



# Cost Benefit Analysis

for species considered for inclusion in the  
Proposed Regional Pest Management Strategy 2002-2022

October 2007

Quality for Life



greater WELLINGTON  
REGIONAL COUNCIL

Biosecurity





greater WELLINGTON  
REGIONAL COUNCIL

# Cost Benefit Analysis for species considered for inclusion in the

Proposed Greater Wellington Regional Pest  
Management Strategy 2002-2022

**Cielle Stephens and Robert Quan**

## FOR FURTHER INFORMATION

Greater Wellington  
Regional Council  
Masterton  
PO Box 41

T 06 378 2484  
F 06 378 7994  
W [www.gw.govt.nz](http://www.gw.govt.nz)

Greater Wellington  
Regional Council  
Upper Hutt  
PO Box 40847

T 04 526 4133  
F 04 526 4171  
W [www.gw.govt.nz](http://www.gw.govt.nz)

October 2007

# Contents

<b>1.</b>	<b>Introduction</b>	<b>7</b>
1.1	Biosecurity Act (1993) requirements for the Cost Benefit Analysis (CBA)	7
1.2	The Meister's Analysis (Section 72 (1) (c))	8
1.3	Infestation ("S"-shaped) curve	8
1.4	Category definitions	9
1.4.1	Total Control	9
1.4.2	Containment or Site Led	9
1.4.3	Suppression	9
1.4.4	Key Native Ecosystem Management	10
1.4.5	Surveillance	10
1.5	Pest species to be included in the Greater Wellington Proposed Regional Pest Management Strategy 2002-2022	10
<b>2.</b>	<b>Pest Animals Cost Benefit Analysis</b>	<b>11</b>
2.1	The model	11
2.2	Results	12
2.3	Conclusions	13
2.4	Proposed Total Control	13
2.4.1	Rooks ( <i>Corvus frugilegus</i> )	13
2.5	Proposed Suppression	14
2.5.1	Rabbits ( <i>Oryctolagus cuniculus</i> )	14
2.6	Proposed Site Led	15
2.6.1	Feral and unwanted cats ( <i>Felis catus</i> )	15
2.6.2	Feral deer ( <i>Dama dama sp.</i> , <i>Cervus sp.</i> )	16
2.6.3	Feral goat ( <i>Capra hircus</i> )	17
2.6.4	Feral pig ( <i>Sus scrofa</i> )	18
2.6.5	Gambusia ( <i>Gambusia affinis</i> )	19
2.6.6	Koi carp ( <i>Cyprinus carpio</i> )	20
2.6.7	Wasps ( <i>Vespula sp.</i> )	21
2.6.8	Magpies ( <i>Gymnorhina tibicen</i> )	22
2.6.9	Possums ( <i>Trichosurus vulpecula</i> )	23
2.7	Proposed Surveillance list	24
2.7.1	Red eared slider turtles ( <i>Trachemys scripta elegans</i> )	24
2.7.2	Rainbow skinks ( <i>Lampropholis delicata</i> )	24

2.7.3	Argentine ants ( <i>Linepithema humile</i> )	25
2.7.4	Darwin's ants ( <i>Doleromyrma darwiniana</i> )	26
2.7.5	Mynas ( <i>Acridotheres tristis</i> )	27
2.7.6	Subterranean termites ( <i>Coptotermes acinaciformis</i> )	27
<b>3.</b>	<b>Pest Plant Cost Benefit Analysis</b>	<b>29</b>
3.1	Assumptions	29
3.1.1	Discount rate	29
3.1.2	Initial area infested	29
3.1.3	Weighted Average Gross Margin for Infested Land (WAGM)	30
3.1.4	Proportion of production loss from infected land	30
3.1.5	Total Area Potentially Infested (TAPI)	31
3.1.6	Years to infest all TAPI	31
3.1.7	Annual cost of control for landholders	31
3.1.8	Proportion of Landholders controlling the pest	31
3.1.9	Proportion of invested land where conservation values apply	32
3.1.10	Years taken to achieve strategy objectives	32
3.1.11	RPMS Scenario costs	32
3.2	Proposed Surveillance pest plants	32
3.2.1	Surveillance pest species	32
3.2.2	Surveillance RPMS – all species	33
3.3	Proposed Total Control species	34
3.3.1	African feather grass ( <i>Pennisetum macrourum</i> )	34
3.3.2	Bathurst bur ( <i>Xanthium spinosum</i> )	36
3.3.3	Blue passion flower ( <i>Passiflora caerulea</i> )	38
3.3.4	Climbing spindleberry ( <i>Celastrus orbiculatus</i> )	39
3.3.5	Eelgrass ( <i>Vallisneria spp.</i> )	41
3.3.6	Madeira vine ( <i>Anredera cordifolia</i> )	43
3.3.7	Manchurian wild rice ( <i>Zizania latifolia</i> )	45
3.3.8	Moth plant ( <i>Araujia sericifera</i> )	47
3.3.9	Perennial nettle ( <i>Urtica dioica</i> )	48
3.3.10	Saffron thistle ( <i>Carthamus lanatus</i> )	50
3.3.11	Woolly nightshade ( <i>Solanum mauritianum</i> )	52
3.4	Proposed Containment	55
3.4.1	Boneseed ( <i>Chrysanthemoides monilifera</i> )	55
3.4.2	Evergreen buckthorn ( <i>Rhamnus alaternus</i> )	57

3.4.3	Hornwort ( <i>Ceratophyllum demersum</i> )	59
3.4.4	Sweet pea shrub ( <i>Polygala myrtifolia</i> )	61
3.5	Proposed Site Led Boundary Control	64
3.5.1	Banana passionfruit ( <i>Passiflora mixta</i> / <i>P.mollisima</i> )	64
3.5.2	Blackberry ( <i>Rubus fruticosus</i> )	65
3.5.3	Cathedral bells ( <i>Cobaea scandens</i> )	67
3.5.4	Gorse ( <i>Ulex europaeus</i> )	69
3.5.5	Hemlock ( <i>Conium maculatum</i> )	71
3.5.6	Nodding thistle ( <i>Carduus nutans</i> )	72
3.5.7	Old man's beard ( <i>Clematis vitalba</i> )	75
3.5.8	Ragwort ( <i>Senecio glastifolius</i> )	77
3.5.9	Variegated thistle ( <i>Silybum marianum</i> )	79
3.5.10	Wild ginger ( <i>Hedychium gardnerianum</i> / <i>H. Flavescens</i> )	80
<b>4.</b>	<b>Key Native Ecosystem RPMS scenario – all pest species</b>	<b>82</b>
4.1	Cost Benefit Analysis summary	86

# 1. Introduction

This report discusses the impacts (both the costs and the benefits) of a range of animal and plant species considered for inclusion in the Proposed Wellington Regional Pest Management Strategy (RPMS) 2008. A Cost Benefit Analysis (CBA) for all pest species listed in the RPMS is a requirement under Section 72 of the *Biosecurity Act 1993* (the Act). The report is a supporting document to be read in conjunction with the Proposed Wellington RPMS 2002-2022. For plants the CBA was only done for species that were either new to the RPMS or had changed categories. A CBA is not required for the species already listed in the current RPMS, as there are no changes from the previous RPMS. Therefore the existing CBAs can be assumed to be all valid. Due to the change in methodology all pest animals were considered for the CBA.

## 1.1 Biosecurity Act (1993) requirements for the Cost Benefit Analysis (CBA)

Section 72 (a) (b) (ba) and (c) of the Act require that for each animal or plant pest species proposed to be included in the RPMS, a Council must be of the opinion that for each species:

- (a) The benefits of having a RPMS would outweigh the costs; and
- (b) that the net benefits of regional intervention exceed the net benefits of an individuals intervention; and
- (ba) where persons are required to directly meet the costs of implementing the strategy, that the benefits that will accrue to those persons outweigh the costs, or that those persons contribute to the creation, continuance or exacerbation of the problem; and
- (c) the pest is having actual or potential environmental effects of regional significance. These effects may be broad in nature, and may be related to economic matters, as well as natural, physical and cultural resources.

Section 72 (c) is logically the first step in generating information that can then be applied to sections 72 (a), (b) and (ba). When obtaining information on the ‘seriousness’ of pest impacts, a Council also begins to aggregate the cost/benefit data on its management approach, thereby identifying the net benefits of the strategy.

To achieve consistency between regions, the Biosecurity Managers’ Group jointly commissioned Harris Consulting to develop a cost-benefit analysis model advising of a robust process for Councils to meet the requirements of Section 72 of the Act. The report, “*Proving the Need for a Regional Pest Management Strategy: Guidelines for Undertaking an Analysis Under Section 72 of the Biosecurity Act (1993)*”, was the guiding document for the pest plant aspect of the report. A second model developed by Auckland Regional Council and the Centre for Biodiversity and Biosecurity was used for pest animal species. A report for this model is entitled “*Developing a Framework for Prioritising Pest Management Policy*”.

Section 72 of the Act requires that the CBA be a comparison between different scenarios – typically what will happen if there is no strategy, and what will happen under different management approaches. Providing that the Council is satisfied that the benefits outweigh the costs, the scenario with the least net costs to the region is usually the most worthwhile. For those plant species where a CBA was appropriate, a comparison has been made between No RPMS, and the proposed options Total Control RPMS and/or Containment RPMS. The animals’ model provided a variety of different potential policy options, with Total Control, Containment, Site Led, Surveillance and Suppression all being considered.

## **1.2 The Meister’s Analysis (Section 72 (1) (c))**

The Meister’s analysis was developed as a process for screening species that are nominated for inclusion in a pest management strategy. It is not a comprehensive assessment model; rather it is a means of establishing whether a species warrants further consideration against the criteria laid out in the Act. The model assesses the impacts that a species might have on economic or non-economic values of a region. Information needed in the analysis includes:

- Description and biological capability of the species, including the form, habitat and regional distribution of the pest.
- Biological success of the species, including the dispersal method, the reproductive ability and the competitive ability of the pest.
- Other considerations, such as the toxicity, resistance to control and the current status of the pest.

The organism needs to be assessed as to the criteria of Section 72 of the Act. This includes the current, potential and severity of impact to endangered species, species diversity, soil resources, water quality, human health, māori culture, production, recreation and international trade. For this analysis it is assumed that any species that has significant impact on the native flora or fauna of New Zealand will be an issue to local iwi and adversely affect the relationship between Maori and their culture and traditions. This information has been summarised for each species. Further information about the Meister Analysis can be found in “*The Scope and Nature of Assessment Required Under the Biosecurity Act Concerning the Effects of Pests and of Pest Management Proposals*” by A. Meister and R. Alexander, Massey University, Palmerston North.

## **1.3 Infestation (“S”-shaped) curve**

The invasion pattern of many pest species tends to follow an “S”-shaped pattern (Figure 1). The important characteristics of the curve are a long tail at the beginning of a species invasion, a steep rise as the pest finds suitable habitats, and then a flattening off as these habitats reach carrying capacity (solid line). As the invasion proceeds, the proportion of uninfested habitat declines at a rate plotted by a “reverse S” (dotted line).

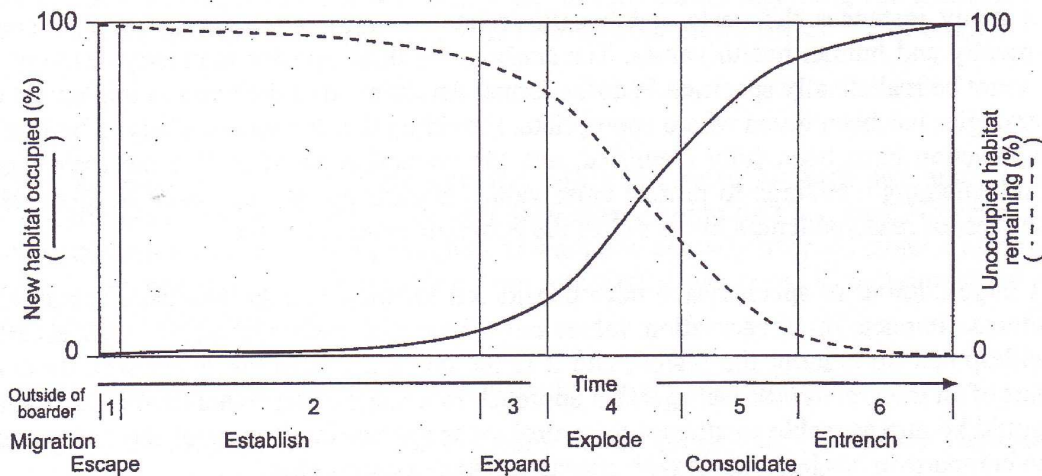


Figure 1.

Conceptual phases in the invasion of a weed through time, and the way these relate to the percentage of occupied and unoccupied habitat. From: Williams P. 1997. Ecology and Management of Invasive Weeds. Department of Conservation.

The location of a pest on the curve is relevant for the management of that pest species. For instance, if a pest in the region is currently at Phase 1 (migration) or Phase 2 (establishment), then Total Control of the species is the most efficient means of pest management. If the species has infested areas beyond the establishment phase, then either a containment approach or a site-led approach is a more efficient use of a region's resources. The locality of a pest species on the infestation curve has been used in this report to provide guidance in selecting the appropriate management scenario for that pest species in the Wellington Region. The curve used in this document has been simplified to represent the three main phases of infestation: Establishment, Expansion and Entrenchment.

## 1.4 Category definitions

### 1.4.1 Total Control

Total Control pests are those species that are of limited distribution or density in the region or part of the region, where total control within the term of the strategy is considered possible.

### 1.4.2 Containment or Site Led

Containment pests are those species that are widespread and abundant in nearly all available habitats in the region, or part of the region. The objectives are to prevent the pest spreading to new areas or neighbouring properties that are clear, maintain the distribution and/or density at current levels, or reduce the distribution and density of the pest species.

### 1.4.3 Suppression

Suppression pests are widespread and have the ability to spread rapidly over long distances. Total Control or range restriction is not achievable and the policy is to suppress pest densities to minimise adverse impacts.



#### 1.4.4 Key Native Ecosystem Management

Pests included in this category will be managed in selected sites throughout the region where conservation values are at risk.

#### 1.4.5 Surveillance

Surveillance pests are pests of concern in the region that are of limited distribution and their impacts are unknown, and/or their status in the region is yet to be determined.

### 1.5 Pest species to be included in the Greater Wellington Proposed Regional Pest Management Strategy 2002-2022

Figure 1 – New or changed pest species considered for inclusion in the proposed Greater Wellington RPMS

Total Control	Containment	Site Led	Surveillance	Suppression
Rooks	Boneseed Evergreen buckthorn Hornwort Sweet pea shrub	Feral cat Feral deer Feral pig Feral goat Gambusia Koi carp Banana passionfruit Blackberry Cathedral bells Gorse Hemlock Nodding thistle Old man's beard Ragwort Variegated thistle Wild ginger Magpies Wasps	African fountain grass Alligator weed Apple of Sodom Asiatic knotweed Australian sedge Bomarea Cape tulip Californian arrowhead Californian bulrush Chilean flame creeper Chilean needle grass Chinese pennisetum Chocolate vine Delta arrowhead Giant knotweed Hawaiian arrowhead Hornwort Houttuynia Hydrilla Johnson grass Manchurian wild rice Nasella tussock Noogoora bur Phragmites Polypodium Purple loosestrife Pyp grass Salvinia Senegal tea Spartina Water hyacinth White edge nightshade White Bryony Red eared slider turtles Darwin's ants Argentine ants Mynas Subterranean termites	Rabbits

## 2. Pest Animals Cost Benefit Analysis

### 2.1 The model

For pest animals requiring a Cost Benefit Analysis, an ordinal score was allocated to a range of assessment factors, including environmental impacts, costs to the council, costs to an individual and to environmental and commercial benefits. The ordinal number range was:

- 5 for low impacts or costs;
- 10 for medium; and
- 15 for high impacts or costs.

The scores given for each option were based on the opinion and experience of Biosecurity staff and on scientific or industry comments. A Meister analysis for each species has been prepared and is summarised here.

To determine the ordinal score of “the risk of loss of regional values” posed by each species, two parameters were researched. These were:

- The current and potential impact of the pest species on the environment (including endangered species, species diversity, water quality and soil resources), human health, māori culture, production, recreation and international trade. This was based on the results of the Meister analysis.
- The likelihood of range increase by 2012. This was determined from an average of the likelihood of natural range increase and the likelihood of human introduction and intervention.

For the final score, both parameters were multiplied together and divided by five. Dividing by a constant of five brought the final score back down to the original ordinal score of 5 – 15. Because of this, comparisons cannot be made between species. However, the focus of a CBA is to compare different policy options rather than compare species.

Parameters considered for each policy option were:

- The financial costs to the Council, commercial interests and to individuals
- The environmental benefits and the environment impacts of each policy option.

Biosecurity staff also assigned a certainty score from one (very certain) through to five (very uncertain) to each parameter given. This gave each ordinal score a range, so for example if an ordinal score of 10 (medium) was given with an uncertainty score of three. The range for that parameter would be 7-13.

The policy conclusion for a species was determined by subtracting all “cost” parameters from all the “benefit” parameters. The policy with the highest final score was considered to be the most appropriate policy option. However when uncertainty is included in the analysis a range of final scores are created and these final scores (and therefore the final policy option) may overlap. The uncertainty scores were incorporated into the analysis by running 10,000 simulations for each model. A random uncertainty value for each parameter was determined from the range given. For each

simulation run, the policy with the highest score was given a value of one. Over the 10,000 simulations, a policy option (e.g. Total Control) may score as the highest option 1,000 times, whereas “Containment” may score as the highest option 8,000 times and “no RPMS” 1,000 times. In this scenario “Containment” is considered to be the favoured option, as over the 10,000 simulations, it had the highest score 80% of the time. All options considered are expressed as percentages.

A CBA was run on 17 different species and included six different scenario options. These were

- No Regional Pest Management Strategy (RPMS)
- Total Control
- Containment
- Site Led
- Surveillance
- Suppression

Most pest animal species were only considered in two different scenarios, the No RPMS and the proposed strategy option. For example red eared slider turtles, rainbow skinks, Argentine ant, Darwin’s ant and subterranean termites were considered for surveillance and No RPMS. Feral cats, feral deer, feral pigs, gambusia, koi carp, wasp and magpies were only considered for the Site Led programme and no RPMS. Exceptions to this are myna, which were considered for Total Control, Surveillance and No RPMS, and possums and rabbits which were considered for Surveillance, Suppression and No RPMS.

## 2.2 Results

Species common name	Species scientific name	NO RPMS	Containment	Total Control	Site led	Surveillance	Suppression
Red eared slider turtle	<i>Trachemys scripta elegans</i>	5				95	
Rainbow skink	<i>Lampropholis delicata</i>	3				98	
Argentine ants	<i>Linepithema humile</i>	0				100	
Darwin’s ant	<i>Doleromyrma darwiniana</i>	1				99	
Mynas	<i>Acridotheres tristis</i>	50		47		3	
Subterranean termites	<i>Coptotermes acinaciformis</i>	1				99	
Rooks	<i>Corvus frugilegus</i>	0	100				
Rabbits	<i>Oryctolagus cuniculus</i>	0			49		51
Feral cat	<i>Felis catus</i>	0			100		
Feral deer	<i>Dama dama: Cervus sp.</i>	0			100		
Feral goat	<i>Capra hircus</i>	0			100		
Feral pig	<i>Sus scrofa</i>	0			100		
Gambusia	<i>Gambusia affinis</i>	0			100		
Koi carp	<i>Cyprinus carpio</i>	0			100		
Wasps	<i>Vespula sp.</i>	0			100		
Magpies	<i>Gymnorhina tibicen</i>	1			99		
Possums	<i>Trichosurus vulpecula</i>	0			99		1

## 2.3 Conclusions

- There is a high confidence for red eared slider turtle, rainbow skink, Argentine ants, Darwin's ant and subterranean termites for the proposed Surveillance category.
- There is high confidence for feral cats, feral deer, feral goats, feral pigs, gambusia, koi carp, wasps, magpies and possums in the proposed Site Led category.
- The preferred policy option for mynas was No RPMS, followed by Total Control. Surveillance was the proposed category.
- The preferred policy option for rooks was the containment option rather than the proposed Total Control option.

## 2.4 Proposed Total Control

### 2.4.1 Rooks (*Corvus frugilegus*)

Rooks are a bird native to the United Kingdom and Europe. They are slightly larger than magpies at about 45cm high. Rooks are black with a violet blue tinge. They were introduced as a biological control agent in the 1860s to control pastoral insect pests. However, rooks have become an agricultural pest eating a variety of cereal crops. Rooks are currently restricted to the Northern Wairarapa, but have been observed in South Wairarapa, Makara-Ohariu and Kapiti.

- |  |              |
|--|--------------|
| - Current and potential impact in Wellington | Low          |
| - Likelihood of spread by 2012               | Low - Medium |

### Recommendation

Despite the CBA indicating that rooks should be retained in the Containment category, Greater Wellington believes that there is a potential to eradicate rooks from the region in 25 years. Total Control of rooks has been achieved in both Canterbury and Otago. Therefore, it is recommended that rooks should fall under Total Control.

Occupier attempts to control rooks is likely to result in scattered rookeries and this may result in an increase in rook numbers. Because of this Greater Wellington believes Total Control by service delivery for rooks is the best option.

