Queen Elizabeth Park

Rehabilitation of Native Forest Remnant

December 2001

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Prepared for
Wellington Regional Council

by

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1.0 Purpose

The preparation of a long-term rehabilitation plan for the native forest remnant in Queen Elizabeth Park provides the opportunity to draw together relevant information on the site and to set out a course of action that can be used to assist the Wellington Regional Council (WRC) in its annual planning process. It will also assist interest groups and individuals with programming their input and resources. Most importantly it assists in providing a level of continuity over an extended period where changes in staff involved in the management of the Park are inevitable.

Recording the planting and maintenance work that is completed each year and monitoring the success of plant establishment and growth is an important part of the process because over time, a body of information will be built up which can be used for future revegetation work on the site, in other parts of the Park and for similar sites.

2.0 Background

The 1.2 hectare kahikatea dune swamp forest remnant located in the consolidated sand dunes south of MacKays Road is one of the last remnants of its type known to exist south of Levin (see Figure 1 and Photograph 1).

In June 1990 the Wellington Regional Council took over the administration of Queen Elizabeth Park from the former Queen Elizabeth Park Board. WRC and other organisations associated with the Park regard the protection and rehabilitation of the forest remnant as essential. The Queen Elizabeth Park Management Plan includes policies aimed at achieving this.

Located on Foxton Sand substrate, this forest type was once relatively common in the coastal dunelands of Horowhenua but all that remains are small, scattered remnants. Not only were the consolidated dunelands easy to clear and bring into farm production in the early years of settlement but subsequently they were easy to convert to residential subdivision as has occurred (and continues to occur) along the Kapiti Coast.

Unfortunately the forest remnant has been under considerable pressure over a long period – from drainage for agricultural development, stock grazing by sheep and cattle, as a training area during occupation by the American forces during WW II[1] and also when it was used as part of a cross-country equestrian course

From a distance the remnant appears to be dense and luxuriant largely because of the closed edge that has been created by dense planting and natural regeneration but it is relatively open underneath.

[1] *. There is evidence of 'foxholes' dug as part of training exercises by American Forces stationed in the area during World War II.*

The Park is very exposed to north-westerly winds and the wind-shorn canopy of the remnant is testament to this. Tall macrocarpas planted on the north-western boundary of the 'core' remnant has provided valuable wind shelter. Several macrocarpa were removed by WRC in 1999 and revegetation work was carried out in the cleared area. Fencing of the remnant in 1991 has allowed stock and horses to be excluded and important revegetation work to be carried out.

In the Management Plan prepared by WRC in 1993[2] the remnant is described as Area 7 and several policies refer specifically to it including:

- the establishment of shelter plantings on the north-western boundary;
- active selective weed control to assist regeneration of native vegetation;
- construction and maintenance of permanent fences;
- all new plantings to use native species specific to the local habitat; and
- limiting recreational use to environmental interpretation and study.

The Management Plan includes a plant species list that was prepared in 1981. This list was subsequently revised in 1987 and again in 2000[3]. The most recent species list is included in Appendix 1.

Section 3.0 provides from records compiled over a 10 year period, an overview and Appendix 2 a tabular summary describing the revegetation work that has been carried out by the Kapiti Environment Action (KEA) and the Kapiti branch of Forest and Bird, including comments on its success.

3.0 Site Description

The remnant does not occupy the entire 1.2 hectare fenced area, only the eastern 'half'. The 'core' of the remnant is located in an inter-dunal flat area with dunes on both the eastern and western edges.

There are Maori occupation sites through the forest area (middens) and there is a large pa site to the north of the remnant between the trees and the wetland.[4]

The 'core' comprises tall emergent canopy trees (kahikatea, matai, tawa, kohekohe), a partly developed sub-canopy and many small canopy tree and other native seedlings. Woody vegetation in the rest of the fenced area comprises macrocarpas, eucalypts, tree lucerne, kanuka and seedlings of various native species planted as part of the revegetation work. This mixed vegetation on the northern and eastern parts of the site is not continuous and in places is very open with large patches of rank grass present. This vegetation does however, provide an important buffer to the core remnant.

[2] Page 33, Queen Elizabeth Park Management Plan, Part 2: Resource Statement, Wellington Regional Council, 1993
[3] Botanist Colin Ogle compiled both the 1981 and 1987 species lists. The Wellington Botanical Society compiled the 2000 list.
[4] Comm. Susan Forbes, August 2001

The remnant comprises the following:

- A 'core' with tall emergent tree species and a partly-developed canopy, and young seedlings;
- Stand of macrocarpas;
- Stand of eucalypts
- Kanuka and area of bracken, rank grass and pest plants in the southern part of the site;
- Tree Lucerne and Tasmanian ngaio planted as edge shelter;
- Dense stand of young kanuka towards the southern boundary, most of which was planted in 1994;
- Plantings of native seedlings.

Figure 2 provides a diagrammatic outline of the composition of the remnant and Photographs 1-12 illustrate aspects of the vegetation cover.

The remnant is an island with a large area of 'edge'[5] in proportion to its overall size. This 'edge effect' makes the remnant vulnerable in terms of isolation, wind exposure, light, suitability as bird habitat, and ease of access. Pest plant species, many of which are light-demanding, readily establish on the edge of stands of remnant vegetation. The edge effect can seriously threaten the health and viability of a stand such as this.

Fencing has created a sizeable buffer area around the core remnant and planting of tree lucerne, Tasmanian ngaio, as well as various native species along the eastern boundary, has effectively sealed this edge. Originally the fenceline was much closer to the macrocarpas; old fence posts mark its position. The tree lucerne which is relatively short-lived, has started to open up with several tall plants dead and dying primarily because they have been over-topped by other species (Photograph 8).

Recent plantings of native seedlings along the northern boundary are starting to provide similar protection at a low level and in time the effectiveness of this vegetation will increase. The kanuka, planted at close spacings in 1994 in the southern part of the site provides dense cover that has helped to suppress grass and pest plants as well as create a closed edge on the south-west of the remnant core (Photograph 9). The stand of eucalypts growing on the dune face on the north-western boundary and the stand of macrocarpas have also provided valuable wind protection.

The soil under the macrocarpas is quite depleted with few seedlings present or even grass. Apart from ngaio, other seedlings planted in the area influenced by the macrocarpa have been suppressed.

[5] Edge: the outer band of a patch of vegetation that has an environment significantly different from the interior of the patch.

Removal of domestic stock and horses, fencing and subsequent planting has enabled the small remnant to start to recover. However, comparing the results of 1981 and 2000 vegetation surveys it appears that parts of the site would have been much wetter in 1981 and a lot of the species not seen in the 2000 survey are plants of wet areas that have either disappeared altogether or been much reduced in occurrence. Natural regeneration is occurring but slowly.[6]

The proposed restoration of the adjacent wetland and the other proposed site rehabilitation works may result in partial reinstatement of the water table that would benefit the remnant.

A number of pest plant species are present within the fenced area with blackberry and inkweed being particularly aggressive and vigorously competing with both regenerating native species and the planted native seedlings. There are also patches of gorse and arum lily that need to be carefully monitored and controlled. (Appendix 1 has a full list of grasses, adventive and pest plants).

4.0 Overview of Revegetation Work Completed

Both KEA and Forest and Bird have completed on behalf of WRC, a lot of revegetation work in the remnant over an extended period. This has included removal and control of pest plants, seed and seedling collection for growing on, planting, and follow up maintenance work. Just as important has been the regular monitoring of the remnant, liaison with WRC and other agencies who have been involved in the management of the remnant, and constant lobbying to secure funds and other resources for the protection and enhancement work.

WRC has also carried out various fencing, revegetation and pest plant control work on its own accord.

KEA have maintained a diary of both the work that its members and those from Forest and Bird carried out between July 1991 and June 1999[7]. These diary notes providing a summary of key events and actions are reproduced in table form in Appendix 2. Records such as this are invaluable.

Planting commenced on the site prior to KEA starting a written diary record in 1991. There is evidence of plantings being carried out in 1989 and it appears that other plantings could have been made earlier than this. The value of the remnant has long been recognised and botanist Colin Ogle's detailed investigation and preparation of a species list in 1981 is testament to this.

Plantings in which KEA and Forest and Bird played a significant role have occurred on five occasions during the past decade, in 1990, 1991, 1994, 2000 and 2001.

[6] Comments included with the List of Vascular Plants in Fenced Bush Area Queen Elizabeth Park, prepared by Wellington Botanical society, September 2000

[7] Diary excerpts, Native Forest Remnant, Queen Elizabeth Park, Paekakariki, July 1991 – June 1999, June Rowland, Kapiti Environment Association. A full summary is included in Appendix 2.

