards.											
Grazing/Stock Management (including fences)												
62	Removed selected fences.											
63	Erect fences1 (see Task 1) (refer to Section 10.4, bullet point 29).											
64	Archaeological supervision of fencing.											
65	Inspect fences to identify general maintenance requirements regularly as part of management, e.g. fortnightly and after storm events.											
66	Regular maintenance of fences.											
67	Implement rotational grazing programme (following completion of fences).											
68	Implement cattle grazing or topping or mowing on the eastern slopes as decided in Task 1.											
69	Damage to intact areas of pasture should be avoided, for example when replacing troughs or when temporary cattle grazing is being undertaken.											
70	Tracking around gateways can be avoided by moving stock regularly to new areas and only permitting stock to have access to one paddock at a time.											
71	Gates between paddocks should be closed when not in use											

1 Revision of the fences will require prior consent from the New Zealand Historic Places Trust (HPT) under the provisions of Section 11 of the Historic Places Act (1993) - refer to Appendix in Volume 2 for information relating to the required HPT authority process. All ground disturbance associated with the fencing programme will need to be subject to direct archaeological monitoring and supervision.

Section 14: Work Plan and Timeline

Tasks	Notes	2004 Year 1	2005 Year 2	2006 Year 3	2007 Year 4	2008 Year 5	2009 Year 6	2010 Year 7	2011 Year 8	2012 Year 9	2013 Year 10	Total
72	for stock movement. Monitoring of revised livestock management regime will be required in order to assess its effectiveness.			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Information Management												
73	Establish document bank (refer to Section 10.4, bullet point 34) to help combat the loss of information associated with the history and management of Mauao. This could also provide a repository for all written information accumulated associated with any management action within the reserve.	Yes										
Visitor/People Management												
74	Undertake monitoring and visitor surveys to determine <ul style="list-style-type: none"> • visitor activities; • seasonal patterns of use; • more precise visitor levels; • assess why people are visiting the reserve - is it for the outdoor experience, physical exercise, views obtained from the site, archaeological features, or perhaps a combination of these experiences. 											
75	Develop visitor management programme based on above surveys.											
76	Implement above.											
77	Interpretation panels and pamphlets (update pamphlets regularly)											
Monitoring												
Archaeology												
78	Prepare an archaeological condition monitoring programme (refer to Section 11.1).											
79	Archaeological inspections every three years (to include inspection of MU2 to identify saplings for removal (refer 10.4, bullet points 6, 10, 11, 12); and to include assessment of livestock management regime).											
Fauna (exotic and indigenous)												
80	Annual possum monitoring.											
81	Rat monitoring.											
82	Mustelid and cat monitoring.											
83	Seabird monitoring.											
84	Fur seal monitoring.											
85	Lizard monitoring.											
86	Establish database to record threatened fauna species visiting the reserve.											
87	Maintain database.											
88	Annual reporting on pest animal control											
Vegetation												
89	Establish and measure permanent photopoints (c.30) (refer to Section 11.2).											
90	Permanent vegetation plots.											
91	FBI points/plots.											
92	Monitor plantings (to determine survival of different species and relative growth rates and threatened plantings).											