### Greater Wellington costs

Greater Wellington will undertake service delivery and annually survey where rooks are known to exist at an annual cost of approximately \$60,000.

### Benefits to the region

Control will help avoid potential adverse impacts on the agricultural economy if Greater Wellington can prevent the species becoming further established in the Wellington region.

## **Containment**

### **Section 72 (a)**

The addition of rooks to the Containment category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

### **Section 72 (b)**

The values protected by the strategy are regional rather than individual therefore, as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

## **Total Control**

### **Section 72 (a)**

The addition of rooks to the Total Control category shows a negative net regional benefit and therefore the requirements of section 72 (a) have not been met.

## **Recommendations**

Greater Wellington recommends that rooks be removed from the Containment category and added to the Total Control category.

## **2.5 Proposed Suppression**

### **2.5.1 Rabbits (*Oryctolagus cuniculus*)**

Wild rabbits are grey or brown in colour. Rabbits originate from the Iberian Peninsula and have been introduced to many other parts of the world. They were introduced to New Zealand from Europe in the 1840s to establish a meat and fur trade. Rabbit reproduction is fast, as females are capable of producing up to 30 young in a year. Rabbits are wide spread across the Wellington region.

Since the release of the Rabbit Calicivirus Disease in 1997, rabbit numbers in the region have dropped. It is unknown how long the virus will continue to suppress rabbit numbers. Rabbits graze pasture, competing with livestock. Rabbits strip vegetation and burrow, exposing pasture to wind erosion and invasive weeds.

- |  |        |
|--|--------|
| - Current and potential impact in Wellington | Medium |
| - Likelihood of spread by 2012               | Low    |

### **Greater Wellington costs**

Greater Wellington will undertake control of rabbits on riverbeds, esplanades or similar public commons and survey land in high rabbit prone areas. Greater Wellington will provide advice and information, and ensure compliance of the strategy rules. This is expected to cost \$110,000 per year.

## **Benefits to the region**

Control and compliance will help to avoid potential adverse impacts on the agricultural economy if Greater Wellington can suppress rabbits to level 5 or below on the Modified McLean Scale in the Wellington region.

### **Section 72 (a)**

The addition of rabbits to the Suppression category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

### **Section 72 (b)**

The values protected by the strategy are regional rather than individual therefore as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

## **Recommendation**

Retain rabbits to the Suppression category.

## **2.6 Proposed Site Led**

### **2.6.1 Feral and unwanted cats (*Felis catus*)**

Cats were introduced to New Zealand in the mid 18<sup>th</sup> century. Feral cats are wholly reliant on wildlife kills for survival. Cats are highly efficient predators and have been known to cause the extinction of sea and land birds on islands. Cats hunt birds, lizards, fish, frogs and invertebrates. Feral cats can live in a variety of habitats from sea level to the snow line.

Potential reproduction is high, with females producing up to three litters per year with an average of four to six kittens per litter. The dispersal of cats into the wild is exacerbated by human dumping and abandonment of unwanted pets. Cats are widespread in the Wellington region.

- |  |               |
|--|---------------|
| - Current and potential impact in Wellington | Medium        |
| - Likelihood of spread by 2012               | Medium - high |

## **Greater Wellington costs**

Undertake direct service delivery of feral or unwanted cats as part of the integrated Key Native Ecosystem programme and at other selected sites. Greater Wellington will provide information and publicity to the public to enhance the awareness of the threat feral and unwanted cats pose to the native fauna of the region. This is expected to cost \$50,000 per year, including funding of cat desexing programmes.

## **Benefits to the region**

The Site Led category will help to protect native fauna in areas of high biodiversity from predation by feral and unwanted cats and assist with the prevention of further loss of indigenous species.

### **Section 72 (a)**

The addition of cats to the Site Led category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

### **Section 72 (b)**

The values protected by the strategy are regional rather than individual therefore, as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

### **Recommendation**

Add feral cats to the Site Led category.

#### **2.6.2 Feral deer (*Dama dama sp.*, *Cervus sp.*)**

There are three types of deer in the Wellington region (red deer, sika deer and fallow deer). Red deer are common throughout the region and can be found in most suitable habitats. Sika deer are limited to a few areas in the Tararua ranges and fallow deer can be found in pockets of private land throughout the region. Illegal introductions of deer are the major cause of range expansion. Natural reproduction is low, with most female deer producing one fawn a season. In forests deer can have strong food preferences, taking the most palatable species. While feral deer are not the sole cause of the changing canopy composition, their impact preventing regeneration of certain species is significant. Deer are vectors of the Bovine Tb virus. Deer are a species managed under the *Wild Animal Control Act 1977*.

- |  |               |
|--|---------------|
| - Current and potential impact in Wellington | Low           |
| - Likelihood of spread by 2012               | Medium - high |

### **Greater Wellington costs**

Greater Wellington will provide information and publicity to the public to enhance the awareness of the threat feral deer pose to the native flora and ensure that the public are aware of their responsibilities under the *Wild Animal Control Act 1977*. This is expected to cost \$4,000 per annum.

Greater Wellington will provide a referral or cost recovery service to landowner/occupiers who require feral deer control. Given their status as a game animal, this will be an uncommon event.

### **Benefits to the region**

The Site Led category will help to protect native flora in areas of high biodiversity from consumption by feral deer.

### **Section 72 (a)**

The addition of feral deer to the Site Led category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

Greater Wellington will seek external services to reduce feral deer densities in selected Key Native Ecosystems and Territorial Local Authority Reserves with the owners consent and where damage to native flora justifies this course of action.

### **Section 72 (b)**

The biodiversity values protected by the strategy are regional rather than individual therefore as the requirements of section 72 (a) have been met, the requirements of section 72 (b) have also been met.

### **Recommendation**

Add feral deer to the Site Led category.

#### **2.6.3 Feral goat (*Capra hircus*)**

Goats were first liberated in New Zealand in the 1770s and are now widespread in most suitable habitats. The feral goat population is derived from domestic breeds such as Toggenburg, Alpine, Saanen and Angora. The main colours of feral goats are white, brown, black or any combination of these. Goats can breed throughout the year, but population spikes in summer with the average female producing 1.4 kids per year. The feral population is exacerbated by human releases and farm escapees.

In native forests goats have the potential to destroy the understorey or the composition of the forests by feeding on nearly everything they can reach by standing on their hind legs. The grazing habitats of goats can lead to erosion and limit the biodiversity of the forest. Feral goats are a species managed under the *Wild Animal Control Act 1977*.

- Current and potential impact in Wellington Medium
- Likelihood of spread by 2012 Medium

### **Greater Wellington costs**

Greater Wellington will undertake direct control by service delivery of feral goats in actively managed Key Native Ecosystems and Territorial Local Authority Reserves with the owners consent.

Greater Wellington will provide information and publicity to enhance public awareness of the threat goats pose to the region.

Greater Wellington will make the public aware of their responsibilities when housing domestic goats. Greater Wellington considers any goat as feral that is not:

- held behind effective fences or otherwise constrained; or
- identified in accordance with a recognised identification system.

Greater Wellington will provide a referral or cost recovery service to landowners/occupiers who require goat control. This is expected to cost \$20,000 per annum.

### **Benefits to the region**

The Site Led category will help to protect native flora and fauna in areas of high biodiversity from the adverse impacts of feral goats.



## Section 72 (a)

The addition of feral goats to the Site Led category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

## Section 72 (b)

The values protected by the strategy are regional rather than individual therefore, as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

## Recommendation

Add feral goats to the Site Led category.

### 2.6.4 Feral pig (*Sus scrofa*)

In New Zealand the feral pig originated from a range of domestic species. Feral pigs were firmly established by the 1840s in most available habitats. Feral pigs are found in medium to low numbers in the Rimutaka and Tararua ranges and the Wairarapa coast. Scattered populations can also be found in the Wellington south coast. The preferred habitat for pigs is native and exotic forests, thick and extensive scrub adjacent to farmland, river flats and tussock grasslands.

Feral pigs can breed year round, producing litters of 6 to 10 piglets. Illegal introductions exacerbate the feral pig problem. Pigs can adversely impact economic values by damaging crops and pasture, killing lambs and cast sheep. Pigs are omnivorous, opportunistic feeders consuming mainly grasses, legumes, roots, crops and berries. They will also consume invertebrates, reptiles, birds and carrion. Where pigs occur in medium to high numbers they have significant impact on the forest floor and ultimately revegetation. Feral pigs are vectors of the Bovine Tb virus. Feral pigs are a species managed under the *Wild Animal Control Act 1977*.

- |  |               |
|--|---------------|
| - Current and potential impact in Wellington | Low           |
| - Likelihood of spread by 2012               | Medium - high |

### Greater Wellington costs

Greater Wellington will provide information and publicity to the public to enhance the awareness of the threat feral pigs pose to the native flora and ensure that the public are aware of their responsibilities under the *Wild Animal Control Act 1977*.

Greater Wellington will provide a referral or cost recovery service to landowners/occupiers who require feral pig control. Given their status as a game animal, this will be an uncommon event.

Greater Wellington will seek external services to feral pig densities in selected Key Native Ecosystems and Territorial Local Authority Reserves with the owner's consent where damage to native flora and fauna justifies this course of action. This is expected to cost \$4,000 per annum.



## Section 72 (b)

The values protected by the strategy are regional rather than individual therefore, as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

### Recommendation

Add gambusia to the Site Led category.

#### 2.6.6 Koi carp (*Cyprinus carpio*)

Koi carp are large ornamental freshwater fish. They are originally from Western Europe, Mediterranean and Western Asia, but are now found throughout the world. Koi carp are highly variable in colour, often with irregular blotching of black, red, gold, orange or pearly white. In New Zealand koi carp can grow up to 5kgs and 600mm in length. Koi carp have been found in Auckland, Waikato and Nelson. No self-sustaining populations have been found in the Wellington region. The spread of koi carp is largely considered to be intentional. The reproductive ability of koi carp is sizable, with females producing 80,000 to 500,000 eggs at spawning. Koi carp have high tolerance for a range of environmental conditions including extreme temperatures, low dissolved oxygen and high salinity. Koi carp can increase the turbidity of the water, stream bank erosion, nutrient concentration and phytoplankton levels, while decreasing the diversity and abundance of desirable aquatic plants and macro-invertebrates.

- |  |               |
|--|---------------|
| - Current and potential impact in Wellington | Medium        |
| - Likelihood of spread by 2012               | Medium - high |

### Greater Wellington costs

Greater Wellington will provide information and publicity to enhance public awareness of the threat koi carp pose to the region. This is expected to cost \$3,000 per annum.

### Benefits to the region

The Site Led category will help to protect native flora and fauna and water quality in areas of high biodiversity from koi carp.

## Section 72 (a)

The addition of koi carp to the Site Led category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

## Section 72 (b)

The values protected by the strategy are regional rather than individual therefore as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

### Recommendation

Add koi carp to the Site Led category.

### 2.6.7 Wasps (*Vespula sp.*)

There are four main species of wasp in New Zealand (common, German, Australian paper and Asian paper wasps). The two most common and problematic wasps in the Wellington region are the common wasp and the German wasp. The German wasp can be identified by its wide yellow band and the separate black dots and rings on its back. The common wasp has wider black bands and the black dots are fused to these bands. Wasps can be found in urban areas, recreational areas, forests (primarily open beech habitat) and beaches. Wasps are a human health problem. Their stings are dangerous, especially to people who are allergic to them. Both the German and common wasps can sting repeatedly. Wasps can also harm native wildlife, as they consume a large number of native invertebrates. Wasps have been known to kill chicks in the nest. Wasps also consume honey dew produced by beech tree scale insects. This is an important food source for many birds.

- |  |        |
|--|--------|
| - Current and potential impact in Wellington | Medium |
| - Likelihood of spread by 2012               | Low    |

#### **Greater Wellington costs**

Provide advice and education to occupiers wanting to undertake wasp control and provide a referral service to landowners who require wasp control at a cost of \$5,000 per annum.

#### **Benefits to the region**

The Site Led category will help to protect people from the health hazards that wasps can cause, especially around schools and recreational areas.

#### **Section 72 (a)**

The addition of wasps to the Site Led category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

#### **Section 72 (b)**

The values protected by the strategy are regional rather than individual therefore as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

#### **Recommendation**

Add wasps to the Site Led category.

### 2.6.8 Magpies (*Gymnorhina tibicen*)

Magpies are black and white birds from Australia, standing approximately 41cm high. Magpies were introduced in the 1860s as a biological control agent for invertebrate pests and since the 1970s they have distributed widely across the Wellington region. Magpies are known to be aggressive birds, swooping and attacking animals or people to defend their territory and/or young. Children in particular can be subject to intimidating and hazardous attacks. Magpies are also known to harass and/or kill native birds while defending their territory. Large birds such as the kererū or tui often become more noticeable when magpies are continually culled from an area. Magpies eat native insects and lizards. As magpies have no natural predators in New Zealand their numbers are thought to be increasing. However, given that the preferred habitat of magpies is pastoral land with scattered trees, it is thought that they are unlikely to significantly impact native forest birds.

- |  |     |
|--|-----|
| - Current and potential impact in Wellington | Low |
| - Likelihood of spread by 2012               | Low |

#### **Greater Wellington costs**

Greater Wellington will undertake service delivery where there is a threat of injury to the public. Greater Wellington will provide advice and assistance to members of the public wanting to undertake magpie control and monitor population trends at an annual cost of \$45,000 per annum.

#### **Benefits to the region**

The Site Led category will help to protect people from the health hazards that magpies can cause, especially around schools and recreational areas.

#### **Section 72 (a)**

The addition of magpies to the Site Led category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

#### **Section 72 (b)**

The values protected by the strategy are regional rather than individual therefore as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

#### **Recommendation**

Retain magpies to the Site Led category.



## 2.7 Proposed Surveillance list

### 2.7.1 Red eared slider turtles (*Trachemys scripta elegans*)

Red eared sliders are aquatic freshwater turtles, with a distinctive broad red stripe behind each eye. They can reach up to 28cm in length and can live for approximately 30 years. They are commonly kept as pets and the release of pets into the wild has led to the introduction of turtles into natural ecosystems. It is thought that red eared sliders could adversely impact indigenous aquatic plant life, invertebrates and in particular endemic fish species. It is less clear whether red eared slider turtles could form self sustaining populations in the Wellington region as its reproductive success depends on prolonged periods of warm temperatures.

- Current and potential impact in Wellington Low
- Likelihood of spread by 2012 Low-Medium

#### Greater Wellington costs

Greater Wellington will provide information and publicity to enhance public awareness of the threat red eared turtles pose to the region.

#### Benefits to the region

May help to avoid potential adverse impacts on the environment if the species does become established in the Wellington region.

#### Section 72 (a)

The addition of red eared slider turtles to the Surveillance category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

#### Section 72 (b)

The values protected by the strategy are regional rather than individual therefore as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

#### Recommendation

Add red eared slider turtles to the Surveillance category.

### 2.7.2 Rainbow skinks (*Lampropholis delicata*)

Rainbow skinks are small lizards, with a snout vent length of approximately 55mm. The back of the skink is normally brown, with a dark brown band along each side of the body. The skinks originated from Eastern Australia and are currently distributed from Northland through to the Waikato. Bioclimatic modelling indicates the skinks final range will include all suitable habitats in the North Island, including the Wellington region. Anecdotal evidence at sites where the skink is found has shown that rainbow skinks have the ability to supersede native skinks. Rainbow skinks are currently protected under the *Wildlife Act 1953*.

- Current and potential impact in Wellington Low
- Likelihood of spread by 2012 Low

**Greater Wellington costs**

Greater Wellington will provide information and publicity to enhance public awareness of the threat rainbow skinks pose to the region.

**Benefits to the region**

May help to avoid potential adverse impacts on the environment if the species does become established in the Wellington region.

**Section 72 (a)**

The addition of rainbow skinks to the Surveillance category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

**Section 72 (b)**

The values protected by the strategy are regional rather than individual therefore as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

**Recommendation**

Add rainbow skinks to the Surveillance category.

**2.7.3 Argentine ants (*Linepithema humile*)**

The Argentine ant is an invasive South American ant. It is small, medium to dark brown and 2 to 3mm long. There are three known or recorded populations in the Wellington region, in Kelburn, Petone and Kapiti; however, these populations appear to be on the decline. Argentine ants have established successfully in Christchurch, suggesting that they may be able to establish in the Wairarapa. Colonies are polygynous (multiple queens), and produce large numbers of offspring, therefore expansion is rapid. The Argentine ant is dominant, highly active and aggressive. They will exert strong competitive influence on other ant species, displace and/or kill native invertebrates, and farm and protect honey dew producing aphid species.

- Current and potential impact in Wellington Low
- Likelihood of spread by 2012 Low - Medium

**Greater Wellington costs**

Greater Wellington will provide information and publicity to enhance public awareness of the threat Argentine ants pose to the region.

**Benefits to the region**

May help to avoid potential adverse impacts on the environment if the species does become established in the Wellington region.



### **Section 72 (a)**

The addition of Argentine ants to the Surveillance category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

### **Section 72 (b)**

The values protected by the strategy are regional rather than individual therefore, as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

### **Recommendation**

Add Argentine ants to the Surveillance category.

#### **2.7.4 Darwin's ants (*Doleromyrma darwiniana*)**

Darwin's ants originate from Australia. They are a small brown ant, similar in appearance to the Argentine ant. They give off a strong odour when crushed. In January 2006, Darwin's ant was first recorded in Plimmerton, and this is the first known record of this species of ant in the Wellington region. Natural rate of dispersal appears to be slow. However, it can attain large densities in urban gardens becoming a nuisance and may displace other invertebrates. Darwin's ant will farm aphids and scale insects.

- Current and potential impact in Wellington                      Low
- Likelihood of spread by 2012    Low

### **Greater Wellington costs**

Greater Wellington will provide information and publicity to enhance public awareness of the threat Darwin's ants pose to the region.

### **Benefits to the region**

May help to avoid potential adverse impacts on the environment if the species does become established in the Wellington region.

### **Section 72 (a)**

The addition of Darwin's ants to the Surveillance category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

### **Section 72 (b)**

The values protected by the strategy are regional rather than individual therefore as the requirements of section 72 (a) have been met, then the requirements of section 72 (b) have also been met.

### **Recommendation**

Add Darwin's ants to the Surveillance category.

### 2.7.5 Mynas (*Acridotheres tristis*)

Mynas are a bird, native to Afghanistan, India, Sri Lanka and Bangladesh, but are now widely established throughout the world. They were introduced to New Zealand as a biological control agent for insect pests. They were once numerous in the Wellington region, but the only surviving population is at the Masterton refuse tip. If established the birds have the potential to compete with native birds for both food and nest holes and prey upon native invertebrates and reptiles. Mynas are a potential crop pest, eating orchard fruit.

- Current and potential impact in Wellington Low
- Likelihood of spread by 2012 Low

#### **Greater Wellington costs**

None

#### **Benefits to the region**

May help to avoid potential adverse impacts on the environment if the species does become further established in the Wellington region.

#### **Section 72 (a)**

The addition of mynas to the Surveillance category shows a negative net regional benefit and therefore the requirements of section 72 (a) have not been met.

#### **Recommendation**

Mynas currently pose little or no threat to the Wellington region. No RPMS is recommended.

### 2.7.6 Subterranean termites (*Coptotermes acinaciformis*)

The Australian termite is similar in appearance to a white ant, approximately 4 to 7mm in size, with two sets of brownish wings. They are not currently found in the Wellington region. Populations in Nelson and Otorohanga were successfully eradicated by Biosecurity New Zealand in 2006 and 1999 respectively. Termites have been transported in timber; natural dispersal is limited as the alates (reproductive termites) do not fly well. Mature colonies may number up to two million individuals and queens are capable of producing 2,000 eggs per day. Subterranean termites live in and consume both dead and live wood, including trees, houses, furniture and fences. Subterranean termites may also compete with native termites.

- Current and potential impact in Wellington Low
- Likelihood of spread by 2012 Low

#### **Greater Wellington costs**

Greater Wellington will provide information and publicity to enhance public awareness of the threat subterranean termites pose to the region.

### **Benefits to the region**

May help to avoid potential adverse impacts on the environment and the economy if the species does become established in the Wellington region.

### **Section 72 (a)**

The addition of subterranean termites to the Surveillance category shows a positive net regional benefit and therefore the requirements of section 72 (a) have been met.

### **Section 72(b)**

The values protected by the strategy are regional rather than individual therefore as the requirements of section 72 (a) have been met the requirements of section 72 (b) have also been met.

### **Recommendation**

Add subterranean termites to the Surveillance category.

### **3. Pest Plant Cost Benefit Analysis**

For Total Control, Containment and Boundary Control plants, the CBA follows the model produced by Simon Harris. The Harris model provides a 'Net Regional Benefit' with respect to the proposed status for each species. This is expressed in terms of Net Present Value (NPV). If this figure is positive, then it means that the benefits associated with the proposed status outweigh the costs (i.e. it meets the requirements of section 72(a)). If the figure is negative, then the costs outweigh the benefits (i.e. it does not meet the requirements of section 72(a)). The model also indicates whether the regional benefits exceed the individual benefits (i.e. the requirements of section 72 (b) of the Act). The entire methodology recommended by Harris is complex and the report does not attempt to explain it in full. A copy of the cost benefit template is provided in the appendix, but for a more detailed explanation refer to the original report.