The survey completed by the Wellington Botanical Society in 2000 records, in general terms, the establishment and growth of these plantings. From recent observations carried out as part of the preparation of this document, it would appear that plant establishment and growth has generally been good and the planting conditions have played a significant role in this success (ie good substrate, ease of planting, good shelter and shade, etc).

However, in the early stages many of the plantings did not get off to a good start because of browsing and trampling by cattle which were able to gain access through a broken fence, inadequate site preparation, especially in respect of removal of blackberry and at times inadequate follow up maintenance work by agencies responsible for management of the remnant.

WRC carried out plantings in the remnant in 1999, 2000 and 2001. In 2000 planting was also completed on the secondary dune faces between the remnant and the wetland. Unfortunately drought conditions over the past two years have resulted in heavier than expected plant losses, except for most of the kanuka on the dune faces.

Plantings completed during the past decade comprised:

1990	252 flax 97 titoki (all titoki were lost when cattle broke through the fence and trampled them, many flax were trampled also and never recovered and taupata were browsed by cattle) karaka (unspecified number)
1991	Extensive shelter planting –7-8 rows of tree lucerne (approximately 1500 plants) planted along north fence; 6 rows along east and south-east fence and similarly along the top of north-west fence.
1994	3000 seedlings planted by Conservation Corps with KEA and Forest and Bird assistance (mahoe, kawakawa, kohuhu, manuka, cabbage tree, *Coprosma* spp.) 500 large kanuka
1999	215 plants (150 kahikatea, 70 kohekohe, 50 karaka, 10 tawa, 30 titoki, 30 hinau, 30 pukatea, 40 taupata, 30 cabbage trees, 35 mahoe)
2000	700 plants (100 kohekohe, 100 titoki, 200 karaka, 200 cabbage tree, 100 mahoe)

In addition, there has been considerable effort in monitoring these plantings and removing competing vegetation (ie. releasing). Appendix 2 notes this work. Photograph 10 shows recent planting and Photograph 11 natural regeneration in the remnant 'core'.

Over the past few years WRC has regularly monitored the presence of pest plants throughout the Park and in the forest remnant specifically[8]. At various times, spraying of pest plants in the remnant has been carried out, particularly blackberry. Since focussed protection and revegetation work has commenced in the remnant it is blackberry that has been has been the main problem with large patches present in several areas. However, the presence of other species such as inkweed, ragwort, gorse, fleabane, nightshade, lupin and thistles have been recorded with a view that control and eventual eradication of these species needs to be achieved.

5.0 Indicators of Remnant Health

It is often easy to see when a remnant area of forest is in very poor health or in major decline. However, by then the remnant could have reached an irreversible level of decline where its long-term viability cannot be assured. Generally , it is not as easy to see the early and often less obvious signs of decline. For example, the canopy from outside the stand may look luxuriant but on close inspection this may be caused by prolific growth of a native or exotic creeper, or a dense understorey layer of vegetation may contain only unpalatable native species with the palatable ones already having been eaten by possums.

Knowing what is in a remnant, its ecological value and an understanding of its ecology provides a good staring point and provides a baseline for later monitoring. The three species surveys that have been prepared since 1981 provide a good basis for monitoring regeneration and plant survival and growth along with the recently instituted WRC monitoring of pest plants.

A summary of key management issues to take into account and their implications are outlined below:

5.1 Wind

Small remnants, particularly those with a high ratio of 'edge', are vulnerable to damage from wind. Certain tree species are more vulnerable to wind damage than others. Wind not only damages the canopy but it also dries out the interior of the stand, reduces the temperature and together these factors inhibit natural regeneration. An open, exposed forest edge is also the common entry point for pest plants.

One of the most fundamental steps in the rehabilitation of forest remnants is to seal off the forest edge. Where a stand is fenced to prevent access from domestic stock or indiscriminate tracking by pedestrians, a 'closed edge' of hardy tree and shrub species generally colonises the edge and develops

[8] A copy of the WRC Pest Plant Infestation Record is included in Appendix 3.

and expands naturally over time. However, to accelerate this process fast growing local shrub species can be planted to create a suitable 'closed edge'.

The macrocarpas would have provided important protection from north-westerly winds and the subsequent planting of tree lucerne, Tasmanian ngaio and kanuka have also provided a much needed closed edge to the stand. However, care has to be taken when exotic species (such as tree lucerne and Tasmanian ngaio) or non-local native species are used as a nurse crop or edge shelter option because these species affect the botanical integrity of the remnant.

5.2 Pest Plants

The composition and ecological value and health of a remnant is compromised and threatened by the establishment and invasion of noxious plants and /or garden plants from adjacent farmland or nearby properties (these are generally referred to as pest plants). In addition, native plants that are not locally occurring that become established often become aggressive competitors, suppressing existing species and compromising the ecological integrity of the remnant.

Often a stand may look healthy and intact when viewed from the outside but on close inspection many exotic and /or pest species may be present. Once established, these unwanted plants are difficult to completely remove or even control. The eradication and control of pest plants can take an enormous amount of resources and effort, so the key is to prevent them from becoming established.

Unfortunately, several pest plant species are well established and they have competed with both the regenerating native vegetation and also with the new plantings.

5.3 Noxious Animals

Possums generally pose the greatest noxious animal threat to forest remnants in farmland. They are virtually impossible to eradicate because as soon as numbers are decreased by poisoning and trapping, the population is boosted by other possums moving in from adjacent areas. Control is certainly possible but it requires a systematic and ongoing approach and also allocation of sufficient resources.

Possums, along with other noxious animals such as rats, rabbits and hares can affect the health and viability of established trees and shrubs primarily through browsing, but they can also have a dramatic effect on regeneration. Rats eat seed on the forest floor as well as a wide range of native fruits and other plant material and they also eat eggs and young birds. Consequently, they impact on regeneration of native plants and on birds as do stoats,

ferrets, and weasels. Along with the control of pest plants, the control of noxious animals, particularly possums, consumes the most management time and resources.

5.4 Domestic Stock and Pets

Legal protection of remnants is of little value unless there is also physical protection. Cattle and sheep can cause major damage in a very short time. Even one or two stock can cause considerable and widespread damage, particularly cattle, where browsing and trampling have a combined impact.

A permanent fence around a remnant should be a standard measure regardless, because it not only protects it against access by stock but it helps deter public access prevent indiscriminate tracking. Lack of suitable fences and damaged fences have been a major issue at Queen Elizabeth Park and the length of time it took resolve this issue had a significant effect on regeneration and plant survival and growth.

Control of pets, particularly cats, poses more of a problem. Their impact is not so much directly on the vegetation but on the bird population; even the presence of a few cats can have a dramatic effect on bird numbers.

5.5 Fire

Fire is always a risk to remnants, particularly in areas where public have access. In addition, there are often areas of fire-prone vegetation around the edge of a remnant such as gorse, broom, manuka, kanuka which makes a remnant particularly vulnerable.

Well grazed pasture around the edge of a remnant functions well as a fire break.

5.6 Tracks

A defined track system is an ideal way to control pedestrian access and circulation through a remnant and to minimise damage to vegetation. However, too many, or poorly sited tracks can result in considerable damage. The tracks have to follow logical and accessible routes otherwise they will not be used and instead new informal tracks will be created by pedestrians through repeated use.

Tracks should be kept to a minimum and sited through areas of vegetation where they will have the least impact. Tracks should be easy to locate, have an easy gradient and the route clearly marked. Signs should provide clear instructions about the need to remain on tracks and not to depart from them because of the potential damage to vegetation.

High numbers of pedestrians through a remnant, can, over time, have both direct and indirect impacts. There are the direct impacts of trampling on

seedlings and small herbaceous species but there are also the indirect or latent impacts where trampling compacts soil around the base of trees. Carefully sited tracks can avoid such impacts but nevertheless the potential impact of access needs to be monitored.

5.7 Vandalism

There is always the likelihood of some vandalism in sites where there is ready public access. Regardless of whether it is vandalism caused by indiscriminate breaking of vegetation alongside tracks, removal of seedlings and /or humus, removal of timber for firewood, or wanton vandalism involving tree felling, defacing signs, breaking fences, lighting fires, etc they all impact on a remnant's viability and ecological value.

Some people do not regard removing seedlings, collecting seeds and cuttings, or collecting fallen branches for firewood as vandalism. All such actions affect the ecological processes naturally operating in a remnant such as this.