Section 14: Work Plan and Timeline

Tasks	Notes	2004 Year 1	2005 Year 2	2006 Year 3	2007 Year 4	2008 Year 5	2009 Year 6	2010 Year 7	2011 Year 8	2012 Year 9	2013 Year 10	Total
Research												
93	Undertake or encourage archaeological research to determine if the area contains cultivated soils or buried archaeological features. (This research will determine whether it is necessary to maintain this area of grazing or whether parts or all can be planted.)	§ 7(2)(b)(ii) - Commercial Position										
94	Archival and archaeological research (to determine the nature and origin of the archaeological features associated with the stone steps).	§ 7(2)(b)(ii) - Commercial Position										
95	Conservation advice and assessment of the stone steps and stone jetty in order to determine what conservation treatment is required and/or appropriate. (Refer to Section 12, bullet point 3.)	§ 7(2)(b)(ii) - Commercial Position										
Roads, Tracks, Water Run-off, Vehicle Access												
96	Review water run-off management from summit access road, reservoir, and all other tracks (refer to Section 10.4, bullet points 21, 22, 23) and assess maintenance of vehicle access to the summit in relation to its impacts on archaeological features. (Run-off from the road and the subsequent translocation of archaeological material is currently a significant issue. Options may include establishment of a berm to divert water off the road into areas where archaeological features are absent, and/or the downscaling of the road above the reservoir to a quad motorcycle access track. It is recommended that the vehicle access track on the summit of Mauao is either closed or scaled down to a quad motorcycle track. This would still allow vehicle access to the summit for emergency vehicles and ceremonies of national significance (as provided for in the 1998 Management Plan), but assist in eliminating damage to archaeological features, particularly on the summit.	§ 7(2)(b)(ii) - Commercial Position										
97	Divert water off tracks at regular intervals. (The existing culvert spacing on the 4WD access track is adequate, but intervention is necessary to reduce the velocity of the water when it exists the culverts. This run-off is currently causing localised channelling and erosion of archaeological features. Reduction of the velocity of the run-off would ensure that water is dissipated over the ground surface, thus preventing channelling. This could be achieved by placing rocks or geotextile near the culvert exits. The results of such intervention would need to be monitored closely, to ensure that scouring does not occur around any new velocity 'barrier'. (Refer to 10.4, bullet point 22.)	Year 1 - For barriers at culvert exits. Year 2 - Provides for berm option.										
98	Ensure the use of machinery during maintenance of the 4WD access track is closely supervised. (If any ground disturbance is likely to occur in any area that is not already clearly part of the established 4WD track - for example, the establishment of additional culverts - the proposed work should be discussed with the NZ Historic Places Trust in order to determine if an Authority to Modify is required.)	TCC to implement, in-house costs										
99	Implement recommendations made in water run-off and vehicle access report (see Task 102 above).	To be costed following preparation of plan.										

Section 14: Work Plan and Timeline

Tasks	Notes	2004 Year 1	2005 Year 2	2006 Year 3	2007 Year 4	2008 Year 5	2009 Year 6	2010 Year 7	2011 Year 8	2012 Year 9	2013 Year 10	Total
100	Inspect tracks to identify general maintenance requirements regularly as part of management, e.g. fortnightly and after storm events.	s 7(2)(b)(ii) - Commercial Position										
101	Inspect water run-off systems to identify general maintenance requirements regularly as part of management, e.g. fortnightly and after storm events.											
102	Track maintenance - transfer to crushed rhyolite surfacing - ongoing (ensure that shell aggregate is not used).											
103	Regular maintenance of track formation and water run-offs.											
104	Track definition - ongoing.											
105	Rationalisation of pedestrian tracks on summit (as per Landscape Concept Figure 5).											
106	Complete circuit track (see Figure 4) (including boardwalking).											
107	Flume overflow from reservoir.											
108	Track upgrades (a) Oruahine (b) Waikorere (c) Stone Steps/Steep Track											
Public Use												
109	Encourage tangata whenua to provide guided walks for large groups.			Yes								
110	Promote the use of the reserve for open air gatherings, ceremonies or similar activities (any such activities would need to be discussed with tangata whenua as part of the decision making process to ensure that such events are appropriate for the setting. Provision must be made for the protection of archaeological features - particularly when these events occur on the summit of Mauao).			Yes								
Management Plan												
111	Review conservation plan.											
TOTALS												

15. IMPLEMENTATION AND REVIEW OF CONSERVATION PLAN

Ongoing consultation with all relevant parties will continue as this plan is implemented.

Any management proposals not currently within the scope of this plan will require a change to the plan before the proposals proceed. Changes in management or standards should be discussed and agreed, in writing, by Tauranga City Council, NZ Historic Places Trust, and tangata whenua.

This plan should be reviewed every 10 years, or more frequently (say, every five years) if required. Authorities to modify archaeological sites if granted by the Historic Places Trust are valid for a period of five years. Five year review of the conservation plan would ensure that any authorities required could be revised and renewed if necessary.

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