#### **3.1 Assumptions**

The analysis depends on a variety of assumptions, which are stated for each pest species analysed. A degree of uncertainty is inherent and must be accepted when assumptions are used. However, the purpose of a scenario is not to make a prediction of what will happen, rather a means to compare the difference in outcomes resulting from alternative scenarios. The assumptions made are based on the following information.

##### **3.1.1 Discount rate**

A CBA must consider costs and benefits across time, rather than for a single year. Economists use a technique called Discounted Cash Flow to calculate future costs and benefits in present day terms. This value is known as the Net Present Value (NPV) of an investment. A discount rate of 8% has been used. This is what has been recommended by the Harris model. The New Zealand government standard is 10%.

Two different multipliers are used to discount and sum the total NPV of a strategy scenario for plant pests.

In the No RPMS scenario, the multiplier calculates the total costs of an infestation when the pest has reached its maximum extent. This value estimates an S-shaped curve between the initial and final infestations, and discount backs to the present day.

In the RPMS scenario, the multiplier estimates a linear decrease in control costs or loss of production between the current losses and the losses expected after the strategy has been in place for a stated period of time.

##### **3.1.2 Initial area infested**

Current infestation sizes were derived from a variety of ways

- For the regional surveillance species, the current area infested was calculated from the Surveillance programme (i.e. pest plant database).
- For Total Control and Containment species, the current area infested were based on actual contract sizes of known infestations and Biosecurity staff knowledge of the region.

- For Boundary Control and other more widespread species, the current area infested was extrapolated from the data recorded on the Pest Plant Database and from Biosecurity staff knowledge of the region.
- For gorse the initial area infested was estimated from the Land Cover Database 2 using the land cover category 'gorse and broom'.

### 3.1.3 Weighted Average Gross Margin for Infested Land (WAGM)

This was based on the reported gross margins in 2005–2006 MAF farming reports. For pastoral land a weighted average of dairy farming, sheep and beef farming and deer farming was used. This gives a figure of \$313 per hectare.

For land where environmental or conservation values apply, non market information was used. Kaye-Blake and Kogler (draft 2006) assessed the willingness of New Zealanders to pay for bush with native species. They found that New Zealanders were willing to pay on the order of \$30 to \$80 per household as part of their rates. In Wellington there are 168,200 households in the region (Statistic NZ 2006) and 72,718 hectares of land where conservation value apply (Regional Parks, Key Native Ecosystems and QEII covenants). Department of Conservation (DoC) land was excluded as this comes under general taxes and not part of rates. Greater Wellington does not conduct work in DoC reserves. This gives a willingness to pay range of \$69 per hectare to \$185 per hectare and an average of \$127 per hectare. For the purposes of this analysis, the average figure was used for native bush, \$185 per hectare for areas that were either rare (e.g. wetlands) or of high value (e.g. coastal areas). The lower figure \$69 per hectare was used for areas with low biodiversity value e.g. mixed shrub land, scrub.

### 3.1.4 Proportion of production loss from infected land

For agricultural and horticultural weeds, this measures the lost production. For example, if the average density of a plant is 30%, then you can assume the potential production lost is 30%. This concept can also be used for environmental weeds. For example if hornwort covers 35% of a freshwater body, this excludes native species from using that 35% of the water body. The projected density and therefore potential loss in production were placed into three categories according the characteristics of the plant (Richardson, D.M. *et al.* 2000. Naturalization and invasion of alien plants: concepts and definitions. *Diversity and distributions* 6: 93-107). DoC weed index score and Esler (1988) ratings were used to determine the category of each species. The scores are derived from assessing two sets of criteria for each pest plant

- i. the Biological Success Rating (BSR) of weed species , and
  - ii. effects on System (EoS), an assessment of the behaviour of a weed species in the community type and geographical location in New Zealand where it has its greatest conservation impact (Owen 1997).
- **Projected density is high:** transformer species (in suitable situations without control can achieve 100% cover) ~ 35% (conservative estimate).

- **Projected density is moderate to high:** can transform ecosystems under some, but not all, conditions/timeframes ~ 15%
- **Moderate:** expected to out compete native species locally ~ 10%

### 3.1.5 Total Area Potentially Infested (TAPI)

The total area potentially infested for all pest plants was calculated using the GIS Land Cover Database, based on the biological characteristics of the particular plant and Pest Plants Officer knowledge of the region.

### 3.1.6 Years to infest all TAPI

The time it would taken for the pest to infest all of the available habitat were estimated from Biosecurity staff knowledge of the region, estimation of unoccupied available habitat from GIS, and all the information available about the particular pest.

In New Zealand, Sullivan *et al* (2004) suggests that “*even within a 53,800 hectare area of largely open and frequently disturbed urban and suburban habitats, it still takes most plant species more than 50 years to become abundant.*” Furthermore, “*it takes most naturalised plants more than a century after naturalisation to appear in all ecologically suitable region scale areas of NZ*”.

This is similar to work on agricultural weeds by Dr Tereso Morfe from the Department of Primary Industry in Victoria, Australia; who classified weeds with a ‘high’ rate of spread as having a 75 year invasion period, weeds with a ‘moderately high’ rate of spread as having a 100 year invasion period, weeds with a ‘moderately low’ rate of spread as having a 125 year invasion period and weeds with a ‘low’ rate of spread as having a 200 year invasion period.

The average rate of spread is 100 years. Mitigating or exacerbating factors such as seed dispersal, cultivation, and seed production determine whether a plant is above or below the average.

### 3.1.7 Annual cost of control for landholders

The cost of weed control is varied between species. This is largely dependant on its life form (e.g., taller trees will cost more to control than smaller trees and shrubs), and the habitats in which it grows in (e.g., weeds in coastal habitats are more expensive to control due to inaccessibility and special equipment required). Where possible, recent contracts were used to determine the cost of control per hectare. This covers both the cost of chemicals and labour to treat a site. When current information was not available the costs of a species with similar control requirements were used.

### 3.1.8 Proportion of Landholders controlling the pest

Based on the experience of Biosecurity staff, Boundary Control species were assumed to be at approximately 5%. This is because the species are more widespread and recognised as weeds. Containment species were estimated to be controlled at 2%. Whereas Total Control, due to low distribution and because most landholders will be unlikely to recognise them as weeds, were estimated to be at about 0.5%.

### 3.1.9 Proportion of invested land where conservation values apply

Indigenous forest, coastal habitat and wetlands were considered to have 'conservation value'. The total habitat where 'conservation value' applied was then divided by the 'Total Potential Area Infested' to get the proportion of land where the conservation values would apply.

### 3.1.10 Years taken to achieve strategy objectives

For consistency between the no RPMS, Total Control and Containment assumptions, the years taken to achieve the objectives from 2006 was the same as the number of years it would take a plant to reach the 'Total Potential Area Infested'.

### 3.1.11 RPMS Scenario costs

Administration and overhead costs were calculated from the amount of resources required to implement each strategy scenario. Biosecurity staff time has been estimated at \$60 per hour. The costs of control for a particular weed species were calculated from the current contract costs per hectare. If that information was not available it was estimated from the costs of a weed with similar control requirements. For a few species such as gorse and ragwort, there is an additional cost of biological control. This is measured in the number of person hours it takes to release or distribute the biological control agent.

## 3.2 Proposed Surveillance pest plants

Surveillance pest species are those pest species in the Wellington region that may have the potential to have serious adverse effects on regional values. The distribution and impact of these pest species in the region has yet to be determined.

Greater Wellington will record and monitor the distribution and density of these plant species until 2012. At the five year review, an impact assessment of the pests will be completed to determine the potential adverse effects these species may have in the region. There is no strategy rule requiring land occupiers to control these species.

### 3.2.1 Surveillance pest species

- Alligator weed (*Alternanthera philoxeroides*)
- Apple of Sodom (*Solanum linnaeanum*)
- Asiatic knotweed (*Reynoutria japonica and hybrids*)
- Australian sedge (*Carex longebrachiata*)
- Bomarea (*Bomarea spp.*)
- Cape tulip (*Moraea flaccida*)
- Californian arrowhead (*Sagittaria montevidensis*)
- Californian bulrush (*Schoenoplectus californicus*)
- Chilean flame creeper (*Tropaeolum speciosum*)
- Chilean needle grass (*Nassella neesiana*)
- Chinese pennisetum (*Pennisetum alopecuroides*)
- Chocolate vine (*Akebia quinata*)
- Delta arrowhead (*Sagittaria platyphylla*)
- Fountain grass (*Pennisetum setaceum*)

- Giant knotweed (*Reynoutria sachalinensis*)
- Hawaiian arrowhead (*Sagittaria sagittifolia*)
- Houttuynia (*Houttuynia cordata*)
- Hydrilla (*Hydrilla verticillata*)
- Johnson grass (*Sorghum halepense*)
- Nassella tussock (*Nassella trichotoma*)
- Noogoora bur (*Xanthium occidentale*)
- Phragmites (*Phragmites australis*)
- Polypodium (*Polypodium vulgare*)
- Purple loosestrife (*Lythrum salicaria*)
- Pyp grass (*Ehrharta villosa*)
- Salvinia (*Salvinia molesta*)
- Senegal tea (*Gymnocoronis spilanthoides*)
- Spartina (*Spartina spp.*)
- Water hyacinth (*Eichhornia crassipes*)
- White edge nightshade (*Solanum marginatum*)
- White bryony (*Bryonia cretica ssp dioica*)

### 3.2.2 Surveillance RPMS – all species

The costs associated with the implementation of the Surveillance RPMS scenario for the pest species listed above are estimated for an integrated approach rather than focusing on individual species. The estimated cost for the Surveillance RPMS is \$30,000 per annum.

#### Expected regional costs (Surveillance RPMS)

Year	Regional costs \$	8% Discount	Net Present Value \$
1	30,000	1.000	30,000
2	30,000	0.926	27,780
3	30,000	0.857	25,710
4	30,000	0.794	23,820
5	30,000	0.735	22,050
<b>Total (Net Present Value)</b>			<b>129,360</b>

#### Section 72 (a) requirements

The benefits of having a Surveillance RPMS for all pest species listed arise from obtaining information on the distribution, density and impacts which outweigh the costs, after taking into account the likely consequences of inaction.

An RPMS to monitor and survey these pest species will have associated costs, but will assist in the early detection of potential pest species and their associated impacts. This will provide the necessary information in order to decide on appropriate pest status before regional costs of control are too high.



## Section 72 (b) – regional costs and benefits

Any benefits that would arise from regional intervention on rural and urban areas would accrue to the individual landowner. Regional intervention of Surveillance will result in better management of potential pest species. Greater Wellington is satisfied that the benefits of regional intervention exceed the benefits of individual intervention, therefore the requirements of section 72 (b) have been met.

## Section 72 (c) – strategy funding

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries and the benefits received will exceed the costs.

## Recommendations

Greater Wellington is satisfied that section 72 (a, b and ba) have been met for all pest species considered for inclusion in the Surveillance category. Therefore, Greater Wellington recommends that the above-mentioned species are included in the Wellington Regional Pest Management Strategy in the Surveillance category. Greater Wellington will record and monitor the distribution and density of these species for the duration of the strategy review period. An impact assessment of the pest species will be completed to further determine the potential impacts of these pest species in the region in order to decide appropriate long term action.

### 3.3 Proposed Total Control species

#### 3.3.1 African feather grass (*Pennisetum macrourum*)

African feather grass is a perennial grass which forms clumps with extensive rhizome roots. It grows erect cylindrical stems up to two metres high that emerge to form a crown. The leaves are light green and strongly ribbed on the upper surface. Numerous bristle-like seeds are produced in spikes that surround the flower head. African feather grass currently infests approximately 80 hectares in the Wellington region and is thought to have the potential to infest 384,648 hectares of pasture, river banks and roadsides. African feather grass invades pasture where it is able to out-compete desirable species and is unpalatable to stock.

#### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	80 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$313/ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	384,648 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$1,663/ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	0%

## Total Control assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	80 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0%

## Total Control costs

Greater Wellington staff estimate the current infestations of African feather grass in the Wellington region could be controlled for \$45,496 per annum (inclusive of control costs and administration).

Year	Regional Council Costs \$	8% Discount	NPV \$
1	45,496	1.000	45,496
2	45,496	0.926	42,129
3	45,496	0.857	38,990
4	45,496	0.794	36,124
5	45,496	0.735	33,440
6	45,496	0.681	30,983
7	45,496	0.630	28,662
8	45,496	0.583	26,524
9	45,496	0.540	24,568
Year 10 onward	45,496	6.253	284,486
<b>Total NPV</b>			<b>591,437</b>

- **Cost Benefit Analysis summary**

### No RPMS scenario

The outcome in the No RPMS Scenario results in a total damage of \$30,491,431 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$7,511,635.

### Total Control scenario

The outcome of the Total Control Scenario is a NPV of \$253,443 for administration, inspection, monitoring and enforcement, a NPV of \$337,994 for cost of control. The total cost to the region when the strategy is achieved is \$591,437 NPV at a discount rate of 8%.

### Section 72 (a)

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$6,920,198 NPV because the costs of undertaking the strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

## Section 72 (b)

The net regional benefits exceed the individual benefits by \$6,841,036 because the strategy prevents the spread of the pest onto 384,568 ha. Total Control therefore meets the requirements of section 72 (b) of the Act.

## Section 72 (a) (b)

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## Recommendation

Retain African feather grass in the Total Control category.

### 3.3.2 Bathurst bur (*Xanthium spinosum*)

Bathurst bur is an erect annual herb that can grow to one metre. The leaf stalks and stem nodes have one or two three-pronged yellow spines. The leaves are three-lobed, 7cm long, narrow and pointed. The upper surface of the leaf is dark green and shiny with a prominent white midrib. Bathurst bar is estimated to infest 260 hectares in Carterton and South Wairarapa. It has the potential to infest 384,648 hectares of pastoral land in the Wellington region. Bathurst bar spines can damage the feet of farm animals and add costs to woollen products. The seedlings are poisonous to stock.

## Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	260 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$313/ha
Proportion of production loss from infested land	(PPLIL)	10%
Total area potentially infested	(TAPI)	384,648 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$69/ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	3%

## Total Control assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	260 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0 %

## Total Control costs

Greater Wellington staff estimate the current infestations of Bathurst bur in the Wellington region could be controlled for \$10,560 per annum (inclusive of control costs and administration).

<b>Year</b>	<b>Regional Council Costs \$</b>	<b>8% Discount</b>	<b>NPV \$</b>
1	12,883	1.000	12,883
2	12,883	0.926	11,930
3	12,883	0.857	11,041
4	12,883	0.794	10,229
5	12,883	0.735	9,469
6	12,883	0.681	8,773
7	12,883	0.630	8,116
8	12,883	0.583	7,511
9	12,883	0.540	6,957
Year 10 onward	12,883	6.253	80,557
<b>Total NPV</b>			<b>167,476</b>

- **Cost Benefit Analysis summary**

#### **No RPMS scenario**

The outcome in the No RPMS Scenario results in a total damage of \$12,325,661 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$3,864,205.

#### **Total Control scenario**

Currently staff are undertaken the control work of Bathurst bur themselves. The outcome of the Total Control Scenario is a NPV of \$167,476 for inspection including control cost at a discount rate of 8%.

#### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$3,696,729 NPV because the costs of undertaking the strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

#### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$3,592,591 because the strategy prevents the spread of the pest onto 384,388 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

#### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

#### **Recommendation**

Retain Bathurst bur in the Total Control category.

### 3.3.3 Blue passion flower (*Passiflora caerulea*)

Blue passion flower is a tall growing vine with angular shoots and five lobbed leaves. It has non-tubular white flowers with a ring of purple filaments and a round yellow fruit. Blue passion flower is estimated to infest 34 hectares in the Wellington region and it could potential adversely affect 274,773 hectares of forest, scrub and coastal habitat in the region. Blue passion flower grows quickly to mid-high canopy and forms large masses. It is capable of causing damage by smothering plants in coastal environments, lowlands and forest margins and prevents natural regeneration.

#### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	34 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$114/ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	274,773 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$253/ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	78%

#### Total Control assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	34 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0%

#### Total Control costs

Greater Wellington staff estimate the current infestations of blue passion flower in the Wellington region could be controlled for \$69,999 per annum (inclusive of control costs and administration).

Year	Regional Council Costs \$	8% Discount	NPV \$
1	69,999	1.000	69,999
2	69,999	0.926	64,819
3	69,999	0.857	59,989
4	69,999	0.794	55,579
5	69,999	0.735	51,449
6	69,999	0.681	47,879
7	69,999	0.630	44,099
8	69,999	0.583	40,809
9	69,999	0.540	37,799
Year 10 onward	69,999	6.253	437,704
<b>Total NPV</b>			<b>909,969</b>

- **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$6,006,114 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$1,131,792.

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$357,480 for administration, inspection, monitoring and enforcement, a NPV of \$552,489 for cost of control. The total cost to the region when the strategy is achieved is \$909,969 NPV at a discount rate of 8%. This amounts to approximately \$1 per hectare of preventing damage to regional values.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$221,823 NPV because the costs of undertaking the strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$765,049 because the strategy prevents the spread of the pest onto 274,739 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

### **Recommendation**

Retain blue passion flower in the Total Control category.

#### **3.3.4 Climbing spindleberry (*Celastrus orbiculatus*)**

Climbing spindleberry is a deciduous climber with woody stems that can grow up to 12 metres. The leaves are alternate, 5 to 10mm long and finely serrated. The flowers are insignificant and pale green. Climbing spindle berry is estimated to infest 19 hectares in the Wellington region and has the potential to adversely affect 276,549 hectares. Climbing spindleberry grows quickly to the mid canopy where it may strangle its host and cause collapse.

## Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	19 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$115/ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	276,549 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$468/ha
Proportion of landholders controlling Pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	78%

## Total Control assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	19 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0%

## Total Control costs

Greater Wellington staff estimate the current infestations of climbing spindleberry in the Wellington region could be controlled for \$17,794 per annum (inclusive of control costs and administration).

Year	Regional Council Costs \$	8% Discount	NPV \$
1	17,794	1.000	17,794
2	17,794	0.926	16,477
3	17,794	0.857	15,249
4	17,794	0.794	14,128
5	17,794	0.735	13,079
6	17,794	0.681	12,118
7	17,794	0.630	11,210
8	17,794	0.583	10,374
9	17,794	0.540	9,609
Year 10 onward	17,794	6.253	111,266
<b>Total NPV</b>			<b>231,317</b>

- **Cost Benefit Analysis summary**

### No RPMS scenario

The outcome in the No RPMS scenario results in a total damage of \$7,253,094 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$1,242,342.

## Total Control scenario

The outcome of the Total Control scenario is a NPV of \$145,116 for administration, inspection, monitoring and enforcement, a NPV of \$86,201 for cost of control. The total cost to the region when the strategy is achieved is \$231,317 NPV at a discount rate of 8%. This amount to approximately \$5/ha of preventing damage to regional values.

### Section 72 (a)

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$1,011,025 NPV because the costs of undertaking the strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### Section 72 (b)

The net regional benefits exceed the individual benefits by \$1,091,151 because the strategy prevents the spread of the pest onto 276,530 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### Section 72 (a) and (b)

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## Recommendation

Retain climbing spindleberry in the Total Control category.

### 3.3.5 Eelgrass (*Vallisneria spp.*)

Eelgrass is a submerged aquatic plant with strap leaves that arise from stout rhizomes. The leaves are winged at the base and can grow from 5cm to 5 metres. Eelgrass forms a dense mass of plant tissue through the entire water column in standing or flowing waters. It will colonise sandy to silty sediments, although dispersal is largely limited to rhizome extent. Eelgrass currently infests approximately two hectares in the Wellington region and has the potential to adversely affect 11,678 hectares of lakes, ponds or rivers. Eelgrass will out-compete native wetland plants, decrease water quality and potentially negatively impact the native biodiversity of aquatic habitats.

### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	2 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$185/ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	11,678 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$297/ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	100%



## Total Control assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	2 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0%

## Total Control costs

Greater Wellington staff estimate the current infestations of eelgrass in the Wellington region could be controlled for \$3,521 per annum (inclusive of control costs and administration).

Year	Regional Council Costs \$	8% Discount	NPV \$
1	3,521	1.000	3,521
2	3,521	0.926	3,260
3	3,521	0.857	3,017
4	3,521	0.794	2,796
5	3,521	0.735	2,588
6	3,521	0.681	2,398
7	3,521	0.630	2,218
8	3,521	0.583	2,053
9	3,521	0.540	1,901
Year 10 onward	3,521	6.253	22,967
<b>Total NPV</b>			<b>45,772</b>

- **Cost Benefit Analysis summary**

### No RPMS scenario

The outcome in the No RPMS scenario results in a total damage of \$386,880 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$74,445.

### Total Control scenario

The outcome of the Total Control scenario is a NPV of \$41,872 for administration, inspection, monitoring and enforcement, a NPV of \$3,900 for cost of control. The total cost to the region when the strategy is achieved is \$45,772 NPV at a discount rate of 8%. This amount to approximately \$3/ha of preventing damage to regional values.

### Section 72 (a)

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$28,673 NPV because the costs of undertaking the strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

## Section 72 (b)

The net regional benefits exceed the individual benefits by \$31,948 because the strategy prevents the spread of the pest onto 11,677 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

## Section 72 (a) and (b)

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## Recommendation

Retain eelgrass in the Total Control category.