6.0 Specific Management Actions

Whilst the legal future of the remnant is secure, its long-term health and viability is not. It will require careful ongoing management in accordance with a clear set of principles, a list of annual management actions and annual budget allocation and careful monitoring. Its ecological and landscape values are too important to ignore and with the realignment of SH 1 and the revised entrance to the Park, the visual prominence and landscape value of this remnant will increase.

Preparation of this rehabilitation plan is to help overcome the ad hoc approach to management of the past and to avoid unfortunate events through lack of timely actions and initiatives.

WRC initiated the preparation of this document to provide long-term management guidance and direction and to provide continuity through inevitable changes in WRC staff and also in the personnel changes that will inevitably occur amongst the organisations involved in the management of the remnant. WRC value the involvement and assistance these organisations provide but acknowledge that it is WRC's responsibility to provide overall direction and management on a sustained basis.

Specific management actions are set out below under a series of headings

- Pest plant removal and control
- Noxious animal control
- Vegetation removal
- Revegetation
- Tracks, fencing and signs
- Maintenance programme
- Monitoring

6.1 Pest Plant Removal and Control

There are several pest plant species in the remnant. Currently the extent of pest plants is relatively localised and control is achievable with a sustained effort over 2-3 years. The current WRC pest plant monitoring and control programme should continue with the aim of eradicating the existing areas of pest plants in association with revegetation of the cleared areas and annual follow up to monitor results and to control any new areas of pest plant establishment.

It is important that the current WRC Pest Plant Infestation Forms are completed regularly and filed to ensure that a comprehensive record is built up. As a start it would be valuable to first determine the type and extent of pest plants present and then prepare an annual programme and budget to deal with them. Specific species should be targeted. From observations, control and eventual eradication of blackberry would appear to be a priority species with arum lily and gorse also requiring early attention.

Removal and control of pest plants goes hand in hand with revegetation as there is little point in carrying out extensive removal of areas of pest plants if these areas are then left to their own devices. If there is sufficient seed source, local native species may germinate in these 'bare niches' but more often it will simply be more pest plants emanating from seed in the soil or originating from the adjacent farmland.

Some pest and unwanted plants are easier to remove and contain than others. They can be 'spot removed' or removed systematically by an intensive effort over a few years. How this is tackled will be influenced by the inventory on distribution and extent of pest and the resources available for an ongoing programme to be established. There is no point starting a programme of eradication and control that cannot be followed through. If resources are unable to be allocated to tackle the issue comprehensively and systematically, then the spread and species composition of noxious or pest plants should at least be monitored annually.

As part of monitoring, specific attention should be given to the spread of macrocarpa, tree lucerne and Tasmanian ngaio. These species have served as useful wind protection but they need to be phased out and local native shrub and canopy species encouraged. All three species have wide site tolerances, their seeds germinate readily and they are quick growing. Small seedlings of these three species are easy to remove by hand but once established their removal is much more difficult.

Actions

- Prepare inventory on distribution and extent of pest plants.
- Prepare programme for pest plant removal and control.
- Establish a three year budget and annual allocation of resources.

- Annual monitoring of success of programme and / or spread of existing populations of pest plants.
- Immediate removal of the few remaining Tasmanian ngaio.
- Specific attention to the removal of macrocarpa and tree lucerne seedlings.
- Education programme on the potential damage noxious plants cause and the problem of garden escapes (through KEA, Forest and Bird, brochures and publicity about the Park local schools, etc).

6.2 Noxious Animal Control

Eradication and control of noxious animals is a key factor in maintaining the health of the remnant and it also directly influences the success of any planting that is done. WRC has a comprehensive region-wide programme of noxious animal control against which priorities and resources are allocated annually. This remnant needs to be included in the programme and budgeted for annually. There is also room for some community input under the direction and control of WRC.

A log of the noxious animal control operation should be kept; recording the actions taken and the numbers of animals killed, etc. Not only will it provide an important ongoing record but it will help raise community awareness of the importance of the remnant and the numbers of possums that are harboured in such areas.

Actions

- Prepare a long-term noxious animal control programme and budget.
- Consult with community on the programme and their possible contribution.
- Set up a log for the noxious animal control operation with the QE Park Ranger who would be responsible for maintaining it.

6.3 Vegetation Removal

Apart from the removal of pest and other unwanted plants and the possibility of removing a limited number of seedlings in selected areas for replanting in other parts of the remnant, there is no need to remove any other vegetation at this stage. The process of tall trees and other vegetation deteriorating, dying and then falling and decaying on the forest floor should be allowed to occur as a part of normal ecological processes. There is no need to remove damaged trees, prune broken branches or tidy up the forest floor; remnants are not ornamental parks or areas that have been planted up for community recreation and use.

Instead there is a need for education and raising an overall awareness of these natural processes and simply allowing them to occur unimpeded.

These processes should be incorporated in the overall interpretation of the Park.

The future of the macrocarpas and to a lesser degree the stand of approximately 12 eucalypts growing on the dune face along the north-western boundary however, require particular attention. Some of the tall macrocarpa that provided valuable wind shelter were removed in 1999 and this has opened up the remnant. Plantings and natural regeneration have gone some way in 'sealing' the forest edge in this area but the full effects of this are still some way off.

Options for dealing with the remainder of these trees are as follows:

1. Leave the remaining macrocarpas and concentrate on restoring other parts of the remnant while at the same time establishing a fast-growing shelter / buffer crop of local native species on the northern boundary outside the existing fenceline. A wind cloth fence would assist this buffer planting to get established.

   Once this vegetation is of sufficient size the macrocarpas would be removed and the cleared area revegetated. This option would be implemented over 5-7 years. Plant numbers of 1500 –2000 would be required for this option, planted in three offset rows and the fenceline shifted to provide protection from stock

2. Progressively remove the macrocarpas (say half of the remaining trees at 2-3 year intervals) and replant the cleared area with local native species. A careful tree felling and extraction plan would be required to minimise damage to the existing regenerating and planted native vegetation. Felling and extraction would start with the trees growing on the inner side (ie against the remnant) and work towards the outer edge. This would ensure that the macrocarpas on the outer edge would continue to provide protection and allow time for a dense buffer of shrubs and trees to become established that would eventually provide wind protection and shade.

3. A combination of parts of the two options is possibly the best way to proceed. That is, initially planting a dense buffer of vegetation along the northern boundary just outside the existing fence as in Option 1 and also gradually removing the macrocarpas from the inner edge and replanting. As with Option 2, extraction of the macrocarpas would have to be considered at the outset and then carefully executed.

Figures 3 illustrates this recommended option.

The stand of eucalypts along the north-western boundary are less of an issue; these trees need not be removed until very late in the rehabilitation programme. By then both revegetation and natural regeneration would have completely sealed the edges of the remnant. The eucalypts could be removed together or in stages and the area replanted (Photograph 12).

Actions

- Monitor vegetation disturbance and removal.
- Promote the importance of ***not*** removing dead and dying trees, pruning limbs, etc.
- Include the dynamics of ecological processes as part of park interpretation.
- Adopt Option 3 for removal of the remaining macrocarpas and replanting and ensure a budget and resources are put in place to complete implementation.

6.4 Revegetation

When pest and unwanted plants are removed, the area in which they were growing needs to be replanted otherwise these areas are readily re-colonised by similar unwanted and pest plants. A programme of sustained planting is required to capitalise on the well-advanced natural regeneration that is occurring on many parts of the site and the planting already completed.

Any planting has to be well planned and well resourced. The remnants have an ecological integrity that should not be compromised and most of the recent plantings have adhered to the principles of planting only native plants raised from local plant populations (eco-sourcing).[9] This involves collecting seeds from plants growing in the remnant or that have been sourced from the ecological district, propagating them, and then planting them in the remnant as part of an ongoing programme.

In some situations very small seedlings (10-15 cm size range), could be carefully removed from one part of the remnant, grown on in a nursery area outside the forest, and then planted in specific areas. However, plants taken out of the bush are generally very tender with weak root systems and liable to sun scorch having developed under sheltered conditions with low light intensities. Consequently, they have to be handled carefully and nurtured before they are planted back into the remnant. Wild plants planted out directly from the forest are no substitute for well-conditioned nursery grown plants.

[9] This is explicitly stated in the Management Plan.

The selection of species planted is also important. Some species grow under high light conditions (light demanding species) whilst others thrive in the shade under the forest canopy (shade tolerant species) and selection of planting sites must recognise this.

Planting is best staged over several years not just because of cost but also because it helps to spread risk and make after-care manageable. Planting huge areas with thousands of plants in one year because funds and resources are available is generally unwise. Not only does adequate labour and resources have to be available to 'release' the new plantings from competing vegetation to ensure their survival and growth, but if there is a particularly harsh season (such as the recent summer droughts) then most if not all of the plantings can be wiped out. Spreading the risk over several years is the safest option and in doing this and regularly monitoring plant survival and growth helps with planning and implementing future revegetation works (ie what species do best, most suitable time of the year to plant, etc).