### 3.3.6 Madeira vine (*Anredera cordifolia*)

Madeira vine is a perennial creeper arising from a fleshy rhizome. The leaves are heart shaped, alternate and grow from reddish brown stems. It has distinctive wart like tubers and numerous small white fragrant flowers. Madeira vine is estimated to infest 15 hectares and has the potential to adversely affect 303,101 hectares of scrub, forest and coastal habitat in the Wellington region. Madeira vine has the ability to compete and displace native plants and can affect native plant succession, and in some instances modify ecosystem structure.

## Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	15 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$111/ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	303,101 ha
Years to infest all of TAPI	(YI)	100 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$1550/ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	71%

## Total Control assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	15 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0%

## Total Control costs

Greater Wellington staff estimate the current infestations of Madeira vine in the Wellington region could be controlled for \$38,044 per annum (inclusive of control costs and administration).

Year	Regional Council Costs \$	8% Discount	NPV \$
1	38,044	1.000	38,044
2	38,044	0.926	35,229
3	38,044	0.857	32,604
4	38,044	0.794	30,207
5	38,044	0.735	27,962
6	38,044	0.681	25,908
7	38,044	0.630	23,968
8	38,044	0.583	22,180
9	38,044	0.540	20,544
Year 10 onward	38,044	6.253	237,890
<b>Total NPV</b>			<b>494,563</b>

- **Cost Benefit Analysis summary**

### No RPMS scenario

The outcome in the No RPMS scenario results in a total damage of \$15,016,508 per annum in 100 years as a result of production losses and additional costs of control. This is a net present value of \$737,438.

### Total Control scenario

The outcome of the Total Control scenario is a NPV of \$312,436 for administration, inspection, monitoring and enforcement, a NPV of \$182,127 for cost of control. The total cost to the region when the strategy is achieved is \$494,563 NPV at a discount rate of 8%. This amount to approximately \$1/ha of preventing damage to regional values.

### Section 72 (a)

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$233,513 NPV because the costs of undertaking the strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### Section 72 (b)

The net regional benefits exceed the individual benefits by \$406,702 because the strategy prevents the spread of the pest onto 303,086 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

**Section 72 (a) and (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

**Recommendation**

Retain Madeira vine in the Total Control category.

**3.3.7 Manchurian wild rice (*Zizania latifolia*)**

Manchurian wild rice is a tall perennial wetland grass. The leaves are 50 - 100cm long, 2 - 3cm wide and are usually erect. The blades have a stout midrib tapering to a sharp point at the tip. Manchurian wild rice currently infests one 50 hectare site in Kapiti and has the potential to infest 4,716 hectares of wetlands in the Wellington region. Manchurian wild rice can cause significant change to natural vegetation by dominating and suppressing the growth of native wetland plants.

**Based assumptions**

	<b>Abbreviation</b>	<b>Values</b>
Discount rate		8%
Initial area infested (ha)	(IAI)	50 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$185/ha
Proportion of production loss from infested land	(PPLIL)	35%
Total area potentially infested	(TAPI)	4,716 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$80/ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	100%

**Total Control assumptions**

	<b>Abbreviation</b>	<b>Values</b>
Current area Infested (ha)	(CAI)	50 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0%

**Total Control Costs**

Greater Wellington staff estimate the current infestations of Manchurian wild rice in the Wellington region could be controlled for \$31,757 per annum (inclusive of control costs and administration).

Year	Regional Council Costs \$	8% Discount	NPV \$
1	31,757	1.000	31,757
2	31,757	0.926	29,407
3	31,757	0.857	27,216
4	31,757	0.794	25,215
5	31,757	0.735	23,341
6	31,757	0.681	21,627
7	31,757	0.630	20,007
8	31,757	0.583	18,514
9	31,757	0.540	17,149
Year 10 onward	31,757	6.253	198,577
<b>Total NPV</b>			<b>412,833</b>

- **Cost Benefit Analysis summary**

#### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$306,800 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$262,873.

#### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$22,841 for administration, inspection, monitoring and enforcement, a NPV of \$389,993 for cost of control. The total cost to the region when the strategy is achieved is \$412,834 NPV at a discount rate of 8 %.

#### **Section 72 (a)**

The net outcome for Total Control produces a net negative benefit of - \$149,961 NPV, and therefore it does not meet the requirements of section 72 (a) of the Act. However, the benefits of implementing RPMS for Manchurian wild rice arise from preventing damages to the values associated with inland wetland, coastal wetland, river and lakeshore. In absence of a control programme the area infested with Manchurian wild rice is expected to increase significantly. It is the opinion of Greater Wellington that these benefits outweigh the costs when compared to the No RPMS, and therefore the requirements of section 72 (a) have been met.

#### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$199,369 because the strategy prevents the spread of the pest onto 4,666 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

#### **Section 72 (a) and (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

#### **Recommendation**

Retain Manchurian wild rice in the Total Control category.

### 3.3.8 Moth plant (*Araujia sericifera*)

Moth plant is a slender, evergreen climbing vine. The leaves are lance shaped and dark green. The flowers are small and creamy coloured and occur from December through to May. The fruits contain 500 seeds attached to silky threads and are released as the pods dry out. Moth plant currently infests 13 hectares and has the potential to infest 298,521 hectares of forest and scrub habitat in the Wellington region. Moth plant has the ability to compete with, smother and replace native plant species.

#### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	13 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$110/ha
Proportion of production loss from infested land	(PPLIL)	35%
Total area potentially infested	(TAPI)	298,521 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$836/ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	71%

#### Total Control assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	13 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0%

#### Total Control costs

Greater Wellington staff estimate the current infestations of moth plant in the Wellington region could be controlled for \$30,398 per annum (inclusive of control costs and administration).

Year	Regional Council Costs (A) \$	8% Discount	NPV \$
1	30,398	1.000	30,398
2	30,398	0.926	28,149
3	30,398	0.857	26,051
4	30,398	0.794	24,136
5	30,398	0.735	22,342
6	30,398	0.681	20,699
7	30,398	0.630	19,151
8	30,398	0.583	17,722
9	30,398	0.540	16,415
Year 10 onward	30,398	6.253	190,079
<b>Total NPV</b>			<b>395,166</b>

- **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS Scenario results in a total damage of \$16,274,055 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$2,742,877.

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$241,379 for administration, inspection, monitoring and enforcement, a NPV of \$153,787 for cost of control. The total cost to the region when the strategy is achieved is \$395,166 NPV at a discount rate of 8%. This amounts to \$11 per hectare of preventing damage to regional values.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$2,347,711 NPV because the costs of undertaking the strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$2,492,910 because the strategy prevents the spread of the pest onto 298,508 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) and (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

### **Recommendation**

Retain moth plant in the Total Control category.

#### **3.3.9 Perennial nettle (*Urtica dioica*)**

Perennial nettle is a clump forming nettle with a rhizomatous root system which grows to 50cm in height. Erect stems grow from a rootstock and have bristly stinging hairs and few branches. The leaves also have stinging hairs, are heart shaped and are sharply toothed. The perennial nettle currently infests approximately 201 hectares and has the potential to infest 659,903 hectares of pasture and scrub in the Wellington region. Perennial nettle is unpalatable to stock and forms dense clumps, excluding desirable pasture species.

## Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	201 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$231/ha
Proportion of production loss from infested land	(PPLIL)	35%
Total area potentially infested	(TAPI)	659,903 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$236/ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	33%

## Total Control assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	201 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0%

## Total Control costs

Greater Wellington staff estimate the current infestations of perennial nettle in the Wellington region could be controlled for \$118,506 per annum (inclusive of control costs and administration).

Year	Regional Council Costs \$	8% Discount	NPV \$
1	118,506	1.000	118,506
2	118,506	0.926	109,737
3	118,506	0.857	101,560
4	118,506	0.794	94,094
5	118,506	0.735	87,102
6	118,506	0.681	80,703
7	118,506	0.630	74,659
8	118,506	0.583	69,089
9	118,506	0.540	63,993
Year 10 onward	118,506	6.253	741,018
<b>Total NPV</b>			<b>1,540,549</b>

- **Cost Benefit Analysis summary**

### No RPMS scenario

The outcome in the No RPMS scenario results in a total damage of \$55,325,024 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$13,632,227.



## Total Control scenario

The outcome of the Total Control scenario is a NPV of \$278,494 for administration, inspection, monitoring and enforcement, a NPV of \$1,262,055 for cost of control. The total cost to the region when the strategy is achieved is \$1,540,549 NPV at a discount rate of 8%. This amounts to approximately \$57/ha of preventing damage to the regional values.

### Section 72 (a)

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$12,091,678 NPV because the costs of undertaking the strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### Section 72 (b)

The net regional benefits exceed the individual benefits by \$13,143,083 because the strategy prevents the spread of the pest onto 659,702 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### Section 72 (a) and (b)

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## Recommendation

Retain perennial nettle in the Total Control category.

### 3.3.10 Saffron thistle (*Carthamus lanatus*)

Saffron thistle is an erect annul thistle that can grow up to one metre. It has stoutly branched, fleshy taproots up to 40cm deep. The stems are white, yellowish–white or pale green. There is generally only a single stem that is multi-branched. The flower heads are solitary and composed of yellow florets. Saffron thistle currently infests 13 hectares in the Wairarapa and has the potential to adversely affect 384,648 hectares of pasture in the Wellington region. Saffron thistle competes with pasture species reducing carry capacity and reduces stock movement. It can cause vegetable faults and reduce the yield of certain crops.

### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	13 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$313/ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	384,648 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$69/ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	0%

**Total Control assumptions**

	<b>Abbreviation</b>	<b>Values</b>
Current area infested (ha)	(CAI)	13 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0%

**Total Control costs**

Greater Wellington staff estimate the current infestations of saffron thistle in the Wellington region could be controlled for \$9,955 per annum (inclusive of control costs and administration).

<b>Year</b>	<b>Regional Council Costs \$</b>	<b>8% Discount</b>	<b>NPV \$</b>
1	9,955	1.000	9,955
2	9,955	0.926	9,218
3	9,955	0.857	8,531
4	9,955	0.794	7,904
5	9,955	0.735	7,317
6	9,955	0.681	6,779
7	9,955	0.630	6,272
8	9,955	0.583	5,804
9	9,955	0.540	5,376
Year 10 onward	9,955	6.253	62,249
<b>Total NPV</b>			<b>129,413</b>

- **Cost Benefit Analysis summary**

**No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$18,225,007 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$2,770,243.

**Total Control scenario**

Currently staff are undertaking the control work of saffron thistle themselves. The outcome of the Total Control scenario is a NPV of \$129,413 for inspection including control cost at a discount rate of 8%.

**Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$2,640,830 NPV because the costs of undertaking the strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

## Section 72 (b)

The net regional benefits exceed the individual benefits by \$2,633,130 because the strategy prevents the spread of the pest onto 384,635 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

## Section 72 (a) and (b)

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## Recommendation

Retain saffron thistle in the Total Control category.

### 3.3.11 Woolly nightshade (*Solanum mauritianum*)

Woolly nightshade is a shrub or small tree which can grow up to 10 metres in height. The leaves are ovate, greyish green on the upper surface and white to yellowish green on the lower surface. The flowers have five purple lobes with a yellow centre and form clusters at the end of branches. Woolly nightshade currently infests 63 hectares and has the potential to adversely impact 278,046 hectares in the Wellington region. Woolly nightshade has the ability to invade scrubland and short tussock land. Woolly nightshade can also form pure colonies and has the ability to suppress the regeneration of native species.

## Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	63 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$115/ha
Proportion of production loss from infested land	(PPLIL)	10%
Total area potentially infested	(TAPI)	278,046 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$206/ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	77%

## Total Control assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	63 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0%

## Total Control costs

Greater Wellington staff estimate the current infestations of woolly nightshade in the Wellington region could be controlled for \$22,088 per annum (inclusive of control costs and administration).

Year	Regional Council Costs \$	8% Discount	NPV \$
1	22,088	1.000	22,088
2	22,088	0.926	20,453
3	22,088	0.857	18,929
4	22,088	0.794	17,538
5	22,088	0.735	16,235
6	22,088	0.681	15,042
7	22,088	0.630	13,915
8	22,088	0.583	12,877
9	22,088	0.540	11,928
Year 10 onward	22,088	6.253	138,116
<b>Total NPV</b>			<b>287,138</b>

- **Cost Benefit Analysis Summary**

#### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$4,283,896 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$894,943.

#### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$79,935 for administration, inspection, monitoring and enforcement, a NPV of \$207,203 for cost of control. The total cost to the region when the strategy is achieved is \$287,138 NPV at a discount rate of 8%. This amounts to approximately \$3 per hectare of preventing damage to the regional values.

#### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$607,805NPV because the costs of undertaking the strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

#### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$802,970 because the strategy prevents the spread of the pest onto 277,984 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

#### **Section 72 (a) and (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

**Recommendation**

Retain woolly nightshade in the Total Control category.

### 3.4 Proposed Containment

#### 3.4.1 Boneseed (*Chrysanthemoides monilifera*)

Boneseed is a bushy, multi-branched shrub that can grow up to three metres tall. The leaves are leathery with a powdery surface. It produces yellow daisy like flowers from early spring to summer. Boneseed is currently estimated to infest 6,564 hectares in the Wellington region with the potential to infest 87,956 hectares if it were to be left alone. A single boneseed plant is able to produce 50,000 seeds per season. The seeds are capable of remaining dormant for many years. Boneseed has the ability to colonise and replace indigenous coastal vegetation.

#### Base assumptions

	Abbreviation	Values
Discount rate		8 %
Initial area infested (ha)	(IAI)	6,564 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$71 / ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	87,956 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$98 / ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	2%

#### Containment assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	6,564 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	6,060 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15%

#### Containment scenario

Boneseed is common throughout coastal areas of the region. However the distribution and density of boneseed within the proposed control area is at a level where infestations are manageable. The Containment RPMS assumes approximately around 504 hectares of boneseed can be eradicated from coastal areas of Kapiti, Porirua and Wairarapa. The initial control costs associated with this scenario are \$68,109 (including administration) and should decrease over time (at a rate of 10%) as the area infested in these parts of the region is reduced.

## Annual Cost of Control for Containment of boneseed

Year	Control + Regional Council Costs \$	8% Discount	NPV \$
1	68,109	1.000	68,109
2	61,299	0.926	56,763
3	55,170	0.857	47,281
4	49,653	0.794	39,424
5	44,688	0.735	32,846
6	40,220	0.681	27,390
7	36,198	0.630	22,805
8	32,579	0.583	18,994
9	29,322	0.540	15,834
Year 10 Onward	26,390	6.253	165,017
<b>Total NPV</b>			<b>494,463</b>

- **Cost Benefit Analysis summary**

### No RPMS scenario

The outcome in the No RPMS Scenario results in a total damage of \$1,090,391 per annum in 75 years as a result of environmental losses and additional costs of control. This is a net present value of \$2,542,790.

### Containment scenario

The Containment scenario has initial costs of \$68,109. The cost to the region by the end of the strategy is \$494,463 NPV.

### Section 72 (a)

The net outcome for containment when compared with the No RPMS approach produces a net positive benefit of \$1,224,728 NPV and therefore it meets the requirements of section 72 (a) of the Act.

### Section 72 (b)

The net regional benefits exceed the individual benefits by \$1,048,290 because the strategy prevents the spread of the pest onto 81,392 hectares. Containment therefore meets the requirements of section 72 (b) of the Act.

### Section 72 (a) (b)

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

### Recommendation

Retain boneseed in the Containment category.

### 3.4.2 Evergreen buckthorn (*Rhamnus alaternus*)

Evergreen buckthorn is a tree that can grow to approximately 10 metres high. It has glossy green leaves and pale green, fragrant and inconspicuous flowers. Flowering occurs between May to November followed by numerous red berries. Evergreen buckthorn is a fast growing species that can form dense stands preventing the regeneration of native species. It can grow in a variety of habitats including coastal environments, shrub lands, forest margins, plantations and gardens. Evergreen buckthorn is estimated to have infested 7,343 hectares in the Wellington region and is thought to have the potential to adversely affect 222,414 hectares.

#### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	7,343 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$111 / ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	222,414 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$567 / ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	72%

#### Containment assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	7,343 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	7,311 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15%

#### Containment scenario

Evergreen buckthorn is widespread throughout Wellington City and some coastal areas of the Greater Wellington region. The Containment RPMS assumes approximately 80 hectares (at approximately 25% coverage) of evergreen buckthorn can be eradicated from unmodified coastal areas of Kapiti. The initial control costs associated with this scenario are \$45,360 and decrease over time (20% per annum) as the area infested in this part of the region is reduced. Annual regional costs for inspection, monitoring and administration are approximately \$3,514 per annum.



## Annual Cost of Control (Containment)

Year	Control Costs \$	8% Discount	NPV \$
1	48,874	1.000	48,874
2	39,099	0.926	36,206
3	31,279	0.857	26,806
4	25,023	0.794	19,868
5	20,018	0.735	14,713
6	16,014	0.681	10,906
7	12,811	0.630	8,071
8	10,249	0.583	5,975
9	8,199	0.540	4,427
Year 10 onward	6,559	6.253	41,013
<b>Total NPV</b>			<b>216,859</b>

- **Cost Benefit Analysis summary**

### No RPMS scenario

The outcome in the No RPMS scenario results in a total damage of \$6,149,791 per annum in 75 years as a result of environmental losses and additional costs of control. This is a net present value of \$8,829,294.

### Containment scenario

The Containment scenario has an initial cost of \$48,874. The cost to the region by the end of the strategy is \$216,859 NPV.

### Section 72 (a)

The net outcome for Containment when compared with the No RPMS approach produces a net positive benefit of \$7,078,909 NPV and therefore it meets the requirements of section 72 (a) of the Act.

### Section 72 (b)

The net regional benefits exceed the individual benefits by \$6,074,477 because the strategy prevents the spread of the pest onto 215,071 hectares. Containment therefore meets the requirements of section 72 (b) of the Act.

### Section 72 (a) (b)

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

### Recommendation

Retain evergreen buckthorn in the Containment category.

### 3.4.3 Hornwort (*Ceratophyllum demersum*)

Hornwort is a dark green, submerged free floating freshwater plant. Its leaves are dark green and in whorls of 5 - 12 and 1 - 4cm long. Hornwort has long elongate stems 30 to 60cm long, that are brittle and stiffly branched, or cord like and flexible. The flowers are greenish and inconspicuous. Hornwort can inhabit still or slow moving freshwater bodies up to 10 metres deep. If established it will compete and displace native aquatic plants species, thus threatening the natural biodiversity of the freshwater environment. Outside the containment zone hornwort is estimated to infest approximately 0.1 hectares in 43 small sites. If left to spread hornwort could potentially adversely affect 8,500 hectares of freshwater habitat in the Wellington region.

#### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	0.1 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$185 / ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	8,500ha
Years to infest all of TAPI	(YI)	100 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$660 / ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservational values apply (%)	(PILCVA)	100%

#### Containment assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	0.1 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	0
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0

#### Containment scenario

Many of the current 43 sites outside of the Containment zone are confined to small, manageable backyard ponds, lined with concrete or polythene. In this situation spread is very limited and the duration for controlling the infestation in terms of years is significantly reduced. As most of the work will be done internally, Greater Wellington Biosecurity staff estimate the infestation of hornwort outside the Containment zone could be controlled at an initial cost of \$5,856 per annum and subsequently is expected to decrease by 30% per annum as the infestation is reduced.

Year	Regional Council Costs \$	8% Discount	NPV \$
1	5,856	1.000	5,856
2	4,099	0.926	3796
3	2,869	0.857	2,459
4	2,009	0.794	1,595
5	1,407	0.735	1,034
6	986	0.681	671
7	691	0.630	435
8	484	0.583	282
9	339	0.540	183
Year 10 onward	238	6.253	1,488
<b>Total NPV</b>			<b>17,800</b>

- **Cost Benefit Analysis summary**

### **No RPMS Scenario**

The outcome in the No RPMS scenario results in a total damage of \$343,358 per annum in 100 years as a result of production losses and additional costs of control. This is a net present value of \$14,290.

### **Containment scenario**

The Containment Scenario has an initial cost of \$5,856. The cost to the region by the end of the strategy is \$17,800 NPV.

### **Section 72 (a)**

The net outcome for Containment when compared with the No RPMS approach produces a net negative benefit of -\$3,560 NPV and therefore it does not meet the requirements of Section 72 (a) of the Act.

### **Section 72 (b)**

There is a negative regional benefit of -\$3,560 therefore the requirements of section 72 (b) of the Act are not met.

### **Section 72 (a) (b)**

Although hornwort does not meet the requirements of section 72 (a) or (b) of the Act, Greater Wellington proposes that hornwort remain as a Containment pest plants as the area currently infested outside the Containment zone is manageable. Many of the current sites outside of the Containment zones are confined to small, manageable backyard pond, lined with concrete or polythene. In this situation spread is very limited and the duration for controlling the infestation in terms of years is significantly reduced. The costs of the strategy should be charged through a general rate to the regional community as beneficiaries.

## Recommendation

Despite the CBA indicating that hornwort should be moved to the Site Led category, Greater Wellington believes that the nature of the current control sites is such that Total Control will be achieved in these pond situations and greatly reduce the potential of movement of plant material from current control sites.

Trials using Endothall are still ongoing and have great potential in controlling this species. Therefore Greater Wellington recommends that hornwort be retained in the Containment category.

### 3.4.4 Sweet pea shrub (*Polygala myrtifolia*)

Sweet pea shrub is a multi-branched perennial shrub that grows to approximately two metres high. The leaves are light green; the flowers are pea like and grow in clusters at the end of each branchlet. Sweet pea shrub is thought to currently infest approximately 7 hectares in the Wellington region. If left uncontrolled sweet pea shrub has the potential to adversely affect 1,402 hectares of coastal habitat in the Wellington region. Sweet pea shrub has the ability to invade and drastically alter the ecology of coastal areas.

### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	7 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$185 / ha
Proportion of production loss from infested land	(PPLIL)	10%
Total area potentially infested	(TAPI)	1,402 ha
Years to infest all of TAPI	(YI)	100 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$98 / ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	100%

### Containment assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	7 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	6.5 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	0 %

### Containment scenario

Within the proposed control area, there is a small patch of around 500m<sup>2</sup> of sweet pea shrub located on the coastal face of Pukerua Bay. Greater Wellington staff estimate this infestation of sweet pea shrub could be controlled at a cost of \$293 per annum.

Year	Regional Council Costs \$	8% Discount	NPV \$
1	293	1.000	293
2	293	0.926	271
3	293	0.857	251
4	293	0.794	232
5	293	0.735	215
6	293	0.681	200
7	293	0.630	185
8	293	0.583	171
9	293	0.540	158
Year 10 onward	293	6.253	1,832
<b>Total NPV</b>			<b>3,809</b>

### Total Control assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	7 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	2 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	10%

### Total Control scenario

Based on current control work undertaken by Greater Wellington staff and contractors, to eradicate all known sweet pea shrub sites found in the region it would cost approximately \$14,800 per annum.

Year	Regional Council Costs \$	8% Discount	NPV \$
1	14,800	1.000	14,800
2	14,800	0.926	13,704
3	14,800	0.857	12,683
4	14,800	0.794	11,751
5	14,800	0.735	10,878
6	14,800	0.681	10,078
7	14,800	0.630	9,324
8	14,800	0.583	8,628
9	14,800	0.540	7,992
Year 10 onward	14,800	6.253	92,544
<b>Total NPV</b>			<b>192,396</b>

- **Cost Benefit Analysis summary**

#### No RPMS scenario

The outcome in the No RPMS scenario results in a total damage of \$28,170 per annum in 100 years as a result of environmental losses and additional costs of control. This is a net present value of \$9,384.

## **Containment scenario**

The Containment scenario has initial cost of \$293. The cost to the region by the end of the strategy is \$3,809 NPV.

### **Section 72 (a)**

The net outcome for Containment when compared with the No RPMS approach produces a net positive benefit of \$5,575 NPV and therefore it meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$3,763 because the strategy prevents the spread of the pest onto 1,395 hectares. Containment therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## **Total Control scenario**

The Total Control scenario has initial cost of \$14,800. The cost to the region by the end of the strategy is \$192,396.

### **Section 72 (a)**

The net outcome for Total Control produces a negative benefit of -\$183,012 NPV and therefore it does not meet the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net outcome for Total Control produces a negative regional benefit of -\$184,825 NPV and therefore it does not meet the requirements of section 72 (b) of the Act.

## **Recommendation**

Containment is the preferred option as it produces a net positive benefit at the lowest costs. This enables Greater Wellington to further advance with the excellent control achieved to date at Pukerua Bay and to protect the region's coastal escarpments from sweet pea shrub invasion.

### 3.5 Proposed Site Led Boundary Control

#### 3.5.1 Banana passionfruit (*Passiflora mixta* / *P.mollisima*)

Banana passionfruit is a vigorous high climbing vine. Its leaves are three fingered with large hanging pink flowers. The fruit are 10cm long, oval, ripening to orange-yellow and containing edible orange pulp with small black seeds. The seed can be dispersed by possums, birds and humans. Banana passionfruit can also grow from stem fragments. Banana passionfruit is fast growing and the vines can smother and overtop trees in native forests and scrub. This can cause irreversible change to ecosystem structure. Banana passionfruit is widespread in urban areas and is estimated to infest approximately 16,050 hectares in the Wellington region, with the ability to infest 289,421 hectares. Banana passionfruit grows in shrub lands, forest margins, roadsides, gardens and wastelands.

#### Base assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	16,050 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$111 / ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	289,421 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$600 / ha
Proportion of landholders controlling pest (%)	(PLCP)	5%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	73%

#### Site Led (Boundary Control) assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	16,050 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	16,050 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15%

#### Site Led (Boundary Control) scenario

For the Site Led (Boundary Control) scenario, Greater Wellington's costs for inspection, administration and enforcement are estimated to be approximately \$13,835 per year.

Year	Regional Council Costs \$	8% Discount	NPV \$
1	13,835	1.000	13,835
2	13,835	0.926	12,811
3	13,835	0.857	11,857
4	13,835	0.794	10,985
5	13,835	0.735	10,167
6	13,835	0.681	9,427
7	13,835	0.630	8,716
8	13,835	0.583	8,066
9	13,835	0.540	7,471
Year 10 onward	13,835	6.253	86,510
<b>Total NPV</b>			<b>179,852</b>

- **Cost Benefit Analysis Summary**

**No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$13,260,547 per annum in 75 years as a result of environmental losses and additional costs of control. This is a net present value of \$24,693,035.

**Site Led (Boundary Control) scenario**

The Site Led (Boundary Control) scenario has a cost of approximately \$13,835 per annum. The cost to the region by the end of the strategy is \$179,852 NPV.

**Section 72 (a)**

The net outcome for Site Led (Boundary Control) when compared with the No RPMS approach produces a net positive benefit of \$21,152,982 NPV and therefore it meets the requirements of section 72 (a) of the Act.

**Section 72 (b)**

The net regional benefits exceed the individual benefits by \$15,321,046 because the strategy prevents the spread of the pest onto 273,371 hectares. Site Led (Boundary Control) therefore meets the requirements of section 72 (b) of the Act.

**Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs. Those on whose property the pest currently exist are exacerbators, and can reasonably be charged the cost of control.

**Recommendation**

Greater Wellington proposes that banana passionfruit be included in the RPMS as Site Led (Boundary Control) as the highest benefit from managing this species occurs on sites that are adjacent to an area that is currently clear.

**3.5.2 Blackberry (*Rubus fruticosus*)**

Blackberry is a prickly, scrambling shrub. It has pink to white flowers in clusters and edible black berries in mid to late summer. Blackberry is widespread and abundant throughout the region and is estimated to infest at least 3,210 hectares, with the potential of adversely 78,910 hectares of scrub and wetland areas in the Wellington region. The seeds of blackberry are dispersed by birds and new plants can also form suckers from a partially buried regenerative crown. Blackberry forms impenetrable thickets, which may exclude native species and prevent regeneration. Blackberry thickets can limit recreational use.



## Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	3,210 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$71 / ha
Proportion of production loss from infested land	(PPLIL)	15 %
Total area potentially infested	(TAPI)	78,910 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$600 / ha
Proportion of landholders controlling pest (%)	(PLCP)	5%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	2%

## Site Led (Boundary Control) assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	3,210 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	3,210 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15%

## Site Led (Boundary Control) scenario

For the Site Led (Boundary Control) Greater Wellington's costs for inspection, administration and enforcement are estimated to be approximately \$10,980 per year.

Year	Regional Council Costs \$	8% Discount	NPV \$
1	10,980	1.000	10,980
2	10,980	0.926	10,167
3	10,980	0.857	9,410
4	10,980	0.794	8,718
5	10,980	0.735	8,070
6	10,980	0.681	7,477
7	10,980	0.630	6,917
8	10,980	0.583	6,401
9	10,980	0.540	5,929
Year 10 onward	10,980	6.253	68,658
<b>Total NPV</b>			<b>142,737</b>

### • Cost Benefit Analysis Summary

#### No RPMS scenario

The outcome in the No RPMS Scenario results in a total damage of \$3,167,928 per annum in 75 years as a result of environmental losses and additional costs of control. This is a net present value of \$5,308,645.

#### Site Led (Boundary Control) scenario

The Site Led (Boundary Control) scenario has a cost of approximately \$10,980 per annum. The cost to the region by the end of the strategy is \$142,737 NPV.

### Section 72 (a)

The net outcome for Site Led (Boundary Control) when compared with the No RPMS approach produces a net positive benefit of \$4,734,830 NPV and therefore it meets the requirements of section 72 (a) of the Act.

### Section 72 (b)

The net regional benefits exceed the individual benefits by \$3,555,046 because the strategy prevents the spread of the pest onto 75,700 hectares. Site Led (Boundary Control) therefore meets the requirements of section 72 (b) of the Act.

### Section 72 (a) (b)

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs. Those on whose property the pest currently exists are exacerbators, and can reasonably be charged the cost of control.

### Recommendation

Due to a number of issues relating to boundary complaints on blackberry, Greater Wellington proposes that blackberry be included in the RPMS as Site Led (Boundary Control) ) as the greatest benefit from managing this species occurs on sites that are adjacent to an area that is currently clear.

#### 3.5.3 Cathedral bells (*Cobaea scandens*)

Cathedral bell is a vigorous, perennial climbing vine. It has oval light green leaves, with prominent purplish veins. Cathedral bell produces large bell shaped flowers from August to May, the flowers are yellow-green on opening, before maturing to a deep purple. Cathedral bells has a rapid rate of spread and grow over and smother trees forming a dense canopy. This can cause significant change to the natural ecosystem structure. Cathedral bell is widespread throughout the region, especially in urban areas, and is thought to infest approximately 16,050 hectares in the Wellington region. It has the potential to adversely impact approximately 289,421 hectares of indigenous forest and scrub in the Wellington region.

### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	16,050 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$111 / ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	289,421 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$600 / ha
Proportion of landholders controlling pest (%)	(PLCP)	5%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	73%

### Site Led (Boundary Control) assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	16,050 ha
Year strategy objectives achieved	(YOA)	15 years
Area Infested if strategy achieved	(AISOA)	16,050 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15%

### Site Led (Boundary Control) scenario

For the Site Led (Boundary Control) scenario, Greater Wellington costs for inspection, administration and enforcement are estimated to be approximately \$1,318 per year.

Year	Regional Council Costs \$	8% Discount	NPV \$
1	1,318	1.000	1,318
2	1,318	0.926	1,220
3	1,318	0.857	1,130
4	1,318	0.794	1,046
5	1,318	0.735	969
6	1,318	0.681	898
7	1,318	0.630	830
8	1,318	0.583	768
9	1,318	0.540	712
Year 10 onward	1,318	6.253	8,241
<b>Total NPV</b>			<b>17,134</b>

- **Cost Benefit Analysis summary**

#### No RPMS scenario

The outcome in the No RPMS Scenario results in a total damage of \$13,260,547 per annum in 75 years as a result of environmental losses and additional costs of control. This is a net present value of \$24,693,035.

#### Site Led (Boundary Control) scenario

The Site Led (Boundary Control) scenario has cost of approximately \$1,318 per annum. The cost to the region by the end of the strategy is \$17,134 NPV.

#### Section 72 (a)

The net outcome for Site Led (Boundary Control) when compared with the No RPMS approach produces a net positive benefit of \$21,315,700 NPV and therefore it meets the requirements of section 72 (a) of the Act.

#### Section 72 (b)

The net regional benefits exceed the individual benefits by \$15,483,764 because the strategy prevents the spread of the pest onto 273,371 hectares. Site Led (Boundary Control) therefore meets the requirements of section 72 (b) of the Act.

## Section 72 (a) (b)

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs. Those on whose property the pest currently exists are exacerbators, and can reasonably be charged the cost of control.

### Recommendation

Greater Wellington proposes that cathedral bells be included in the RPMS as Site Led (Boundary Control) as the greatest benefit from managing this species occurs on sites that are adjacent to an area that is currently clear.

#### 3.5.4 Gorse (*Ulex europaeus*)

Gorse is a spiny, woody, perennial shrub that can grow to two or more metres in height. Gorse is smothered in yellow flowers for much of the year. Gorse is widespread in the Wellington region, infesting up to approximately 25,150 hectares. Gorse is capable of growing in a wide range of habitats, but could potentially adversely affect at least 384,648 hectares of productive land in the Wellington region. Gorse has the ability to cause detrimental impacts to regions of the agricultural sector through the loss of production, create a nuisance value in urban areas and competes with early successional species such as mānuka and kanuka. Regenerated forests, that began as gorse will have a different composition than those that regenerated with native species. Gorse is also a fire risk.

### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	25,150 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$313 / ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	384,648 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$600 / ha
Proportion of landholders controlling pest (%)	(PLCP)	5%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	0%

### Site Led (Boundary Control) assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	25,150 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	25,150 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15%

### Site Led (Boundary Control) scenario

For the Site Led (Boundary Control) scenario, the regional costs for inspection, administration and enforcement are estimated to be approximately \$14,274 per year.

Year	Regional Council Costs \$	8 % Discount	NPV \$
1	14,274	1.000	14,274
2	14,274	0.926	13,218
3	14,274	0.857	12,233
4	14,274	0.794	11,334
5	14,274	0.735	10,491
6	14,274	0.681	9,721
7	14,274	0.630	8,993
8	14,274	0.583	8,322
9	14,274	0.540	7,708
Year 10 onward	14,274	6.253	89,255
<b>Total NPV</b>			<b>185,558</b>

- **Cost Benefit Analysis summary**

#### **No RPMS scenario**

The outcome in the No RPMS Scenario results in a total damage of \$28,695,702 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$60,579,265.

#### **Site Led (Boundary Control) scenario**

The Site Led (Boundary Control) scenario has cost of approximately \$14,274 per annum. The cost to the region by the end of the strategy is \$185,558 NPV.

#### **Section 72 (a)**

The net outcome for Site Led (Boundary Control) when compared with the No RPMS approach produces a net positive benefit of \$45,546,335 NPV and therefore it meets the requirements of section 72 (a) of the Act.

#### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$36,940,545 because the strategy prevents the spread of the pest onto 359,498 hectares. Site Led (Boundary Control) therefore meets the requirements of section 72 (b) of the Act.

#### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs. Those on whose property the pest currently exist are exacerbators, and can reasonably be charged the cost of control.

#### **Recommendation**

Greater Wellington proposes that gorse remain in the Site Led (Boundary Control) management category as the highest benefit from managing this species occurs on sites that are adjacent to productive land.

### 3.5.5 Hemlock (*Conium maculatum*)

Hemlock is a perennial plant that grows to two metres in height, with white flowers in clusters on the end of branches and purple blotches on the stems. Hemlock produces a foul smell when crushed or damaged. Hemlock is very toxic to humans and livestock; all parts of the plant are considered poisonous, even when dry. Hemlock is widespread in the Wellington region, and is thought to infest 4,000 hectares. If left to spread, hemlock has the potential to infest 384,648 hectares in the Wellington region.

#### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	4,000 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$303 / ha
Proportion of production loss from infested land	(PPLIL)	10%
Total area potentially infested	(TAPI)	384,648ha
Years to infest all of TAPI	(YI)	200 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$59 / ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	0%

#### Site Led (Boundary Control) assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	4,000 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	4000 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	10%

#### Site Led (Boundary Control) scenario

For the Site Led (Boundary Control) scenario, the regional costs for inspection, administration and enforcement were estimated to be approximately \$2,196 per year.

Year	Regional Council Costs \$	8% Discount	NPV \$
1	2,196	1.000	2,196
2	2,196	0.926	2,033
3	2,196	0.857	1,882
4	2,196	0.794	1,744
5	2,196	0.735	1,614
6	2,196	0.681	1,495
7	2,196	0.630	1,383
8	2,196	0.583	1,280
9	2,196	0.540	1,186
Year 10 onward	2,196	6.253	13,732
<b>Total NPV</b>			<b>28,547</b>

- **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$12,252,578 per annum in 200 years as a result of environmental losses and additional costs of control. This is a net present value of \$3,069,466.

### **Site Led (Boundary Control) scenario**

The Site Led (Boundary Control) scenario has cost of approximately \$2,196 per annum. The cost to the region by the end of the strategy is \$28,547 NPV.

### **Section 72 (a)**

The net outcome for Site Led (Boundary Control) when compared with the No RPMS approach produces a net positive benefit of \$1,466,645 NPV and therefore it meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$1,448,219 because the strategy prevents the spread of the pest onto 380,648 hectares. Site Led (Boundary Control) therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of Section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

### **Recommendation**

For human health reason, Greater Wellington proposes that hemlock be included in the RPMS as Site Led (boundary control) as the highest benefit from managing this species occurs on sites that are adjacent to an area that is currently clear.

#### **3.5.6 Nodding thistle (*Carduus nutans*)**

Nodding thistle is an annual or perennial thistle that can grow to 1.6m high with a fleshy taproot. Stems are erect and multi-branched. Nodding thistle has grey-green leaves that are deeply divided to the mid vein. The flowers are red-purple or white and contain many thistle-down seeds. Inside the containment zone, Nodding thistle is estimated to infest approximately 13 hectares. Outside the containment zone, there are an estimated 260 sites, or 5,083 hectares predominately in the Wairarapa. Nodding thistle is an agricultural pest, and can replace pastoral species and prevent stock movement. Dense infestations can harbour animal pests. If left to spread, nodding thistle has the potential to infest and adversely affect 384,648 hectares of pastoral land.

### **Based assumptions**

	<b>Abbreviation</b>	<b>Values</b>
Discount rate		8%
Initial area infested (ha)	(IAI)	5,083 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$313 / ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	384,648 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$59 / ha
Proportion of landholders controlling pest (%)	(PLCP)	2%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	0%

### **Containment assumptions**

	<b>Abbreviation</b>	<b>Values</b>
Current area infested (ha)	(CAI)	5,083 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	5,070 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15%

### **Containment scenario**

Within the proposed control area, nodding thistle is confined to an area of around 13 hectares with the density coverage of approximately 20%. Greater Wellington estimates the control costs of nodding thistle outside the Containment zone equate to approximately \$509 per annum. In addition to this there is the administration, inspection and enforcement costs inside the containment zone of \$5,490 per year. The total assessed costs are \$5,999.

### **Annual cost of control**

<b>Year</b>	<b>Regional Council Costs \$</b>	<b>8% Discount</b>	<b>NPV \$</b>
1	5,999	1.000	5,999
2	5,999	0.926	5,555
3	5,999	0.857	5,141
4	5,999	0.794	4,763
5	5,999	0.735	4,409
6	5,999	0.681	4,085
7	5,999	0.630	3,779
8	5,999	0.583	3,497
9	5,999	0.540	3,239
Year 10 onward	5,999	6.253	37,512
<b>Total NPV</b>			<b>77,986</b>

### **Site Led (Boundary Control) scenario**

Greater Wellington staff estimate the Site Led (Boundary Control) scenario will cost approximately \$5,490 per annum for inspection, monitoring and administration.

### **Annual cost of control**



Year	Regional Council Costs \$	8% Discount	NPV \$
1	5,490	1.000	5,490
2	5,490	0.926	5,084
3	5,490	0.857	4,705
4	5,490	0.794	4,359
5	5,490	0.735	4,035
6	5,490	0.681	3,739
7	5,490	0.630	3,459
8	5,490	0.583	3,201
9	5,490	0.540	2,965
Year 10 onward	5,490	6.253	34,329
<b>Total NPV</b>			<b>71,369</b>

### Site Led assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	5,083 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	5,083 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15 %

- **Cost Benefit Analysis summary**

#### No RPMS scenario

The outcome in the No RPMS scenario results in a total damage of \$18,151,294 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$15,415,950.

#### Containment scenario

The Containment scenario has costs of approximately \$5,999 per annum. The cost to the region by the end of the strategy is \$77,986 NPV.

#### Section 72 (a)

The net outcome for Containment when compared with the No RPMS approach produces a net positive benefit of \$12,341,554 NPV and therefore it meets the requirements of section 72 (a) of the Act.

#### Section 72 (b)

The net regional benefits exceed the individual benefits by \$12,346,181 because the strategy prevents the spread of the pest onto 379,565 hectares. Containment therefore meets the requirements of section 72 (b) of the Act.

#### Site Led (Boundary Control) scenario

The Site Led (Boundary Control) scenario has costs of approximately \$5,490 per annum. The cost to the region by the end of the strategy is \$71,369 NPV.

#### Section 72 (a)

The net outcome for Site Led (Boundary Control) when compared with the No RPMS approach produces a net positive benefit of \$12,343,818 NPV and therefore it meets the requirements of section 72 (a) of the Act.

**Section 72 (b)**

The net regional benefits exceed the individual benefits by \$12,346,181 because the strategy prevents the spread of the pest onto 379,565 hectares. Site Led (Boundary Control) therefore meets the requirements of section 72 (b) of the Act.

**Recommendations**

Both the Containment and Site Led (Boundary Control) scenario meet the requirements of the Act, given that nodding thistle does not have the same economic impact that was first thought to be. The Site Led scenario has a slightly lower total cost and losses (\$3,072,132) than the Containment scenario (\$3,074,396). Greater Wellington recommends that nodding thistle moves to the Site Led (Boundary Control) category as landowners have been controlling nodding thistle when and where it causes economic losses. Biological control agents have been successful in reducing nodding thistle populations in the southern coast areas of Wairarapa. Other thistle species such as Californian thistle, winged thistle and variegated thistle have much the same impact as nodding thistle.