Planting and other work at the remnant has drawn excellent support from KEA, Forest and Bird and other groups. Continued support and involvement from these groups should be a key aim of the rehabilitation programme. However, this involvement cannot simply be left to happen; it has to be planned and adequately resourced. Between the WRC's recently appointed Volunteers Co-ordinator and the resident QE Park Ranger, co-ordination of ongoing community involvement should be readily achievable.

However, if community labour is used for planting then this should be supervised to ensure the plants are planted correctly thus giving them a high chance of survival. Many revegetation projects fail because of poor planting techniques carried out by inexperienced people.

If left to nature and attention paid only to removal and control of pest plants, and noxious animal control, fencing, etc, then, in time the remnant would slowly 'heal' and return to a level of equilibrium. Its species composition and distribution however may not be the same because of the environmental changes that have already occurred (eg lowered water table, exposure, wind, etc).

Unfortunately, in this instance given the level of degradation that has already occurred, relying solely on natural processes is not sufficient. The natural processes need to be accelerated by intervention such as planting. Planting should concentrate on a few key areas, around the edges to provide a buffer to protect the interior from wind damage and drying out, and in the canopy gaps. Planting around the edge and in open grassed areas should initially use a limited range of fast growing species drawn from the following list:

cabbage tree
kanuka
karamu
kawakawa
kanuka
mahoe
mapou
ngaio
poroporo
ramarama

This planting should adhere to the method used previously - planting small grade well-hardened plants at close spacings on the most favourable sites (ie microsites). While it will depend on the species being planted, spacings generally should be no greater than at 1.0 metre centres. Follow up maintenance during the first three years is essential.

For planting inside the remnant where there is less exposure and the environmental conditions are more favourable there is opportunity to plant a greater range of species including many of the canopy species such as kahikatea, matai, kohekohe, titoki, tawa, hinau, rewarewa, pukatea.

The key to planting success is to ensure that:

- Any plants used are sourced from the remnant itself or from within the Foxton Ecological District;
- Plants are acclimatised to the site conditions, particularly if they have been raised in a shade house or similar sheltered environment;
- The best sites should be selected as a priority for planting (ie those with the best environmental conditions or 'microsites'); and
- There is follow up aftercare such as releasing, to ensure a high survival rate.

The planting of 500 kanuka at close centres in 1994 has been very effective in suppressing areas of dense blackberry and other pest plants and also in providing a sealed edge to the remnant. A similar planting regime should be implemented elsewhere, especially in the southern more open parts of the site.

Over the next five years the aim should be to plant at least 1000 plants a year with species selected based on the areas are being planted. Each year both fast-growing colonising / shelter type species and also canopy tree species should be planted; the actual proportion of each would depend on what area is selected.

Setting up plant propagation and supply contracts with reputable growers is generally the most cost effective method, particularly if it can be programmed on a three year rolling cycle rather than on just an annual basis.

The draft Queen Elizabeth Park Restoration Concept recently prepared for the MacKays Crossing Entry and Wetland, proposes long-term, that the existing remnant would be extended beyond the existing fenced area, both northwards and to the south. This extension, in association with the new Park entry off SH 1 and the restoration and extension of the wetlands, is logical. However, as far as the existing remnant is concerned, it is important that its rehabilitation remains the sole focus over the next 5-10 years before the remnant area is extended.

Actions

- Adopt an ongoing revegetation plan and ensure that it is adequately resourced.
- Specifically Identify areas to be planted and establish plant species and numbers on a rolling three year cycle.
- Set up plant supply contracts with reputable growers.
- Consult with community and gauge level of ongoing support for implementation of planting.
- Prepare planting maintenance plan and ensure adequate and timely resources are available.
- Monitor plant survival and growth.

6.5 Tracks, Fencing and Signs

The boundaries of the remnant should be kept securely fenced as a priority, regardless of whether there is stock in adjacent paddocks. Given the sensitive nature of the site and that revegetation work that will continue for some time public access into the remnant should be restricted in the short term.

In time this could be reviewed and limited access provided. If and when this occurs not only does the vegetation have to be protected from damage but also the existing archaeological sites. Only a single or very limited number of access points should be provided and these should be clearly identified and any tracks clearly marked. Access should be via stiles or similar rather than gates which are easily left open and which also allow easy access for horses and trail bikes.

Tracks in effect create new ‘edges’ because generally they cut a swathe through vegetation and often a different range of species becomes established along these new edges. It is important therefore, particularly in a small remnant such as this, to keep tracks to a minimum and to site tracks wherever possible in places where they will have the least impact.

In siting tracks the following aspects need to be considered:

- they should follow a logical alignment and an easy grade where practicable;
- any areas of sensitive vegetation and archaeological sites should be avoided;
- if possible they should traverse a loop route;
- their width should be limited (ie no greater than 1200 mm), they should be of properly formed and of sound construction, and be designed to shed water and be able to be used year round. Boardwalks should be used to cross wet areas;
- track markers should be used sparingly and they should be carefully located (ie not nailed to trees);
- a sign explaining the importance of remaining on tracks and the damage that can be caused by deviating from them should be located at track all egress points.

Signs should be kept to a minimum; a proliferation of signs tends to indicate poor site planning and design. Signs fall into two categories - those that give *direction and instructions*, and those that provide *information and details* on an area. At this stage, provision should be made for a limited number of instructional signs. Interpretative signs are not considered a high priority at this stage but should be included as part of the overall development plan of the Park.

The following signs should be provided:

- sign at the main entrance to the Park with details on the value of the remnant and the need for protection and conservation, the importance of keeping to tracks and not to take or damage plants, report vandalism, etc;
- a sign at the northern boundary that identifies the remnant and reinforces the protection and conservation message (ie no access) and ;
- in time, simple track markers at strategic locations

Actions

- Ensure all boundaries are securely fenced and regularly checked.

Long Term Actions

- Construct stiles or similar at egress points.
- Select track route(s) in consultation with the community.
- Construct track(s).
- Prepare schedule of signs and consult with community.
- Prepare and erect signs.
- Monitor track usage and damage.

6.6 Maintenance Programme

It is important that maintenance is kept at an appropriate level given the aim is to allow natural systems to function with minimal interference. Any maintenance work must be geared simply to allow this to occur. Monitoring the health of the remnants and the success of the works carried out, and then taking remedial action if necessary, is all that is required.

An annual maintenance schedule should be prepared as part of overall Park planning and management that details the range of works to be carried out in the remnant and when these should occur. Any input or involvement from the community should be identified and integrated into the schedule where appropriate.

Actions

- Preparation of an annual maintenance schedule, resources required and timing.
- Identify timing for community involvement and how the community input will be utilised.

6.7 Monitoring

Monitoring is a key to ongoing successful management of remnant forest areas. There is little value in carrying out maintenance or revegetation work without evaluating its success. Monitoring the health and condition of the remnant will determine what actions need to be taken and also the success of the current management and maintenance regime. Monitoring needs to be systematic, recorded and formally incorporated into the overall management.

The following aspects need to be monitored:

- Health of existing vegetation
- Planting - plant survival and growth
- Spread of pest plants
- Noxious / pest plant and animal control programmes
- Tracks and access points
- Level of use
- Vandalism and damage

WRC's existing Forest General Surveillance Checklist provides a good format which could be expanded slightly to incorporate a section on annual planting, survival rates and growth.

7.0 Budget

WRC have allocated funding to this project for each year for the next 10 years to implement the actions set out in the summary in Section 8.0. It is

possible that allocations could change over time, but within current planning the amounts allocated are set out in the table below:

Year	**$ Amount**
2001/02	$5,000
2002/03	$2,000
2003/04	$2,000
2004/05	$2,000
2005/06	$2,000
2006/07	$2,000
2007/08	$2,000
2008/09	$10,000
2009/10	$8,000

This funding can be used for the growing or purchase of plant material, planting, pest control work and the development of the area generally. The allocation for 2008/09 includes an amount for reassessment and possibly track development if the care group feel it is appropriate at that time.

As with any rehabilitation project, long term planning can only be general and is dependent on the results achieved. At the planning phase each year it will be necessary to evaluate progress and to make allocations accordingly.

8.0 Programme / Summary of Actions

The spread sheet below sets out a summary of tasks and priorities.

Task	Priority	Action
1. Pest Plants		
1a. Prepare pest plant inventory	High	2001
1b. Prepare 3 year pest plant management plan and budget	High	2001 – 2002
1c. Pest plant monitoring	High	Continue and ongoing
1d. Implement macrocarpa removal programme in consultation with community groups	Medium	2001 – 2002
1e. Implement annual pest plant management programme in conjunction with vegetation removal and planting programme	High	Ongoing – annual
2. Noxious Animals		
2a. Prepare noxious animal control programme and budget	Medium	2001 – 2002
2b. Establish noxious animal control log	Medium	2001
2c. Implement annual programme		Ongoing
3. Revegetation		
3a. Identify microsites to be planted annually in conjunction with pest plant removal	High	2001 – ongoing

Task	Priority	Action
programme		
3b. Establish plant numbers and species required annually (for first 3 years)	High	2001 – ongoing
3c. Community liaison re ongoing involvement in revegetation programme (role and resources)	High	200 - ongoing
3d. Set up plant propagation and supply contracts	Medium	200-ongoing
3e. Seed collection	Ongoing	Spring – Summer
3f. Propagation	Ongoing	Spring – Autumn
3g. Planting	Ongoing	Winter
3f. After care (i.e. releasing blanking etc.)	Ongoing	Late spring and late summer / autumn in years 1 – 2 after planting; and late spring in year 3
4. Tracks and signs		
4a. Determine tracks and signs required	Medium	2001 – 2002
4b. Install instruction signs	Low	2002 – 2003
4c. Install interpretation signs	Low	2005+
4d. Form loop track	Low	2005+
5. Monitoring		
5a. Monitor condition of boundary fence	High	Weekly
5b. Monitor pest plants and effectiveness of control programme	Ongoing	Six monthly
5c. Monitoring planting	Ongoing	Quarterly

Glossary

adventive plants*: plants that have arrived from outside; in contrast to local native plants.*

canopy*: the layer or layers defined by the uppermost plant crowns.*

colonise*: the spread of plants onto a new site.*

edge*: the outer band of a patch of vegetation that has an environment significantly different from the interior of the patch.*

eco-sourcing*: ensuring that native species planted in a remnant or similar area are propagated from seed and other propagating material obtained from that same site.*

ecosystem*: a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.*

emergent*: standing out above a lower and more continuous part of the canopy.*

microsites*: areas with favourable environmental conditions selected for planting.*

mulch*: spreading of loose, readily permeable material around newly planted trees and shrubs to protect the roots and trap moisture.*

noxious animal / plant*: a species of plant or animal that has been listed as being harmful and aggressive. Landowners have a statutory responsibility to eradicate or at least control noxious plants and animals on their properties.*

pest plants: *noxious, exotic or unwanted plants*

plant association*: a group of plant species that are usually found together in the same habitat.*

plant succession*: different plant associations that grow in sequence, a process by which the composition of vegetation changes from simple and relatively short-lived, rapidly growing plants through to mature and more complex forest cover over time.*

releasing*: the removal of unwanted vegetation from around a plant releasing it from competition for light and nutrients*

.

remnant*: a small patch of original vegetation.*

revegetation*: restoration of native vegetation by planting*

understorey*: the plants that grow under the canopy of any vegetation*

N

KEY:

Forest Remnant area

Dune area

Wetland area

NOTES: - Photo Taken 15 May 1998, supplied by courtesy of Terralink NZ Limited.

Queen Elizabeth Park
Paekakariki
LOCATION PLAN

Date: July 2001
Reference: W00114
Scale: 1:5000 A4 (approx.)

0 50 100 150m
Graphic Scale 1:5000 (A4)

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PHOTOGRAPH 1 Looking south from Mackays Road. The sand dunes, inter-dunal wetlands and the native forest remnant characterise this part of Queen Elizabeth Park.

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Queen Elizabeth Park
Paekakariki,
Rehabilitation of Native
Forest Remnant

Date: July 2001
Reference: W00114

PHOTOGRAPH 2 View looking south. Wind damage to the tall emergent canopy trees is clearly evident. Low vegetation in the foreground has been planted in the past 10 years to seal and protect the edges of the remnant.

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Queen Elizabeth Park
Paekakariki,
Rehabilitation of Native Forest Remnant

Date: July 2001
Reference: W00114

PHOTOGRAPH 3 View looking west. The ' core' of the remnant is in the foreground with tall emergent kahikatea clearly visible. Effects of winds from the north-west very evident. Tiered vegetation, much of which has been planted, is providing increasing effective shelter to the remnant. Macrocarpas to the right (rear) of photograph.

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Queen Elizabeth Park
Paekakariki,
Rehabilitation of Native Forest Remnant

Date: July 2001
Reference: W00114

PHOTOGRAPH 4 Looking towards the south-east, the location of the remnant in the dune landscape and the extensive shelter provided by macrocarpa and eucalypts can be clearly seen.

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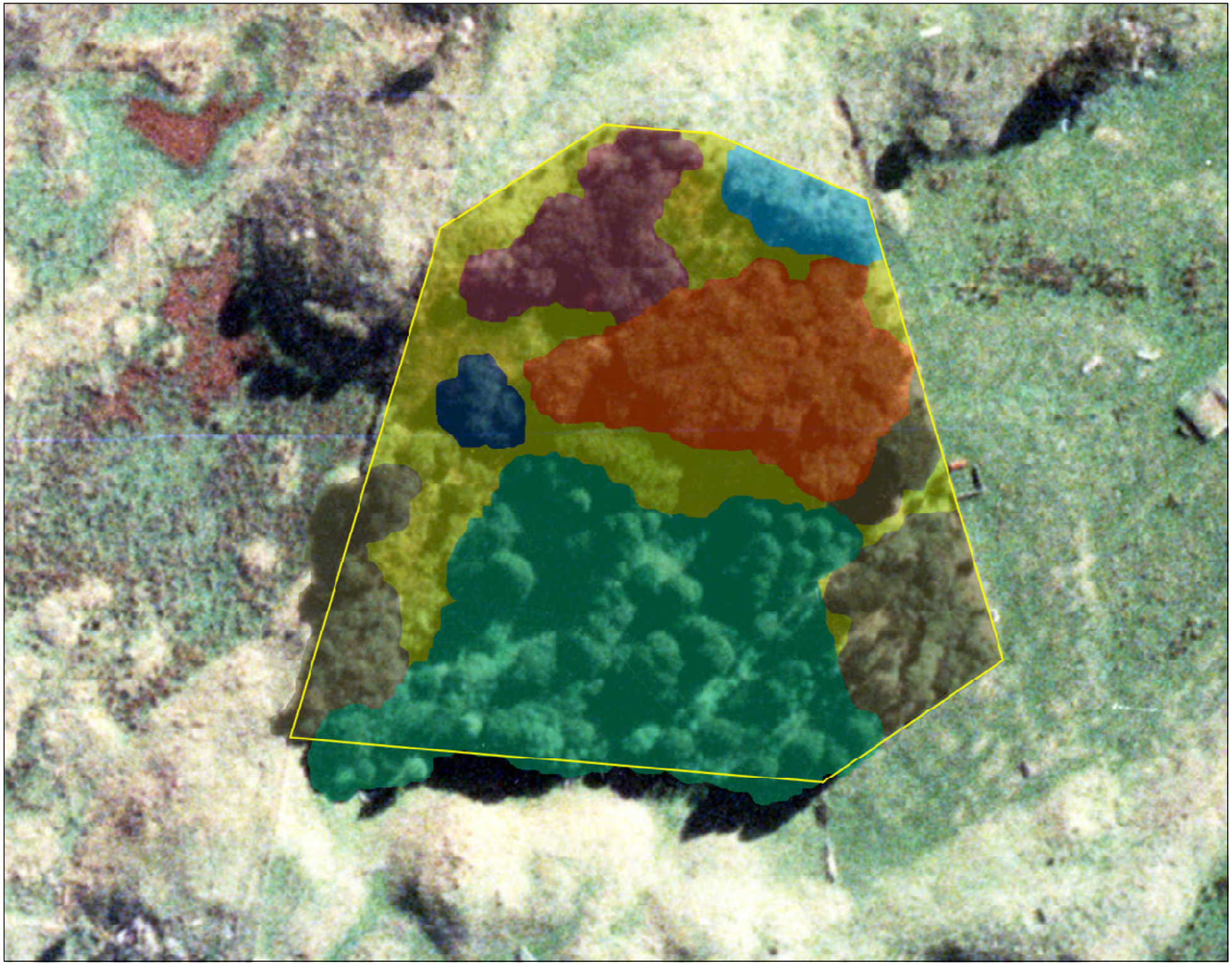
Queen Elizabeth Park
Paekakariki,
Rehabilitation of Native Forest Remnant

Date: July 2001
Reference: W00114

PHOTOGRAPH 5: From several locations such as this view from the south-east, the remnant appears dense and luxuriant but on close inspection it is quite open underneath.