**3.5.7 Old man’s beard (*Clematis vitalba*)**

Old man’s beard is a deciduous, perennial woody climber that can grow to more than 20 metres in height. The young vines are ribbed; the leaves comprise of five leaflets and the flowers are 2cm in diameter, green-white and appear from December to February. The seed heads are pom-pom shaped, fluffy and grey coloured. Old man’s beard can produce up to 100,000 seed heads per year. Old man’s beard has a high rate of spread and the ability to invade disturbed forests and shrub land. It has the potential to cause significant change in these natural areas and suppress the regeneration of native species. Old man’s beard is wide spread in the Greater Wellington region. The total infested area of old man’s beard is estimated to be approximately 16,050 hectares. Old man’s beard could potentially adversely affect 289,421 hectares.

**Base assumptions**

	<b>Abbreviation</b>	<b>Values</b>
Discount rate		8%
Initial area infested (ha)	(IAI)	16,050 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$111 / ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	289,421 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$600 / ha
Proportion of landholders controlling pest (%)	(PLCP)	5%
Proportion of infested land to which conservation values apply (%)	(PLCVA)	73%

**Site Led (Boundary Control) assumptions**

	<b>Abbreviation</b>	<b>Values</b>
Current area infested (ha)	(CAI)	16,050 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	16,050 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15%

### **Site Led (Boundary Control) scenario**

For the Site Led (Boundary Control) scenario, the regional costs, for inspection, administration and enforcement are estimated to be approximately \$62,366 per year.

<b>Year</b>	<b>Regional Council Costs \$</b>	<b>8% Discount</b>	<b>NPV \$</b>
1	62,366	1.000	62,366
2	62,366	0.926	58,677
3	62,366	0.857	54,305
4	62,366	0.794	49,519
5	62,366	0.735	45,839
6	62,366	0.681	42,471
7	62,366	0.630	39,291
8	62,366	0.583	36,359
9	62,366	0.540	33,678
Year 10 onward	62,366	6.253	389,975
<b>Total NPV</b>			<b>810,742</b>

- **Cost Benefit Analysis summary**

#### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$13,260,547 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$24,693,035.

#### **Site Led (Boundary Control) scenario**

The Site Led (Boundary Control) scenario has cost of approximately \$62,366 per annum. The cost to the region by the end of the strategy is \$810,742 NPV.

#### **Section 72 (a)**

The net outcome for Site Led (Boundary Control) when compared with the No RPMS approach produces a net positive benefit of \$20,522,092 NPV and therefore it meets the requirements of section 72 (a) of the Act.

#### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$14,690,156 because the strategy prevents the spread of the pest onto 273,371 hectares. Site Led (Boundary Control) therefore meets the requirements of section 72 (b) of the Act.

#### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs. Those on whose property the pest currently exists are exacerbators, and can reasonably be charged the cost of control.

**Recommendation**

Greater Wellington proposes that old man’s beard be included in the RPMS as Site Led (Boundary Control) as the highest benefit from managing this species occurs on sites that are adjacent to an area that is currently clear.

**3.5.8 Ragwort (*Senecio glastifolius*)**

Ragwort is an erect herbaceous annual, biennial or perennial herb, 30 to 120cm in height. The flowers are bright yellow and in clusters. Ragwort is widely distributed in the Wellington region and is estimated to infest 10 to 20% of all available habitats, approximately 38,464 hectares. It has the potential to adversely affect 384,648 hectares of pasture land. Ragwort is a pastoral pest, and has the ability to waste large areas of productive farmland.

**Based assumptions**

	<b>Abbreviation</b>	<b>Values</b>
Discount rate		8%
Initial area infested (ha)	(IAI)	38,464 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$313 / ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	384,648 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$98 / ha
Proportion of landholders controlling pest (%)	(PLCP)	5%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	0%

**Site Led (Boundary Control) assumptions**

	<b>Abbreviation</b>	<b>Values</b>
Current area infested (ha)	(CAI)	38,464 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	38,464 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15%

**Site Led (Boundary Control) scenario**

For the Site Led (Boundary Control) scenario, the regional costs for inspection, administration and enforcement are estimated to be approximately \$2,196.

Year	Regional Council Costs \$	8% Discount	NPV \$
1	2,196	1.000	2,196
2	2,196	0.926	2,033
3	2,196	0.857	1,882
4	2,196	0.794	1,744
5	2,196	0.735	1,614
6	2,196	0.681	1,495
7	2,196	0.630	1,383
8	2,196	0.583	1,280
9	2,196	0.540	1,186
Year 10 onward	2,196	6.253	13,732
<b>Total NPV</b>			<b>28,547</b>

- **Cost Benefit Analysis summary**

#### **No RPMS scenario**

The outcome in the No RPMS Scenario results in a total damage of \$19,041,037 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$49,777,736.

#### **Site Led (Boundary Control) scenario**

The Site Led (Boundary Control) scenario has a cost of approximately \$2,196 per annum. The cost to the region by the end of the strategy is \$28,547 NPV.

#### **Section 72 (a)**

The net outcome for Site Led (Boundary Control) when compared with the No RPMS approach produces a net positive benefit of \$27,041,860 NPV and therefore it meets the requirements of section 72 (a) of the Act.

#### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$25,948,377 because the strategy prevents the spread of the pest onto 346,184 hectares. Site Led (Boundary Control) therefore meets the requirements of section 72 (b) of the Act.

#### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs. Those on whose property the pest currently exists are exacerbators, and can reasonably be charged the cost of control.

#### **Recommendation**

Greater Wellington proposes that ragwort remain in the Site Led (Boundary Control) management category as the highest benefit from managing this species occurs on sites that are adjacent to productive land.

### 3.5.9 Variegated thistle (*Silybum marianum*)

Variegated thistle is an erect annual or biennial herb, growing to approximately 2.5 metres in height. The leaves have prominent white veins and blotches. The flowers are purple, with large flower heads. Variegated thistle is mainly found in Paraparamu, Waikanae, and the eastern hills and coastal areas of the Wairarapa. The initial infested area is estimated to be approximately 23,100 hectares. Variegated thistle is thought to have the potential to infest approximately 384,648 hectares of pastoral land. Variegated thistle is poisonous to cattle and sheep. Variegated thistle will compete with other pasture species and will eliminate other plants through shading and competition.

#### Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	23,100 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$313 / ha
Proportion of production loss from infested land	(PPLIL)	10%
Total area potentially infested	(TAPI)	384,648 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$59 / ha
Proportion of landholders controlling pest (%)	(PLCP)	5%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	0%

#### Site Led (Boundary Control) assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	23,100 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	23,100 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	10%

#### Site Led (Boundary Control) scenario

For the Site Led (Boundary Control) scenario, the regional costs for inspection, administration and enforcement are estimated to be approximately \$2,196 per year.

Year	Regional Council Costs \$	8% Discount	NPV \$
1	2,196	1.000	2,196
2	2,196	0.926	2,033
3	2,196	0.857	1,882
4	2,196	0.794	1,744
5	2,196	0.735	1,614
6	2,196	0.681	1,495
7	2,196	0.630	1,383
8	2,196	0.583	1,280
9	2,196	0.540	1,186
Year 10 Onward	2,196	6.253	13,732
<b>Total NPV</b>			<b>28,547</b>

- **Cost Benefit Analysis Summary**

**No RPMS scenario**

The outcome in the No RPMS Scenario results in a total damage of \$12,572,220 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$24,881,693.

**Site Led (Boundary Control) scenario**

The Site Led (Boundary Control) scenario has cost of approximately \$2,196 per annum. The cost to the region by the end of the strategy is \$28,547 NPV.

**Section 72 (a)**

The net outcome for Site Led (Boundary Control) when compared with the No RPMS approach produces a net positive benefit of \$15,761,713 NPV and therefore it meets the requirements of section 72 (a) of the Act.

**Section 72 (b)**

The net regional benefits exceed the individual benefits by \$15,415,346 because the strategy prevents the spread of the pest onto 361,548 hectares. Site Led (Boundary Control) therefore meets the requirements of section 72 (b) of the Act.

**Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs. Those on whose property the pest currently exist are exacerbators, and can reasonably be charged the cost of control.

**Recommendation**

Greater Wellington proposes that variegated thistle remain in the Site Led (Boundary Control) management category as the highest benefit from managing this species occurs on sites that are adjacent to productive land.

**3.5.10 Wild ginger (*Hedychium gardnerianum* / *H. Flavescens*)**

There are two species of wild ginger, kahili ginger (*Hedychium gardnerianum*) and yellow-ginger (*H. Flavescens*). Wild ginger is a herbaceous perennial plant, which grows from large branching rhizomes, with vertical stems. Adult stems can reach 2 metres in height, with large wax-covered ovate leaves. Kahili flowers are lemon yellow with conspicuous red stamens and can produce over 100 seeds per flower head. The yellow-ginger flowers are cream to light yellow and do not produce seeds. Both species of wild ginger are widespread in the Wellington region, particularly in urban areas, and it is estimated to infest approximately 16,050 hectares. Wild ginger has the potential to adversely impact 289,421 hectares of indigenous forest and shrub in the Wellington region. Wild ginger has a rapid rate of spread and the ability to cause significant change to the structure of natural areas and suppress the regeneration of native species.

## Based assumptions

	Abbreviation	Values
Discount rate		8%
Initial area infested (ha)	(IAI)	16,050 ha
Weighed average gross margin for infested land (\$/ha)	(WAGM)	\$111 / ha
Proportion of production loss from infested land	(PPLIL)	15%
Total area potentially infested	(TAPI)	289,421 ha
Years to infest all of TAPI	(YI)	75 years
Annual cost of control for landholder (\$/ha affected)	(ACCL)	\$600 / ha
Proportion of landholders controlling pest (%)	(PLCP)	5%
Proportion of infested land to which conservation values apply (%)	(PILCVA)	73%

## Site Led (Boundary Control) assumptions

	Abbreviation	Values
Current area infested (ha)	(CAI)	16,050 ha
Year strategy objectives achieved	(YOA)	15 years
Area infested if strategy achieved	(AISOA)	16,050 ha
Proportion of production loss from infested land when strategy objectives achieved (%)	(PPLSOA)	15%

## Site Led (Boundary Control) scenario

For the Site Led (Boundary Control) scenario, the regional costs for inspection, administration and enforcement are estimated to be approximately \$19,764 per year.

Year	Regional Council Costs \$	8% Discount	NPV \$
1	19,764	1.000	19,764
2	19,764	0.926	18,301
3	19,764	0.857	16,938
4	19,764	0.794	15,693
5	19,764	0.735	14,527
6	19,764	0.681	13,459
7	19,764	0.630	12,451
8	19,764	0.583	11,522
9	19,764	0.540	10,673
Year 10 onward	19,764	6.253	123,584
<b>Total NPV</b>			<b>256,927</b>

- **Cost Benefit Analysis summary**

### No RPMS scenario

The outcome in the No RPMS scenario results in a total damage of \$13,260,547 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$24,693,053.

### Site Led (Boundary Control) scenario

The Site Led (Boundary Control) scenario has cost of approximately \$19,764 per annum. The cost to the region by the end of the strategy is \$256,927 NPV.



### **Section 72 (a)**

The net outcome for Site Led (Boundary Control) when compared with the No RPMS approach produces a net positive benefit of \$21,075,907 NPV and therefore it meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$15,243,971 because the strategy prevents the spread of the pest onto 273,371 hectares. Site Led (Boundary Control) therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs. Those on whose property the pest currently exists are exacerbators, and can reasonably be charged the cost of control.

### **Recommendation**

Greater Wellington proposes that wild ginger be included in the RPMS as Site Led (Boundary Control) as the highest benefit from managing this species occurs on sites that are adjacent to an area that is currently clear.

## **4. Key Native Ecosystem RPMS scenario – all pest species**

Greater Wellington's Key Native Ecosystem (KNE) programme is working towards fulfilling New Zealand's commitments made under the Convention of Biological Diversity as outlined in the *New Zealand Biodiversity Strategy (2000)*. Greater Wellington will undertake pest control in selected areas throughout the region that represent a range of conservation values. Sustained control of pests in specific areas selected for their conservation significance will help restore and improve natural ecosystem functions, as well as protect indigenous biodiversity. Following pest control, it is likely there will be a recovery of native vegetation and greater survival of native fauna. Increased fruiting will support more native birds, which in turn will improve vegetation recovery through seed dispersal. Sustaining New Zealand's biodiversity will benefit the whole community through the enjoyment and identity we derive from our natural world, and the pride and profit from our distinctive 'green' branding.

Under the KNE Management category, all pests will be managed as part of an integrated pest management plan. The impact that each individual pest has on native flora and fauna is difficult to separate from the impacts of other pest species and habitat degradation. The costs associated with the implementation of a KNE RPMS are estimated for an integrated approach rather than focussing on specific species.

A total of 19,986 hectares (18,406 Pest Animals; 1,580 Pest Plants) are currently managed under the KNE programme at a cost of \$1,135,900 per year. This includes \$172,200 of funding from Territorial Authorities and through DoC's Biodiversity

Condition fund plus \$48,500 for the predator control programme at Pukaha/Mt Bruce. There is also a significant input from landowners and volunteers. Work on pest plants costs approximately \$135 per hectare for control and work on pest animals costs approximately \$43 per hectare. The current cost average of \$52.13 per hectare. Assuming the proportion of pest animals to pest plants work remains constant, the net present value for the costs of the KNE programme is \$224.79 per hectare.

#### Expected costs (Key Native Ecosystem RPMS)

Year	Regional Costs \$	8% Discount	Net Present Value \$
1	52.13	1.000	52.13
2	52.13	0.926	48.27
3	52.13	0.857	44.68
4	52.13	0.794	41.39
5	52.13	0.735	38.32
<b>Total (Net Present Value)</b>		<b>4.312</b>	<b>224.79</b>

The regional benefit was assessed at \$127 per hectare. Kaye-Blake and Kogler (draft 2006) assessed the willingness of New Zealanders to pay for bush with native species. They found that New Zealanders were willing to pay on the order of \$30 to \$80 per household as part of their rates. In Wellington there are 168,200 households in the region (*Statistic NZ 2006*) and 72,718 hectares of land where conservation values apply (Regional Parks, Key Native Ecosystems and QEII covenants). This gives a willingness to a pay range of \$69 per hectare to \$185 per hectare and an average of \$127 per hectare. For the purposes of this analysis, the average figure was used for native bush, \$185 per hectare for areas that were either rare (e.g. wetlands) or of high value (e.g. coastal areas). The lower figure \$69 was used for areas with low biodiversity value e.g. mixed shrub land, scrub.

Year	Regional Benefits \$	8% Discount	Net Present Value \$
1	127	1.000	127
2	127	0.926	117.60
3	127	0.857	108.84
4	127	0.794	100.84
5	127	0.735	93.35
<b>Total (Net Present Value)</b>		<b>4.312</b>	<b>547.63</b>

#### Section 71 (a) requirements

The benefits of implementing KNE RPMS for all pest species listed arise from preventing damages to conservation and Maori values in regionally significant conservation sites when compared to having no pest management. The cost benefit analysis gives a net regional benefit of \$547.63 per hectare (NPV) over the five years of the strategy.

## Pest Species Considered for Key Native Ecosystem Management

- Argentine ant (*Linepithema humile*)
- Feral cat (*Felis catus*)
- Feral deer (*Cervus elaphus scoticus*; *C. nippon*; *Dama dama*)
- Feral goat (*Capra hircus*)
- Feral pig (*Sus scrofa*)
- Ferret (*Mustela furo*)
- Hare (*Lepus europaeus*)
- Hedgehog (*Erinacues nebulosus*)
- House mouse (*Mus musculus*)
- Koi carp (*Cyprinus carpio*)
- Mosquito fish (*Gambusia affinis*)
- Norway rat (*Rattus norvegicus*)
- Possum (*Trichosurus vulpecula*)
- Rabbit (*Oryctolagus cuniculus*)
- Rook (*Corvus frugilegus*)
- Ship rat (*Rattus rattus*)
- Stoat (*Mustela erminea*)
- Wasp (*Vulpecula germanica*; *V. vulgaris*)
- Weasel (*Mustela nivalis*)
- African club moss (*Selaginella kraussiana*)
- Agapanthus (*Agapanthus praecox*)
- Aluminium plant (*Galeobdolon luteum*)
- Artillery plant (*Galeobdolon luteum*)
- Arum lily (*Zantedeschia aethiopica*)
- Darwin's barberry (*Berberis glaucocarpa*)
- Bindweed (*Calystegia sepium*)
- Blackberry (*Rubus fruticosus*)
- Blue morning glory (*Ipomoea indica*)
- Boxthorn (*Lycium ferocissimum*)
- Broom (*Cystisus scoparius*)
- Brush wattle (*Paraserianthes lophantha*)
- Buddleia (*Buddleja davidii*)
- Cape honey flower (*Melianthus major*)
- Cape ivy (*Senecio angulatus*)
- Chinese privet/tree privet (*Ligustrum*; *sinese L. lucidum*)
- Climbing asparagus (*Asparagus scanden*)
- Climbing dock (*Rumex sagittatus*)
- Elaeagnus (*Elaeagnus x reflexa*)
- English ivy (*Hedera helix*)
- German ivy (*Senecio mikanioides*)
- Hawthorn (*Crataegus monogyna*)
- Himalayan honeysuckle (*Leycesteria formosa*)
- Japanese honeysuckle (*Lonicera japonica*)
- Lagarosiphon (*Lagarosiphon major*)
- Marram grass (*Ammophila arenaria*)

- Mist flower (*Ageratina riparia*)
- Montbretia (*Crocasmia x crocosmiiflora*)
- Nasturtium (*Trapaeolum majus*)
- Onion weed (*Allium vineale*)
- Oxygen weed (*Egeria densa*)
- Parrots feather (*Myriophyllum aquaticum*)
- Pampas grasses (*Cortaderia jubata*; *C. selloana*)
- Periwinkle (*Vinca major*)
- Plectranthus (*Plectranthus ciliatus*)
- Purple ragwort (*Senecio glastifolius*)
- Smilax (*Asparagus asparagoides*)
- Spanish heath (*Erica lusitanica*)
- Stinking iris (*Iris feotidissima*)
- Tradescantia (*Tradescantia fluminensis*)
- Velvet groundsel (*Senecio petasitis*)
- Wild ginger (*Hedychium*; *gardnerianum*; *H. flavescens*)
- Wilding conifers (*Larix deciduas*; var)
- Wilding pines (*Pinus spp*)

In general all introduced species to a natural ecosystem will be managed to allow site biodiversity recovery. A KNE RPMS to control pests in selected areas representing a range of indigenous biodiversity will have associated costs, but will result in the recovery and enhancement of natural ecosystem processes important to the region. It is Greater Wellington's opinion that the benefits of a KNE RPMS outweigh the costs and therefore the requirements of section 72 (a) have been met.

### **Section 72 (b) – regional costs and benefits**

Individual intervention for pests in areas with high conservation values is unlikely to significantly reduce damages to these values. Regional intervention will result in increased protection of indigenous biodiversity, enhanced efficiencies in pest management, and help in the establishment of wildlife corridors by linking the mosaic of KNE sites. This will benefit the whole community. Greater Wellington is satisfied that the benefits for regional intervention exceed the benefits of individual intervention, therefore the requirements of section 72 (b) have been met.

### **Section 72 (ba) – strategy funding**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the strategy can be charged through a general rate to the regional community as beneficiaries and the benefits received will exceed the costs.

Any benefits that would arise from regional intervention on private land not part of the KNE programme would accrue to the individual landowner. Those on whose property the pest currently exists are both exacerbators and beneficiaries and are therefore responsible for the costs of control on their property.

## Recommendations

Greater Wellington is satisfied that section 72 (a), (b), (ba) and (c) have been met for all pest species considered for inclusion in the Key Native Ecosystem Management category. A KNE RPMS will protect significant regional conservation values when compared to no pest management. Therefore, Greater Wellington recommends all species considered for inclusion which have an adverse impact on conservation values are included in the Wellington Regional Pest Management Strategy in the KNE Management category. Greater Wellington will undertake integrated pest control where necessary in selected sites included in the KNE programme.

### 4.1 Cost Benefit Analysis summary

The table below summarises the results of the CBA of Greater Wellington's Proposed Regional Pest Management Strategy (RPMS). With the exception of rooks, the benefits of inclusion of the proposed species into the RPMS outweigh the costs. The application of the proposed RPMS is expected to cost Greater Wellington approximately \$2,335,448 per annum (including administrative overheads).