PHOTOGRAPH 6: Tall closely -spaced and even aged macrocarpas have provided important shelter to the remnant that will be long term. Several trees were removed in 1999 and the stand is quite open underneath.



KEY:

- Eucalypts
- Macrocarpas
- Core of remnant
- Kanuka stand - planted 1994
- Kanuka
- Open areas - rank grass / weeds / kanuka / scrub
- Native species planting

N

Queen Elizabeth Park
Paekakariki,
Rehabilitation of Native Forest Remnant

FIGURE 2:
VEGETATION COVER

Date: July 2001
Reference: W00114
Scale: 1:1000 (A3)

0 10 20 30m
Graphic Scale 1:1000 (A3)

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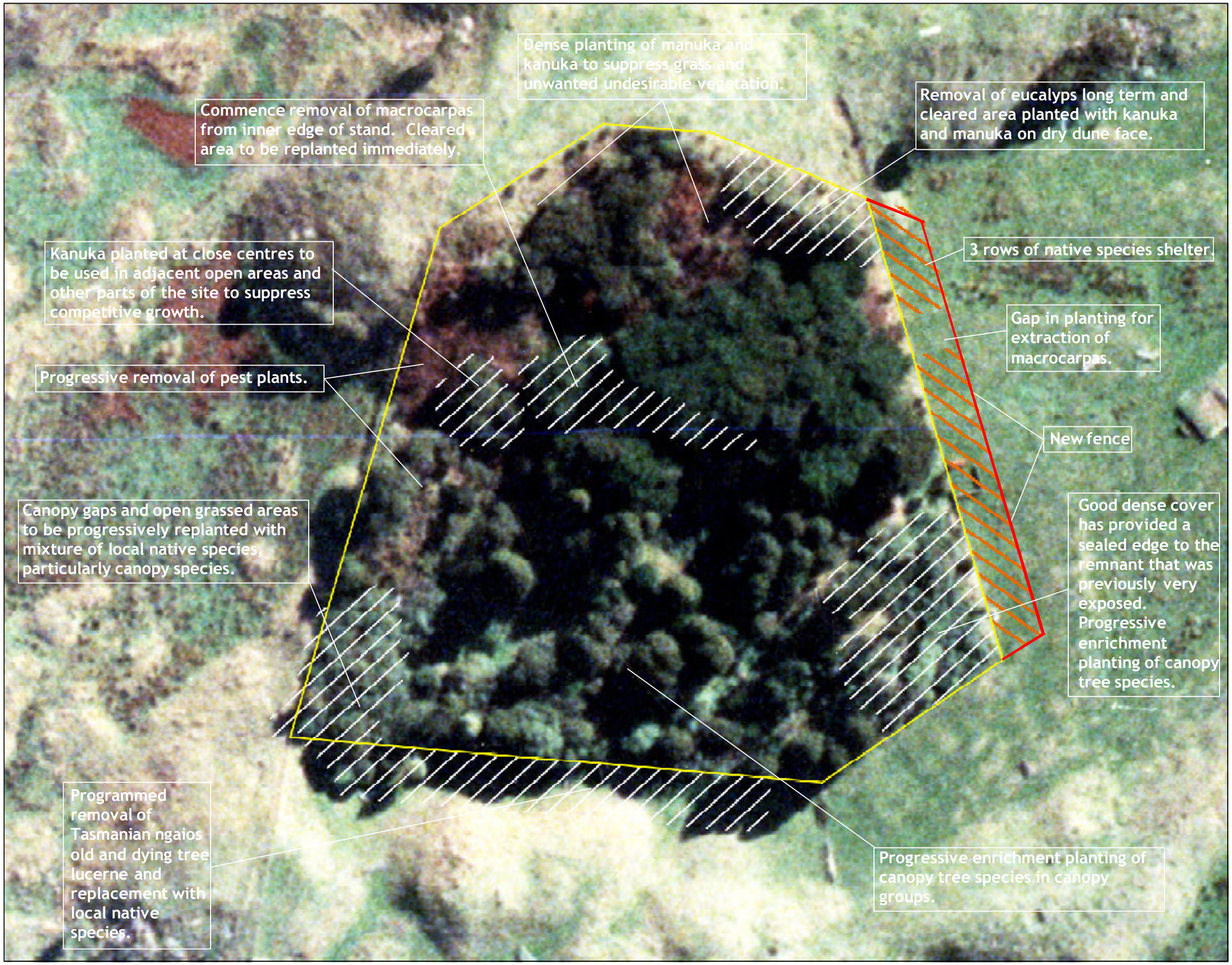

N

Queen Elizabeth Park Paekakariki, Rehabilitation of Native Forest Remnant

FIGURE 3: **RESTORATION CONCEPT**

Date: July 2001
Reference: W00114
Scale: 1:1000 (A3)

0 10 20 30m
Graphic Scale 1:1000 (A3)

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Appendix 1 Species List

LIST OF VASCULAR PLANTS IN FENCED BUSH AREA QUEEN ELIZABETH PARK

Topomap R26 & Pt R25 761245

Original list C.C. Ogle 01/03/81 & 11/87
Chris Horne, Jane Humble, Lyn Pomare & Daisy, Pat Enright (3hrs) 30/09/00
unc = uncommon (only 1 or 2 specimens seen)
1 = species not seen on current survey
2 = addition to original list

This site is a small kahikatea (*Dacrycarpus dacrydioides*) swamp forest remnant with an area of old dunes with sparse kanuka (*Kunzea ericoides*) cover and areas of kanuka covered in pohuehue (*Muehlenbeckia complexa*) and what looks like a hybrid with the larger leaved *M. australis.*

There are some interesting conclusions to be drawn from the differences between the original survey and the current one.

The site would appear to have been much wetter in parts back in 1981. A lot of the species not seen in 2000 are plants of wet areas that have either disappeared altogether or been much reduced in occurrence. Five specimens of swamp maire (*Syzygium maire*) were originally recorded may still be there and growing together in an area that was missed. The whole area has probably been getting drier since the first european settlement with drainage of the wetlands and removal of the original vegetation. This is reflected graphically in this small remnant by the disappearance of species such as *Centipeda cunninghamii, Isolepis prolifer* and *Polygonum hydropiper*. The juncus species are still growing in the area but the lack of seeding specimens makes species determination difficult.

A note here about the *Centipeda* species. On the original list it was shown as *C.orbicularis* as it was not known at the time that there were two species, one exotic and the other with a tenuous indigenous status. As the nearest occurrence of known identity is *C. cunninghamii* (Te Hapua Road) this is used in this list. As the species is also recorded from the wetlands at Queen Elizabeth Park, identification of this species will give the lie to this assumption.

There has been a lot of planning in the area and plants have been locally sourced to maintain the gene pool. Natural regeneration is doing well but slowly. There are several fern and sedge species that are represented by only one or two specimens after nearly twenty years but look healthy enough to survive. Splitting off tillers or offshoots and replanting in sterilised compost or potting mix would give nature a non-invasive hand.

The area is blasted by strong winds at times so the macrocarpas (*Cupressus macrocarpa*) and perhaps what appears to be some mature tasmanian ngaios (*Myoporum insulare*) should be left indefinitely as a wind break although any seedlings should be removed.

Gymnosperm trees and shrubs

	Dacrycarpus dacrydioides	
1	Prumnopitys taxifolia (unc) (1 seen 11/87)	

Dicotyledonous trees and shrubs

	Alectryon excelsus subsp. excelsus (unc 3)	titoki
	Beilschmiedia tawa	tawa
2	Coprosma grandifolia	
	Coprosma repens	
2	Coprosma rhamnoides	
2	Coprosma robusta	karamu
	Corynocarpus laevigatus	karaka
	Dysoxylum spectabile	kohekohe
	Elaeocarpus dentatus (unc)	hinau
	Griselinia lucida	puka, broadleaf
	Knightia excelsa	rewarawa
	Kunzea ericoides	kanuka
	Laurelia novae-zelandiae	pukatea
	Leptospermum scoparium	manuka
	Lophomyrtus bullata (unc)	ramarama
2	Macropiper excelsum subsp. excelsum	kawakawa
	Melicytus ramiflorus	mahoe
	Myoporum laetum	ngaio
	Myrsine australis (unc)	red matipo
	Pennantia corymbosa	kaikomako
	Solanum laciniatum	poroporo
	Streblus banksii (unc)	towai, large leaved milk tree
	Streblus heterophyllus (unc)	turepo, small leaved milk tree
1	Syzygium maire (5 seen)	swamp maire

Monocotyledonous trees and shrubs

	Cordyline autralis	ti, cabbage tree

Monocotyledonous lianes

	Ripogonum scandens	kareao, supplejack

Dicotyledonous lianes and related trailing plants

	Metrosideros perforata	akatea
	Muehlenbeckia australis	pohuehue
	Muehlenbeckia complexa	pohuehue
	Muehlenbeckia australis x M. complexa	
	Parsonsia heterophylla	kaihua, N.Z. jasmine
	Tetragona trigyna	native spinach
2	Passiflora tetrandra	passionvine

Psilopsids, Lycopods and Quillworts

Ferns

2	Asplenium appendiculatum subsp. maritimum (unc)	
	Asplenium flaccidum	hanging spleenwort
2	Asplenium oblongifolium (unc)	huruhuruwhenua, shining spleenwort
2	Asplenium polyodon (unc)	petako, sickle spleenwort
2	Blechnum filiforme (unc)	thread fern
2	Cyathea dealbata (unc)	ponga, silver fern
2	Histiopteris incisa	matata, water braken
	Hypolepis ambigua	
2	Microsorum pustulatum (unc)	kowaowao, hounds tongue
2	Microsorum scandens (unc)	mokimoki, scented fern
2	Paesia scaberula (unc)	matata, scented fern
2	Pteridium esculentum (unc)	rahatu, bracken
	Pteris tremula (unc)	turawera, shaking brake
	Pyrrosia eleagnifolia	ota, leather-leaf fern
2	Rumohra adiantiformis (unc)	

Orchids

Grasses

	Cortaderia fulvida (planted?)
	Microlaena stipoides

Sedges

2	Carex flagellifera
	Carex geminata? (no seed heads)
	Carex virgata
2	Carex sp. (cf. raoulii, “raotest”) (unc)
	Cyperus ustulatus (unc)
	Eleocharis acuta
1	Isolepis prolifer

Rushes and allied plants

1	Juncus australis
1	Juncus gregiflorus
1	Juncus pallidus
2	Juncus planifolius
1	Juncus sarophorus

Remaining Monocotyledonous plants

	Phormium tenax (planted ?)	harakeke, flax

Daisy-like herbs (Composites)

2	Dichondra repens	
	Hydrocotyle moschata	
	Hydrocotyle novae-zelandiae agg.	
2	Leptostigma setulosa	water milfoil
1	Myriophyllum propinquum	
2	Oxalis exilis	yellow oxalis
	Parictaria debilis	

Adventives

* = native but not to the area

Dicotyledonous trees and shrubs

2	Chamaecytisus palmensis (originally planted)	tree lucerne
	Cupressus macrocarpa	macrocarpa
	Lupinus arboreus	tree lupin
2	Myoporum insulare	tasmanian ngaio
	Phytolacca octandra	inkweed
*2	Pittosporum crassifolium	karo
	Sambucus nigra	elderberry
	Ulex europaeus	gorse

Dicotyledonous lianes and related trailing plants

	Fumaria muralis	scrambling fumitory
2	Physalis peruviana	cape gooseberry
	Rubus fruticosus	blackberry
	Vicia sativa	climbing veitch

Psilopsids Lycopods and Quillworts

Ferns

Grasses

	Agrostis stolonifera	creeping bent
	Agrostis tenuis	browntop
	Anthoxanthum odoratum	sweet vernal
	Arrhenatherum elatius	tall oat grass

	Cynosurus cristatus	crested dog's tail
	Dactylis glomerata	cocksfoot
	Ehrhata erecta	veld grass
	Holcus lanatus	yorkshire fog

Sedges

Rushes and allied plants

1	Juncus articulatus	

Remaining Monocotyledonous plants

	Zantedeschia aethiopica	arum lily

Daisy-like herbs (Composites)

	Conyza bilbaoana	fleabane
	Crepis capillaris	hawksbeard
	Hypochaeris radicata	catsear
	Senecio bipinnatisectus	ragwort
	Sonchus oleraceus	sow thistle

Dicotyledonous herbs other than Composites

2	Cardamine flexuosa	
	Carduus tenuiflorus	winged thistle
1	Centipeda cunninghamii	sneezeweed
	Cerastium glomeratum	mouse eared chickweed
	Cirsium arvense	californian thistle
	Cirsium vulgare	scotch thistle
	Digitalis purpurea	foxglove
	Galium aparine	cleavers
2	Galium palustre	marsh bedstraw
1	Geranium molle	soft doves foot
	Geranium robertianum	herb robert
	Lotus peduncularis	
1	Mentha pulegium	pennyroyal
2	Ranunculus repens	creeping buttercup
	Plantago lanceolata	
2	Plantago major	
1	Polygonum hydropiper	water pepper
	Rumex crispus	curled dock
	Rumex conglomeratus	dock
2	Solanum chenopodioides	velvety nightshade
	Solanum nigrum	black nightshade
	Solanum pseudocapsicum	jerusalem cherry
	Stellaria media	chickweed
1	Trifolium dubium	suckling clover
	Trifolium repens	white clover

Appendix 2 Revegetation and Other Works: KEA Diary (June Rowland): July 1991 – June 1999

Date	Planting & Regeneration	Other Works
July – Aug 1990	- 252 flax along perimeter of north fence and up hill. Some clumps within bush - 97 titoki planted in similar areas as above	- Noted south fence in poor state – no battens and sagging wire
Sept 1990	Good poroporo growth	- Macrocarpas being cut out for firewood and their removal - Thistle and inkweed becoming rampant
Oct 1990	Karaka seedlings planted (no quantity specified)	
Nov 1990	- Prolific karaka and kohukohu seedlings growing under old kanuka - Matipo seedlings under kanuka - Regeneration of supplejack, rata, Maori jasmine - Poroporo prolific under macrocarpa	- Thistles rampant - Long grass and ferns around young kahikatea
Dec 1990	- All titoki and taupata eaten by cattle as well as regenerating vegetation - Many flax trampled	- Cattle enter remnant through broken fence and cause widespread damage - Another macrocarpa removed. Further opening up , wind exposure to remnant
Feb 1991	Taupata and kohekohe regenerating, also extensive regeneration at north end.	- Fence still broken but paddocks full of grass because of good growing season so no cattle in remnant - Inkweed rampant
May 1991	- Regeneration progressing well - Flaxes that were trampled recovering well	Inkweed extensive
Aug 1991	Good regeneration of karaka, kohekohe, taupata, Muehlenbeckia	Fence nearly down at top corner
Nov 1991	Inkweed, thistle and nightshade cut out	
Jun 1992		Fence fixed using old battens, some new wire, hurricane netting and short length of electric fence.
Jul 1992		Planting programme prepared by KCDC; WRC and KEA involved.
Oct 1992	Tree lucerne planted by Conservation Corps and Forest and Bird. - 7-8 rows along north fence - 6 rows along east and southeast fence - Smaller amount of planting along top of northwest fence to end	
Jan 1993	- Tree lucerne growing well and seeding amongst long grass. - Taupata growing well - Many karaka seedlings present	

Date	Planting & Regeneration	Other Works
	- Good kohokohe regeneration	
Aug 1993	- Good regeneration of kahikatea under parent tree - Also good regeneration of karaka, pukatea, mahoe, and poroporo - Planted kahikatea and cabbage trees 2.0 - 3.0m tall	
May 1994	- Tree lucerne 2 – 3.5m tall forming an effective wind barrier - Taupata, kohekohe, rata, karaka, jasmine and mahoe flourishing - 8 cabbage trees planted in 1989 4.0 – 5.0m tall	- Blackberry a problem; needs to be removed to permit regeneration of native species. - Conservation Corps fence two wetland areas adjacent to remnant.
Sept – Oct 1994	- Extensive planting carried out by Conservation Corps with KEA and Forest and Bird - 3000 seedlings (mahoe, kawakawa, kohuhu, manuka, Coprosma spp., cabbage tree) - 500 large kanuka planted	Some blackberry cleared by Conservation Corps and area planted in native species.
Nov 1994		On site meeting with WRC, KCDC, KEA, Forest and Bird to discuss long-term planting proposals.
Dec 1994		Blackberry grubbing carried out by Forest and Bird and KEA. However, blackberry reappeared from cleared area.
Jan 1995	- Kanuka thriving in all areas - Most other plantings growing well	Area of blackberry cleared and planted by Conservation Corps covered in thistle, inkweed, willow weed with few kawakawa, cabbage trees, manuka and *Coprosma* spp. just visible.
Feb 1995		- Releasing of plantings carried out - Area of blackberry previously cleared has re-sprouted and also many other weed species well established. - Other areas of blackberry still need attention.
May – Oct 1995	- Kanuka continue to grow well - Kohekohe regeneration good at base of trees with regeneration in grass areas also. - Kanuka regenerating in open areas; - Rata growth exceptionally good. - Cabbage tree growth good only in northeast corner of site.	Cleared blackberry patch covered shoulder high in weeds but very little blackberry present.