Species	Proposed Category	Section 72(a) Do the benefits outweigh the costs?	Section 72(b) Is there a net regional benefit?	Section 72(a)(b) Who receives the benefit?	Estimated Council Costs per annum * \$
Rooks	Total control	X		Agricultural and wider regional community	60,000
Rabbits	Suppression	✓	✓	Agricultural and wider regional community	110,000
Feral and unwanted cats	Site Led	✓	✓	Wider regional community	45,000
Feral deer	Site Led (KNE)	✓	✓	Wider regional community	4,000
Feral goats	Site Led	✓	✓	Wider regional community	20,000
Feral pigs	Site Led (KNE)	✓	✓	Wider regional community	4,000
Gambusia	Site Led	✓	✓	Wider regional community	3,000
Koi carp	Site Led	✓	✓	Wider regional community	3,000

<b>Species</b>	<b>Proposed Category</b>	<b>Section 72(a)</b> Do the benefits outweigh the costs?	<b>Section 72(b)</b> Is there a net regional benefit?	<b>Section 72(a)(b)</b> Who receives the benefit?	<b>Estimated Council Costs per annum * \$</b>
Wasps	Site Led (Human Health)	✓	✓	Wider regional community	5,000
Magpies	Site Led (Human Health)	✓	✓	Wider regional community	45,000
Possums (outside of KNE)	Site Led	✓	✓	Wider regional community	350,000
Animals Surveillance programme		✓	✓	Wider regional community	12,000
African feather grass	Total Control	✓	✓	Agricultural and wider regional community	45,496
Bathurst bur	Total Control	✓	✓	Agricultural and wider regional community	12,883
Blue passion flower	Total Control	✓	✓	Wider regional community	69,999
Climbing spindleberry	Total Control	✓	✓	Wider regional community	17,794
Eelgrass	Total Control	✓	✓	Wider regional community	3,521
Manchurian wild rice	Total Control	✓	✓	Wider regional community	31,757
Madeira vine	Total Control	✓	✓	Wider regional community	38,044
Moth plant	Total Control	✓	✓	Wider regional community	30,398
Perennial nettle	Total Control	✓	✓	Agricultural and wider regional community	118,506

<b>Species</b>	<b>Proposed Category</b>	<b>Section 72(a)</b> Do the benefits outweigh the costs?	<b>Section 72(b)</b> Is there a net regional benefit?	<b>Section 72(a)(b)</b> Who receives the benefit?	<b>Estimated Council Costs per annum * \$</b>
Saffron thistle	Total Control	✓	✓	Agricultural and wider regional community	9,955
Woolly nightshade	Total Control	✓	✓	Wider regional community	22,088
Boneseed	Containment	✓	✓	Wider regional community	68,109
Evergreen buckthorn	Containment	✓	✓	Wider regional community	48,874
Hornwort	Containment	✓	✓	Wider regional community	5,856
Sweet pea shrub	Containment	✓	✓	Wider regional community	293
Banana passionfruit	Boundary Control	✓	✓	Wider regional community	13,835
Blackberry	Boundary Control	✓	✓	Wider regional community	10,980
Cathedral bells	Boundary Control	✓	✓	Wider regional community	1,318
Gorse	Boundary Control	✓	✓	Agricultural and wider regional community	14,274
Hemlock	Boundary Control	✓	✓	Agricultural and wider regional community	2,196
Nodding thistle	Boundary Control	✓	✓	Agricultural and wider regional community	5,490
Old man's beard	Boundary Control	✓	✓	Wider regional community	62,366
Ragwort	Boundary Control	✓	✓	Wider regional community	2,196

<b>Species</b>	<b>Proposed Category</b>	<b>Section 72(a)</b> Do the benefits outweigh the costs?	<b>Section 72(b)</b> Is there a net regional benefit?	<b>Section 72(a)(b)</b> Who receives the benefit?	<b>Estimated Council Costs per annum * \$</b>
Variiegated thistle	Boundary Control	✓	✓	Agricultural and wider regional community	2,196
Wild ginger	Boundary Control	✓	✓	Wider regional community	19,764
Surveillance plants programme		✓	✓	Wider regional community	129,360
Key Native Ecosystems**		✓	✓	Wider regional community	1,135,900
<b>Total</b>					<b>1,287,220448</b>

\*Figures are based on what was spent in the 06/07 financial year.

\*\*This includes TLA contributions, DoC biodiversity condition fund and the predator control programme at Pukaka / Mt Bruce.



Water, air, earth and energy: elements in Greater Wellington's logo that combine to create and sustain life. Greater Wellington promotes **Quality for Life** by ensuring our environment is protected while meeting the economic, cultural and social needs of the community.

#### FOR FURTHER INFORMATION

Greater Wellington  
34 Chapel Street  
PO Box 41  
Masterton 5840  
T 06 378 2484  
F 06 378 7994  
W [www.gw.govt.nz](http://www.gw.govt.nz)

Greater Wellington  
1056 Fergusson Drive  
PO Box 40847  
Upper Hutt 5140  
T 04 526 4133  
F 04 526 4171

Greater Wellington is the  
promotional name of the  
Wellington Regional Council

Published November 2007  
GW/BIO-G-07/285



# Cost Benefit Analysis Calculations

for species considered for inclusion in the  
Proposed Regional Pest Management Strategy 2002-2022

October 2007

Quality for Life



greater WELLINGTON  
REGIONAL COUNCIL

Biosecurity





# Cost Benefit Analysis Calculations for species considered for inclusion in the

Proposed Greater Wellington Regional Pest  
Management Strategy 2002-2022

Cielle Stephens and Robert Quan

## FOR FURTHER INFORMATION

Greater Wellington  
Regional Council  
Masterton  
PO Box 41

T 06 378 2484  
F 06 378 7994  
W [www.gw.govt.nz](http://www.gw.govt.nz)

Greater Wellington  
Regional Council  
Upper Hutt  
PO Box 40847

T 04 526 4133  
F 04 526 4171  
W [www.gw.govt.nz](http://www.gw.govt.nz)

October 2007

# Contents

<b>1.</b>	<b>Cost Benefit Analysis for existing Total Control species</b>	<b>5</b>
1.1	African feather grass ( <i>Pennisetum macrourum</i> )	5
1.2	Bathurst bur ( <i>Xanthium spinosum</i> )	8
1.3	Blue passion flower ( <i>Passiflora caerulea</i> )	11
1.4	Climbing spindleberry ( <i>Celastrus orbiculatus</i> )	14
1.5	Eelgrass ( <i>Vallisneria spp.</i> )	17
1.6	Madeira vine ( <i>Anredera cordifolia</i> )	20
1.7	Manchurian wild rice ( <i>Zizania latifolia</i> )	23
1.8	Moth plant ( <i>Araujia sericifera</i> )	26
1.9	Perennial nettle ( <i>Urtica dioica</i> )	29
1.10	Saffron thistle ( <i>Carthamus lanatus</i> )	32
1.11	Woolly nightshade ( <i>Solanum mauritianum</i> )	35
1.12	Rooks	39
1.13	Feral cat	40
1.14	Feral deer	41
1.15	Feral goat	42
1.16	Feral pigs	43
1.17	Gambusia	44
1.18	Koi carp	45
1.19	Rabbits	46
1.20	Red eared slider turtle	47
1.21	Rainbow skinks	48
1.22	Argentine ants	49
1.23	Darwin's ants	50
1.24	Mynas	51
1.25	Subterranean termites	52

## **1. Cost Benefit Analysis for existing Total Control species**

### **1.1 African feather grass (*Pennisetum macrourum*)**

#### **Initial area infested (hectares)**

Approximately 80 hectares identified based on staff knowledge of known sites within the region, Karori, Masterton, Carterton, South Wairarapa and Kapiti.

#### **Weighted average gross margin (\$ per hectare)**

\$313 per hectare calculated from MAF farm monitoring report 2005/06

#### **Proportion of production loss from infested land (%)**

Assumed as 15 % based on Effect On System (EOS) score.

#### **Total area potentially infested (hectare) (TAPI)**

African feather grass prefers damp areas such as swamp and along borders of streams, but can also tolerate drought. It has been found in urban areas, on dry shady banks, roadsides, and lowland and hill country pasture of the region. Potentially, if no control was undertaken, 384,648 hectares of available habitat in the region could be infested within 75 years.

#### **Years to infest all TAPI**

African feather grass is a perennial plant which produces large numbers of seeds and grows rapidly in spring and summer. Seed is dispersed by wind, human and water. New colonies can establish from moved or broken rhizomes. African feather grass has a Biological Success Rating (BSR) score of 17. For the purpose of this analysis 75 was assumed to infest all TAPI.

#### **Annual cost of control for landholder (\$/hectare)**

\$1,663 per hectare based on average control cost estimate by staff.

#### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

#### **Proportion of infested land to which conservation values apply (%)**

N/A

#### **Any benefits provided by the weeds (\$ per annum)**

N/A

#### **Biocontrol (\$ per annum)**

N/A

## Year strategy objectives achieved (total control)

Assume 15 years from 2007 when RPMS becomes effective.

## Area infested if objectives (total control) achieved (hectare)

0 based on control success to date in Karori and Kapiti.

## Results

	No RPMS \$	Containment \$	Total Control \$
Cost and losses under option	7,576,134	0	519,437
Section 72(a) NPV		0	6,920,198
Section 72(a) regional values cost/ha		0	0
Section 72(b) NPV (NRB)		0	7,179,030
Section 72(b) area of spillover prevented (ha)		0	384,568

### Base Assumptions

Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	80	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$313	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	15%	(%)
Total Area Potentially Infested	(TAPI)	384,648	(ha)
Years to Infest all of TAPI (years)	(YI)	75	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$1,663	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	0%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)

### Total Control Assumptions

Year Strategy objectives Achieved	(YOA)	15	(Years)
-----------------------------------	-------	----	---------

Regional Council Costs		
Year	Containment \$	Total Control \$
1		19,496
2		19,496
3		19,496
4		19,496
5		19,496
6		19,496
7		19,496
8		19,496
9		19,496
Year 10 onward		19,496
NPV	0	253,443

Control Costs		
Year	Containment \$	Total Control \$
1		26,000
2		26,000
3		26,000
4		26,000
5		26,000
6		26,000
7		26,000
8		26,000
9		26,000
Year 10 onward		26,000
NPV	0	337,994

## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the NO RPMS scenario results in a total damage of \$30,491,431 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$7,511,635.

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$253,443 for administration, inspection, monitoring and enforcement, a NPV of \$337,994 for cost of control. The total cost to the region when the Strategy achieved is \$591,437 NPV at a discount rate of 8%.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$6,920,198 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$7,179,030 because the Strategy prevents the spread of the pest onto 384,568 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## **1.2 Bathurst bur (*Xanthium spinosum*)**

### **Initial area infested (hectare)**

Approximately 260 hectares identified based on staff knowledge of known sites. Currently only known to be present in Carterton and South Wairarapa.

### **Weighted average gross margin (\$ per hectare)**

\$313 per hectare calculated from the MAF farm monitoring report 2005/06.

### **Proportion of production loss from infested land (%)**

Assumed as 10% based on Effect On System (EOS) score.

### **Total area potentially infested (hectare) TAPI**

Bathurst bur has been found predominantly on dairy farms in areas of Carterton and South Wairarapa; it also grows in waste places, coastal sites and gardens. It is of economic important to the region because it can down grade wool quality. Potentially if no control was undertaken, 384,648 hectares of pastoral land in the region could be infested within 75 years.

### **Years to infest all TAPI**

Bathurst bur is spread by stock, clothing and any fibrous material. It can also float on water and move rapidly along water courses. Bathurst bur has a Biological Success Rating (BSR) score of 14. For the purpose of this analysis 75 years was assumed to infest all TAPI.

### **Annual cost of control for landholder (\$ per hectare)**

\$69 per hectare based on average control cost estimate by staff.

### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

### **Proportion of infested land to which conservation values apply (%)**

N/A

### **Any benefits provided by the weeds (\$ per annum)**

N/A

### **Biocontrol (\$ per annum)**

N/A



## Year strategy objectives achieved (total control)

Assume 15 years from 2007 when RPMS becomes effective.

## Area infested if objectives (total control) achieved (hectare)

0.

## Results

	No RPMS \$	Containment \$	Total Control \$
Cost and losses under option	3,864,205	0	167,476
Section 72(a) NPV		0	3,696,729
Section 72(a) regional values cost/ha		0	0
Section 72(b) NPV (NRB)		0	3,592,592
Section 72(b) area of spillover prevented (ha)		0	384,388
Base Assumptions			
Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	260	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$313	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	10%	(%)
Total Area Potentially Infested	(TAPI)	384,648	(ha)
Years to Infest all of TAPI (years)	(YI)	75	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$69	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	0%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)
Total Control Assumptions			
Year Strategy objectives Achieved	(YOA)	15	(Years)

Regional Council Costs		
Year	Containment \$	Total Control \$
1		12,883
2		12,883
3		12,883
4		12,883
5		12,883
6		12,883
7		12,883
8		12,883
9		12,883
Year 10 onward		12,883
NPV	0	167,476

## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$12,325,661 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$3,864,205.

### **Total Control scenario**

Currently staff are undertaking control work of Bathurst bur themselves. The outcome of the Total Control scenario is a NPV of \$167,476 for inspection including control cost at a discount rate of 8%.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$3,696,729 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$3,592,592 because the Strategy prevents the spread of the pest onto 384,388 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

### **1.3 Blue passion flower (*Passiflora caerulea*)**

#### **Initial area infested (hectare)**

Approximately 34 hectares identified based on staff knowledge of known sites within the region, Wellington, Upper/Lower Hutt, Masterton, Carterton, South Wairarapa, Kapiti, and Porirua.

#### **Weighted average gross margin (\$ per hectare)**

\$114 per hectare based on land class which are likely to be effected.

#### **Proportion of production loss from infested land (%)**

Assumed as 15% based on Effect On System (EOS) score.

#### **Total area potentially infested (hectare) TAPI**

Blue passion flower is an escape from cultivation and can be expected to occur in many places, coastal areas, forest margins, scrub, roadsides, wastelands and domestic gardens. Potentially, if no control was undertaken, 274,773 hectares of available habitat in the region could be infested within 75 years.

#### **Years to infest all TAPI**

Blue passion flower is a perennial plant which flowers from December till late April. Fruit is eaten by birds and possums which can then spread the seeds over long distances. It is the most cold tolerant of all passiflora species in New Zealand that can also spread vegetatively. Blue passion flower has a Biological Success Rating (BSR) score of 15. For the purpose of this analysis 75 years was assumed to infest all TAPI.

#### **Annual cost of control for landholder (\$ per hectare)**

\$253 per hectare based on average control cost estimate by staff.

#### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

#### **Proportion of infested land to which conservation values apply (%)**

78% of available habitat was identified as having conservation values.

#### **Any benefits provided by the weeds (\$ per annum)**

N/A

#### **Biocontrol (\$ per annum)**

N/A

**Year strategy objectives achieved (total control)**

Assume 15 years from 2007 when RPMS becomes effective.

**Area infested if objectives (total control) achieved (hectare)**

0.

**Results**

	<b>No RPMS \$</b>	<b>Containment \$</b>	<b>Total Control \$</b>
Cost and losses under option	1,114,138	0	909,969
Section 72(a) NPV		0	221,823
Section 72(a) regional values cost/ha		0	\$1
Section 72(b) NPV (NRB)		0	765,050
Section 72(b) area of spillover prevented (ha)		0	274,739

**Base Assumptions**

Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	34	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$114	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	15%	(%)
Total Area Potentially Infested	(TAPI)	274,773	(ha)
Years to Infest all of TAPI (years)	(YI)	75	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$253	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	78%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)

**Total Control Assumptions**

Year Strategy objectives Achieved	(YOA)	15	(Years)
-----------------------------------	-------	----	---------

<b>Regional Council Costs</b>		
<b>Year</b>	<b>Containment \$</b>	<b>Total Control \$</b>
1		27,499
2		27,499
3		27,499
4		27,499
5		27,499
6		27,499
7		27,499
8		27,499
9		27,499
Year 10 onward		27,499
<b>NPV</b>	<b>0</b>	<b>357,480</b>

<b>Control Costs</b>		
<b>Year</b>	<b>Containment \$</b>	<b>Total Control \$</b>
1		42,500
2		42,500
3		42,500
4		42,500
5		42,500
6		42,500
7		42,500
8		42,500
9		42,500
Year 10 onward		42,500
<b>NPV</b>	<b>0</b>	<b>552,489</b>

## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$6,006,114 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$1,131,792.

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$357,480 for administration, inspection, monitoring and enforcement, a NPV of \$552,489 for cost of control. The total cost to the region when the Strategy achieved is \$909,969 NPV at a discount rate of 8%. This amount to approximately \$1 per hectare of preventing damage to regional values.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$221,823 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$765,050 because the Strategy prevents the spread of the pest onto 274,739 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of Section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

#### **1.4 Climbing spindleberry (*Celastrus orbiculatus*)**

##### **Initial area infested (hectare)**

Approximately 19 hectares identified based on staff knowledge of known sites within the region, Wellington, Upper Hutt, Masterton, Carterton, South Wairarapa and Kapiti.

##### **Weighted average gross margin (\$ per hectare)**

\$115 per hectare based on land class which are likely to be effected.

##### **Proportion of production loss from infested land (%)**

Assumed as 35% based on Effect On System (EOS) score.

##### **Total area potentially infested (hectare) TAPI**

Climbing spindleberry can be found in disturbed areas, under closed canopy forest, scrub/shrublands and riparian zones. Potentially, if no control was undertaken, 276,549 hectares of available habitat in the region could be infested within 75 years.

##### **Years to infest all TAPI**

Climbing spindleberry is a prolific seeder with a high rate of viability and germination. It can adapt to a wide range of conditions which make it highly competitive with native vegetation. Seeds are dispersed by birds. Climbing spindleberry has a Biological Success Rating (BSR) score of 14. For the purpose of this analysis 75 years was assumed to infest all TAPI.

##### **Annual cost of control for landholder (\$ per hectare)**

\$468 per hectare based on average control cost estimate by staff.

##### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

##### **Proportion of infested land to which conservation values apply (%)**

78% of available habitat was identified as having conservation values.

##### **Any benefits provided by the weeds (\$ per annum)**

N/A

##### **Biocontrol (\$ per annum)**

N/A

##### **Year strategy objectives achieved (total control)**

Assume 15 years from 2007 when RPMS becomes effective.

**Area infested if objectives (total control) achieved (hectare)**

0.

**Results**

	<b>No RPMS</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>	<b>\$</b>
Cost and losses under option	1,242,342	0	231,317
Section 72(a) NPV		0	1,011,025
Section 72(a) regional values cost/ha		0	\$5
Section 72(b) NPV (NRB)		0	1,091,151
Section 72(b) area of spillover prevented (ha)		0	276,530

**Base Assumptions**

Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	19	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$115	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	15%	(%)
Total Area Potentially Infested	(TAPI)	276,549	(ha)
Years to Infest all of TAPI (years)	(YI)	75	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$468	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	78%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)

**Total Control Assumptions**

Year Strategy objectives Achieved	(YOA)	15	(Years)
-----------------------------------	-------	----	---------

<b>Regional Council Costs</b>		
<b>Year</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>
1		11,163
2		11,163
3		11,163
4		11,163
5		11,163
6		11,163
7		11,163
8		11,163
9		11,163
Year 10 onward		11,163
<b>NPV</b>	<b>0</b>	<b>145,116</b>

<b>Control Costs</b>		
<b>Year</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>
1		6,631
2		6,631
3		6,631
4		6,631
5		6,631
6		6,631
7		6,631
8		6,631
9		6,631
Year 10 onward		6,631
<b>NPV</b>	<b>0</b>	<b>86,201</b>

## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$7,253,094 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$1,242,342.

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$145,116 for administration, inspection, monitoring and enforcement, a NPV of \$86,201 for cost of control. The total cost to the region when the Strategy achieved is \$231,317 NPV at a discount rate of 8%. This amount to approximately \$5 per hectare of preventing damage to regional values.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$1,011,025 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$1,091,151 because the Strategy prevents the spread of the pest onto 276,530 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.



## **1.5 Eelgrass (*Vallisneria spp.*)**

### **Initial area infested (hectare)**

Approximately two hectares identified based on staff knowledge of known sites within the region.

### **Weighted average gross margin (\$ per hectare)**

\$185 per hectare based on land class which are likely to be effected.

### **Proportion of production loss from infested land (%)**

Assumed as 15% based on Effect On System (EOS) score.

### **Total area potentially infested (hectare) TAPI**

Eelgrass is a perennial freshwater aquatic plant that grows in flowing water and colonises lake-bed sediment. Potentially, if no control was undertaken, 11,678 hectares of available lake and pond, river and lakeshore habitat in the region could be infested within 75 years.

### **Years to infest all TAPI**

Eelgrass is bottom rooting with a stout rhizome. New colonies can establish from rhizome fragments. Eelgrass has a Biological Success Rating (BSR) score of 14. For the purpose of this analysis 75 years was assumed to infest all TAPI.

### **Annual cost of control for landholder (\$ per hectare)**

\$297 per hectare based on average control cost estimate by staff.

### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

### **Proportion of infested land to which conservation values apply (%)**

100% of available habitat was identified as having conservation values.

### **Any benefits provided by the weeds (\$ per annum)**

N/A

### **Biocontrol (\$ per annum)**

N/A

## Year strategy objectives achieved (total control)

Assume 15 years from 2007 when RPMS becomes effective.

## Area infested if objectives (total control) achieved (hectare)

0. Based on excellent control achieved to date at sites found in Kapiti.

### Results

	No RPMS \$	Containment \$	Total Control \$
Cost and losses under option	74,445	0	45,772
Section 72(a) NPV		0	28,673
Section 72(a) regional values cost/ha		0	\$3
Section 72(b) NPV (NRB)		0	31,948
Section 72(b) area of spillover prevented (ha)		0	11,677

#### Base Assumptions

Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	2	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$185	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	15%	(%)
Total Area Potentially Infested	(TAPI)	11,678	(ha)
Years to Infest all of TAPI (years)	(YI)	75	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$297	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	100%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)

#### Total Control Assumptions

Year Strategy objectives Achieved	(YOA)	15	(Years)
-----------------------------------	-------	----	---------

Regional Council Costs		
Year	Containment \$	Total Control \$
1		3,221
2		3,221
3		3,221
4		3,221
5		3,221
6		3,221
7		3,221
8		3,221
9		3,221
Year 10 onward		3,221
NPV	0	41,872

Control Costs		
Year	Containment \$	Total Control \$
1		300
2		300
3		300
4		300
5		300
6		300
7		300
8		300
9		300
Year 10 onward		300
NPV	\$0	3,900

## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$386,880 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$74,445.