Date	Planting & Regeneration	Other Works
Feb 1996	Areas of kahikatea seedlings prominent; these were lifted and potted up for later re-planting.	Patch of blackberry cut back.
Jun 1996	Excellent plant establishment and growth for all species.	Large area of blackberry identified for removal (spraying).
Feb 1997	Noted a few *Coprosma* spp. have died as a result of wet season.	- Macrocarpa damaged and opened up as a result of storm - Tree lucerne also decimated by wind - Blackberry rampant in many places throughout. No remedial action to control blackberry has been carried out as scheduled.
May 1997		KEA makes submission on WRC Annual Plan for sufficient funds to deal with weed control and management. WRC advised that blackberry eradication would be carried out using Park funds.
Dec 1997		No progress on blackberry control. Blackberry infestation and growth widespread.
Feb – Mar 1998	Plantings and regeneration progressing very well despite drought conditions. All plants large enough to cope with.	WRC scheduled to spray blackberry in Autumn.
Apr 1998		Areas of blackberry sprayed
Nov 1998		- Forest and Bird recommend removal of macrocarpas overhanging mature revegetation and suppressing growth and vigour. - Extreme flooding over entire district during past few weeks.
July 1999		Macrocarpas removed from along northern edge and opens up stand to prevailing winds.

Appendix 3

PEST PLANT INFESTATION RECORD

Completed by:	**Date:**
Location name:	**Grid reference:**

Pest Plant

Common name: **Scientific name:**	**Tentative name:** **Sample taken:**

Infestation

Description/Sketch of infestation location:
Vegetation description (predominant species in the area)

Feature	**Rating estimate** (Tick appropriate level or write estimate)	**Notes**
Size of Infestation	Estimate size in m2 or hectares:	
Distribution of infestation	1 ☐ One small patch 2 ☐ Locally scattered 3 ☐ Local patches 4 ☐ Scattered throughout 5 ☐ Patches throughout 6 ☐ Common throughout	
Adult/Juvenile ratio	% Juvenile % Adult	
Presence of flowers, seeds, or propagules	Flowers ☐Y ☐N Seeds ☐Y ☐N Propagules (suckers, runners etc) ☐Y ☐N	
Access to the site	1 ☐ Difficult access, several kilometres from roads, no easy helicopter landing sites 2 ☐ Several kilometres to road, but good helicopter landing site 3 ☐ Short walk to road suitable for two-wheel drive 4 ☐ Vehicle access right to the site	
Likely mechanism of arrival	1 ☐ Unknown 5 ☐ Carried downstream 2 ☐ Wind 6 ☐ Intentional introduction by humans 3 ☐ Birds 7 ☐ Accidental introduction by humans 4 ☐ Rubbish dumping 8 ☐ Other (specify in notes)	
Likelihood of spread	What is the likelihood the plant pest will spread: 1 ☐ None 2 ☐ Low 3 ☐ Moderate 4 ☐ High 5 ☐ Unknown	
Likelihood of re-invasion	What is the likelihood the plant pest will re-invade if removed: 1 ☐ None 2 ☐ Low 3 ☐ Moderate 4 ☐ High 5 ☐ Unknown	

Notes: Possible Control, etc

Appendix 4

FOREST GENERAL SURVEILLANCE CHECKLIST

Location name:	**Grid reference:**	**Date:**

Fieldworker names:	**Weather:**

Landscape unit:	**Altitude:**
Aspect:	**Drainage:**
Description/sketch of area assessed:	**Special species or communities:** (rare, threatened, unusual distribution, etc)
	Forest canopy composition: Underline dominant species.

Indicator	**Rating**	**Estimate** (Tick appropriate level)	**Notes** Species etc
Birds	1	☐ Very few birds, and only 1-2 species	
	2	☐ Occasional birds, and 2-4 species	
	3	☐ Common birds, and 5-10 species	
	4	☐ Abundant birds, and > 10 species	
Canopy condition	1	☐ Very sparse foliage, many large holes, dieback > 20% of tree crowns.	
	2	☐ Foliage sparse in some areas, canopy holes common. Some dieback	
	3	☐ Foliage mostly dense, only occasional sparse areas, canopy holes rare, very occasional dieback.	
	4	☐ Abundant dense foliage over whole canopy, no canopy holes or dieback	
Understorey	1	☐ No browse palatable species 45cm – 1.35m. Understorey bare.	
	2	☐ Very few browse palatable species 45cm – 1.35m. Scattered seedlings of less palatable species.	
	3	☐ Moderate browse palatable species 45cm – 1.35m. Other species relatively abundant.	
	4	☐ Abundant browse palatable species and other species present.	
Ground cover	1	☐ Bare soil, rock/gravel > 20% of forest floor. Ground vegetation (ferns, moss, seedlings etc < 45cm tall) absent or very uncommon. Leaf litter on remainder of forest floor.	
	2	☐ Scattered bare soil and rock. Ground vegetation (ferns, moss, seedlings etc, 45cm tall) < 20%. Leaf litter on remainder of forest floor.	
	3	☐ Bare soil, rock absent or very uncommon. Ground vegetation (ferns, moss, seedlings etc, 45cm tall) 20% - 50%. Leaf litter on remainder of forest floor.	
	4	☐ No bare soil, rock, or eroding soil. Ground vegetation (ferns, moss, seedlings etc < 45cm tall), abundant, 50% - 100%. Leaf litter on remainder of forest floor.	
Vine Weeds	1	☐ Very common, > 50% canopy cover	
	2	☐ Common, 10% - 50% canopy cover	
	3	☐ Occasional, up to 10% canopy cover	
	4	☐ None present	
Shrub/Tree Weeds	1	☐ Very Common, > 50% understorey or canopy cover	
	2	☐ Common, 10% - 50% understorey or canopy cover	
	3	☐ Occasional, up to 10% understorey or canopy cover.	
	4	☐ None present	

Indicator	Rating	Estimate (Tick appropriate level)	Notes Species etc
Ground cover weeds	1	☐ Very common, cover > 50% ground area	
	2	☐ Common, 10% - 50% ground area	
	3	☐ Occasional, up to 10% ground area	
	4	☐ None present	
Possums	1	☐ Abundant fresh sign (droppings, pad runs, bark scratching and biting).	
	2	☐ Common fresh sign but sometimes scattered	
	3	☐ Sign uncommon, often quite old	
	4	☐ No sign.	
Deer	1	☐ Abundant fresh sign (droppings, major tracks and hoof prints). Occasional deer may be disturbed.	
	2	☐ Common fresh sign but sometimes scattered. Sightings of deer uncommon.	
	3	☐ Sign uncommon. Sign is often old.	
	4	☐ No sign.	
Goats	1	☐ Abundant fresh sign (droppings, major tracks and hoof prints, bedding areas). Goats commonly heard, seen, or smelt.	
	2	☐ Common fresh sign but sometimes scattered. Occasional goats heard, seen, or smelt.	
	3	☐ Sign uncommon. Sign is often old.	
	4	☐ No sign.	
Pigs	1	☐ Abundant fresh sign (rooting, droppings and hoof prints). Pigs commonly seen, or heard nearby.	
	2	☐ Common fresh sign but sometimes scattered.	
	3	☐ Sign uncommon. Sign is often old.	
	4	☐ No sign.	
Stock	1	☐ Abundant fresh sign (droppings, major tracks and hoof prints). Stock heard or seen throughout area.	
	2	☐ Common fresh sign but sometimes scattered. Occasional stock heard or seen, generally confined to scattered areas on edge.	
	3		
	4	☐ Sign uncommon. Sign is often old. Only near edges.	
		☐ No sign	
Fencing	1	☐ No fencing.	
	2	☐ Some fencing, for example, one side, or fence poorly maintained with large breaks.	
	3	☐ Most of boundary fenced, includes all areas where stock access likely. Some small recent breaks.	
	4	☐ Secure, intact fencing around whole area.	
Human Visitors	1	☐ Widespread trampling, and other damage throughout area.	
	2	☐ Common trampling and damage but limited to certain areas	
	3	☐ Occasional localised minor damage	
	4	☐ No damage.	

Management needs/actions	By Whom	By When