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$41,872 for administration, inspection, monitoring and enforcement, a NPV of \$3,900 for cost of control. The total cost to the region when the Strategy achieved is \$45,772 NPV at a discount rate of 8%. This amount to approximately \$3 per hectare of preventing damage to regional values.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$28,673 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$31,948 because the Strategy prevents the spread of the pest onto 11,677 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## **1.6 Madeira vine (*Anredera cordifolia*)**

### **Initial area infested (hectare)**

Approximately 15 hectares identified based on staff knowledge of known sites within the region.

### **Weighted average gross margin (\$ per hectare)**

\$111 per hectare based on land class which are likely to be effected.

### **Proportion of production loss from infested land (%)**

Assumed as 15% based on Effect On System (EOS) score.

### **Total area potentially infested (hectare) TAPI**

Mignonette vine has been found in coastal places, disturbed areas, shrubland and domestic gardens around the region. Potentially, if no control was undertaken, 303,101 hectares of available habitat in the region could be infested within 75 years.

### **Years to infest all TAPI**

Mignonette vine can spread freely by pieces of rhizome and stem tubers. Seeds are dispersed by gravity, machinery and soil movement. Mignonette vine has a Biological Success Rating (BSR) score of 11. For the purpose of this analysis 100 years was assumed to infest all TAPI.

### **Annual cost of control for landholder (\$ per hectare)**

\$1,150 per hectare based on average control cost estimate by staff.

### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

### **Proportion of infested land to which conservation values apply (%)**

71% of available habitat was identified as having conservation values.

### **Any benefits provided by the weeds (\$ per annum)**

N/A.

### **Biocontrol (\$ per annum)**

N/A

### **Year strategy objectives achieved (total control)**

Assume 15 years from 2007 when RPMS becomes effective.

**Area infested if objectives (total control) achieved (hectare)**

0.

**Results**

	<b>No RPMS</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>	<b>\$</b>
Cost and losses under option	728,076	0	494,563
Section 72(a) NPV		0	233,513
Section 72(a) regional values cost/ha		0	\$1
Section 72(b) NPV (NRB)		0	406,703
Section 72(b) area of spillover prevented (ha)		0	303,086

**Base Assumptions**

Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	15	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$111	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	15%	(%)
Total Area Potentially Infested	(TAPI)	303,101	(ha)
Years to Infest all of TAPI (years)	(YI)	100	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$1,550	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	71%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)

**Total Control Assumptions**

Year Strategy objectives Achieved	(YOA)	15	(Years)
-----------------------------------	-------	----	---------

<b>Regional Council Costs</b>		
<b>Year</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>
1		24,043
2		24,043
3		24,043
4		24,043
5		24,043
6		24,043
7		24,043
8		24,043
9		24,043
Year 10 onward		24,043
NPV	0	312,436

<b>Control Costs</b>		
<b>Year</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>
1		14,010
2		14,010
3		14,010
4		14,010
5		14,010
6		14,010
7		14,010
8		14,010
9		14,010
Year 10 onward		14,010
NPV	0	182,127

## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$14,356,163 per annum in 100 years as a result of production losses and additional costs of control. This is a net present value of \$728,076

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$312,436 for administration, inspection, monitoring and enforcement, a NPV of \$182,127 for cost of control. The total cost to the region when the Strategy achieved is \$494,563 NPV at a discount rate of 8%. This amount to approximately \$1 per hectare of preventing damage to regional values.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$233,513 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$406,703 because the Strategy prevents the spread of the pest onto 303,086 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## **1.7 Manchurian wild rice (*Zizania latifolia*)**

### **Initial area infested (hectare)**

Approximately 50 hectares identified at one known site in Kapiti.

### **Weighted average gross margin (\$ per hectare)**

\$185 per hectare based on land class which are likely to be effected.

### **Proportion of production loss from infested land (%)**

Assumed as 35% based on Effect On System (EOS) score.

### **Total area potentially infested (hectare) TAPI**

Manchurian wild rice is an aquatic, emergent weed that grows at the edges of fresh water or moderately saline, lakes, streams and wetlands. Potentially, if no control was undertaken, 4,716 hectares of available coastal/inland wetland, river and lakeshore habitat in the region could be infested within 75 years.

### **Years to infest all TAPI**

Manchurian wild rice produce large amounts of seed which germinate quickly with new plant form by tailoring of rhizome that spread outwards. Seeds and rhizome fragments can spread via waterways, livestock and machinery. Manchurian wild rice has a Biological Success Rating (BSR) score of 16. For the purpose of this analysis 75 years was assumed to infest all TAPI.

### **Annual cost of control for landholder (\$ per hectare)**

\$80 per hectare based on average control cost estimate by staff.

### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

### **Proportion of infested land to which conservation values apply (%)**

100% of available habitat was identified as having conservation values (i.e. coastal/inland wetland, river and lakeshore).

### **Any benefits provided by the weeds (\$ per annum)**

N/A

### **Biocontrol (\$ per annum)**

N/A

**Year strategy objectives achieved (total control)**

Assume 15 years from 2007 when RPMS becomes effective.

**Area infested if objectives (total control) achieved (hectare)**

0.

**Results**

	<b>No RPMS</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>	<b>\$</b>
Cost and losses under option	262,873	0	412,833
Section 72(a) NPV		0	-149,961
Section 72(a) regional values cost/ha		0	-\$32
Section 72(b) NPV (NRB)		0	190,622
Section 72(b) area of spillover prevented (ha)		0	4,666

Base Assumptions

Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	50	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$185	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	35%	(%)
Total Area Potentially Infested	(TAPI)	4,716	(ha)
Years to Infest all of TAPI (years)	(YI)	75	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$80	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	100%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)

Total Control Assumptions

Year Strategy objectives Achieved	(YOA)	15	(Years)
-----------------------------------	-------	----	---------

<b>Regional Council Costs</b>		
<b>Year</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>
1		1,757
2		1,757
3		1,757
4		1,757
5		1,757
6		1,757
7		1,757
8		1,757
9		1,757
Year 10 onward		1,757
NPV	0	22,841

<b>Control Costs</b>		
<b>Year</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>
1		30,000
2		30,000
3		30,000
4		30,000
5		30,000
6		30,000
7		30,000
8		30,000
9		30,000
Year 10 onward		30,000
NPV	0	389,993



## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$306,800 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$262,873.

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$22,841 for administration, inspection, monitoring and enforcement, a NPV of \$389,993 for cost of control. The total cost to the region when the strategy achieved is \$412,834 NPV at a discount rate of 8%.

### **Section 72 (a)**

Total Control produces a net negative benefit of -\$149,961 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$190,622 because the Strategy prevents the spread of the pest onto 4,666 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## **1.8 Moth plant (*Araujia sericifera*)**

### **Initial area infested (hectare)**

Approximately 13 hectares identified based on staff knowledge of known sites in the region.

### **Weighted average gross margin (\$ per hectare)**

\$110 per hectare based on land class which are likely to be effected.

### **Proportion of production loss from infested land (%)**

Assumed as 35% based on Effect On System (EOS) score.

### **Total area potentially infested (hectare) TAPI**

Moth plant primarily found in domestic gardens with a few odd sites in waste places and disturbed areas of the region. Potentially, if no control was undertaken, 298,521 hectares of available habitat in the region could be infested within 75 years.

### **Years to infest all TAPI**

Moth plant is a perennial plant that flowers from December till late May. The plants are self fertile and freely set seed. Moth plant has a Biological Success Rating (BSR) score of 15. For the purpose of this analysis 75 years was assumed to infest all TAPI.

### **Annual cost of control for landholder (\$ per hectare)**

\$836 per hectare based on average control cost estimate by staff.

### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

### **Proportion of infested land to which conservation values apply (%)**

71% of available habitat was identified as having conservation values.

### **Any benefits provided by the weeds (\$ per annum)**

N/A

### **Biocontrol (\$ per annum)**

N/A

### **Year strategy objectives achieved (total control)**

Assume 15 years from 2007 when RPMS becomes effective.

**Area infested if objectives (total control) achieved (hectare)**

0.

**Results**

	<b>No RPMS</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>	<b>\$</b>
Cost and losses under option	2,742,877	0	395,166
Section 72(a) NPV		0	2,347,711
Section 72(a) regional values cost/ha		0	\$11
Section 72(b) NPV (NRB)		0	2,492,911
Section 72(b) area of spillover prevented (ha)		0	298,508

**Base Assumptions**

Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	13	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$110	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	35%	(%)
Total Area Potentially Infested	(TAPI)	298,521	(ha)
Years to Infest all of TAPI (years)	(YI)	75	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$836	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	71%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)

**Total Control Assumptions**

Year Strategy objectives Achieved	(YOA)	15	(Years)
-----------------------------------	-------	----	---------

<b>Regional Council Costs</b>		
<b>Year</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>
1		18,568
2		18,568
3		18,568
4		18,568
5		18,568
6		18,568
7		18,568
8		18,568
9		18,568
Year 10 onward		18,568
<b>NPV</b>	<b>0</b>	<b>241,379</b>

<b>Control Costs</b>		
<b>Year</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>
1		11,830
2		11,830
3		11,830
4		11,830
5		11,830
6		11,830
7		11,830
8		11,830
9		11,830
Year 10 onward		11,830
<b>NPV</b>	<b>0</b>	<b>153,787</b>

## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$16,274,055 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$2,742,877.

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$241,379 for administration, inspection, monitoring and enforcement, a NPV of \$153,787 for cost of control. The total cost to the region when the Strategy achieved is \$395,166 NPV at a discount rate of 8%. This amount to \$11 per hectare of preventing damage to regional values.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$2,347,711 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$2,492,911 because the Strategy prevents the spread of the pest on to 298,508 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## **1.9 Perennial nettle (*Urtica dioica*)**

### **Initial area infested (hectare)**

Approximately 201 hectares identified based on staff knowledge of known sites within the region.

### **Weighted average gross margin (\$ per hectare)**

\$231 per hectare based on land class which are likely to be effected.

### **Proportion of production loss from infested land (%)**

Assumed as 10% for the purpose of this analysis.

### **Total area potentially infested (hectare) TAPI**

Perennial nettle has an extensive system of underground rhizomes that has the ability to form tall dense stands which can easily invade paddocks and good pasture land. It generally grows in damp areas but it can also tolerate a wide range of soil types and conditions. New colonies can establish from rhizome fragments and can be spread by water and machinery. Seeds are dispersed by stock and birds. Potentially, if no control was undertaken, 659,903 hectares of the available habitat in the region could be infested within 75 years.

### **Years to infest all TAPI**

Based on habitat information (above). For the purpose of this analysis 75 years was assumed to infest all TAPI.

### **Annual cost of control for landholder (\$ per hectare)**

\$236 per hectare based on average control cost estimate by staff.

### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

### **Proportion of infested land to which conservation values apply (%)**

33% of available habitat was identified as having conservation values.

### **Any benefits provided by the weeds (\$ per annum)**

N/A

### **Biocontrol (\$ per annum)**

N/A

**Year strategy objectives achieved (total control)**

Assume 15 years from 2007 when RPMS becomes effective.

**Area infested if objectives (total control) achieved (hectare)**

0.

**Results**

	<b>No RPMS \$</b>	<b>Containment \$</b>	<b>Total Control \$</b>
Cost and losses under option	13,632,227	0	1,540,549
Section 72(a) NPV		0	12,091,678
Section 72(a) regional values cost/ha		0	\$57
Section 72(b) NPV (NRB)		0	13,143,083
Section 72(b) area of spillover prevented (ha)		0	659,702

Base Assumptions

Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	201	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$231	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	35%	(%)
Total Area Potentially Infested	(TAPI)	659,903	(ha)
Years to Infest all of TAPI (years)	(YI)	75	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$236	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	33%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)

Total Control Assumptions

Year Strategy objectives Achieved	(YOA)	15	(Years)
-----------------------------------	-------	----	---------

<b>Regional Council Costs</b>		
<b>Year</b>	<b>Containment \$</b>	<b>Total Control \$</b>
1		21,423
2		21,423
3		21,423
4		21,423
5		21,423
6		21,423
7		21,423
8		21,423
9		21,423
Year 10 onward		21,423
<b>NPV</b>	<b>0</b>	<b>278,494</b>

<b>Control Costs</b>		
<b>Year</b>	<b>Containment \$</b>	<b>Total Control \$</b>
1		97,083
2		97,083
3		97,083
4		97,083
5		97,083
6		97,083
7		97,083
8		97,083
9		97,083
Year 10 onward		97,083
<b>NPV</b>	<b>0</b>	<b>1,262,055</b>

## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$55,325,024 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$13,632,227.

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$278,494 for administration, inspection, monitoring and enforcement, a NPV of \$1,262,055 for cost of control. The total cost to the region when the strategy achieved is \$1,540,549 NPV at a discount rate of 8%. This amount to approximately \$57 per hectare of preventing damage to the regional values.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$12,091,678 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$13,143,083 because the Strategy prevents the spread of the pest onto 659,702 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## **1.10 Saffron thistle (*Carthamus lanatus*)**

### **Initial area infested (hectare)**

Approximately 13 hectares identified based on staff knowledge of known sites, Masterton, Carterton, and South Wairarapa.

### **Weighted average gross margin (\$ per hectare)**

\$313 per hectare calculated from the MAF farm monitoring report 2005/06.

### **Proportion of production loss from infested land (%)**

Assumed as 15% for the purpose of this analysis.

### **Total area potentially infested (hectare) TAPI**

Infestations of saffron thistle are only found in areas of Wairarapa which occurs mainly on pasture land. Although saffron thistle seed is considered heavy and tends to fall at the base of the plant, hence infestation is more localised and the rate of spread is slow, but it can also spread by machinery, harvested crops and clothing materials. Saffron thistle is of economic importance to the region as it can reduce grazing pasture. Potentially, if no control was undertaken, 384,648 hectares of the regions high and low producing grassland could be infested within 75 years.

### **Years to infest all TAPI**

Based on habitat information (above). For the purpose of this analysis 75 years was assumed to infest all TAPI.

### **Annual cost of control for landholder (\$ per hectare)**

\$69 per hectare as estimated cost for Bathurst bur.

### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

### **Proportion of infested land to which conservation values apply (%)**

0.

### **Any benefits provided by the weeds (\$ per annum)**

N/A

### **Biocontrol (\$ per annum)**

N/A.



## Year strategy objectives achieved (total control)

Assume 15 years from 2007 when RPMS becomes effective.

## Area infested if objectives (total control) achieved (hectare)

0.

## Results

	No RPMS \$	Containment \$	Total Control \$
Cost and losses under option	2,770,243	0	129,413
Section 72(a) NPV		0	2,640,830
Section 72(a) regional values cost/ha		0	0
Section 72(b) NPV (NRB)		0	2,633,130
Section 72(b) area of spillover prevented (ha)		0	384,635
Base Assumptions			
Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	13	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$313	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	15%	(%)
Total Area Potentially Infested	(TAPI)	384,648	(ha)
Years to Infest all of TAPI (years)	(YI)	75	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$69	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	0%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)
Total Control Assumptions			
Year Strategy objectives Achieved	(YOA)	15	(Years)

Regional Council Costs		
Year	Containment \$	Total Control \$
1		9,955
2		9,955
3		9,955
4		9,955
5		9,955
6		9,955
7		9,955
8		9,955
9		9,955
Year 10 onward		9,955
NPV	0	129,413

## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$18,225,007 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$2,770,243.

### **Total Control scenario**

Currently staff are undertaking the control work of saffron thistle themselves. The outcome of the Total Control scenario is a NPV of \$129,413 for inspection including control cost at a discount rate of 8%.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$2,640,830 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$2,633,130 because the Strategy prevents the spread of the pest onto 384,635 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## **1.11 Woolly nightshade (*Solanum mauritianum*)**

### **Initial area infested (hectare)**

Approximately 63 hectares identified based on staff knowledge of known sites within the region.

### **Weighted average gross margin (\$ per hectare)**

\$115 per hectare based on land class which are likely to be effected.

### **Proportion of production loss from infested land (%)**

Assumed as 10% based on Effect On System (EOS) score.

### **Total area potentially infested (hectare) TAPI**

Woolly nightshade has been found growing in scrub, scrublands, forest margins and urban areas of the region. Potentially, if no control was undertaken, 278,046 hectares of available habitat in the region could be infested within 75 years.

### **Years to infest all TAPI**

Woolly nightshade produces berries that turn yellow when ripe and contain many seeds. Berries are eaten by birds and seeds can be spread over large distances. Woolly nightshade has a Biological Success Rating (BSR) score of 14. For the purpose of this analysis 75 years was assumed to infest all TAPI.

### **Annual cost of control for landholder (\$ per hectare)**

\$206 per hectare based on average control cost estimate by staff.

### **Proportion of landholders controlling pest (%)**

For the purpose of this analysis a maximum of 2% was assumed.

### **Proportion of infested land to which conservation values apply (%)**

77% of available habitat was identified as having conservation values.

### **Any benefits provided by the weeds (\$ per annum)**

N/A

### **Biocontrol (\$ per annum)**

N/A

### **Year strategy objectives achieved (total control)**

Assume 15 years from 2007 when RPMS becomes effective.

**Area infested if objectives (total control) achieved (hectare)**

0.

**Results**

	<b>No RPMS</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>	<b>\$</b>
Cost and losses under option	894,943	0	287,138
Section 72(a) NPV		0	607,805
Section 72(a) regional values cost/ha		0	\$3
Section 72(b) NPV (NRB)		0	802,971
Section 72(b) area of spillover prevented (ha)		0	277,984

**Base Assumptions**

Discount Rate		8%	
Initial Area Infested (ha)	(IAI)	63	(ha)
Weighted Average Gross Margin for Infested Land (\$/ha)	(WAGM)	\$115	(\$/ha)
Proportion of Production Loss from Infested Land (%)	(PPLIL)	10%	(%)
Total Area Potentially Infested	(TAPI)	278,046	(ha)
Years to Infest all of TAPI (years)	(YI)	75	(Years)
Annual Cost of Control for Landholder (\$/ha affected)	(ACCL)	\$206	(\$/ha)
Proportion of Landholders Controlling Pests (%)	(PLCP)	2.0%	(%)
Proportion of Infested Land to which Conservation Values Apply (%)	(PILCV)	77%	(%)
Any Benefits Provided by Weed (total \$ / annum)	(BPBW)	-	(\$)

**Total Control Assumptions**

Year Strategy objectives Achieved	(YOA)	15	(Years)
-----------------------------------	-------	----	---------

<b>Regional Council Costs</b>		
<b>Year</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>
1		6,149
2		6,149
3		6,149
4		6,149
5		6,149
6		6,149
7		6,149
8		6,149
9		6,149
Year 10 onward		6,149
<b>NPV</b>	<b>0</b>	<b>79,935</b>

<b>Control Costs</b>		
<b>Year</b>	<b>Containment</b>	<b>Total Control</b>
	<b>\$</b>	<b>\$</b>
1		15,939
2		15,939
3		15,939
4		15,939
5		15,939
6		15,939
7		15,939
8		15,939
9		15,939
Year 10 onward		15,939
<b>NPV</b>	<b>0</b>	<b>207,203</b>

## **Cost Benefit Analysis summary**

### **No RPMS scenario**

The outcome in the No RPMS scenario results in a total damage of \$4,283,896 per annum in 75 years as a result of production losses and additional costs of control. This is a net present value of \$894,943.

### **Total Control scenario**

The outcome of the Total Control scenario is a NPV of \$79,935 for administration, inspection, monitoring and enforcement, a NPV of \$207,203 for cost of control. The total cost to the region when the strategy achieved is \$287,138 NPV at a discount rate of 8%. This amount to approximately \$3 per hectare of preventing damage to the regional values.

### **Section 72 (a)**

The net outcome for Total Control when compared with the No RPMS approach produces a net positive benefit of \$607,805 NPV because the costs of undertaking the Strategy are less than the likely losses in production and control costs if the organisms were allowed to spread. Total Control therefore meets the requirements of section 72 (a) of the Act.

### **Section 72 (b)**

The net regional benefits exceed the individual benefits by \$802,971 because the Strategy prevents the spread of the pest onto 277,984 hectares. Total Control therefore meets the requirements of section 72 (b) of the Act.

### **Section 72 (a) (b)**

As the requirements of section 72 (a) and (b) are deemed by Greater Wellington to have been met, then the costs of the Strategy can be charged through a general rate to the regional community as beneficiaries, and the benefits received will exceed the costs.

## 1.12 Rooks

**Key:**

N = None            1 = High  
 L = Low            5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)	
On endangered species	N	1	L	1	
On species diversity	N	1	L	1	
Soil resources	N no concern with low no's.	1	L	3	In their thousands, potential for wind assisted soil erosion
Water quality	N	1	L	1	
Human health	N	1	L	2	Extremely large roosts could cause fouling of stock troughs
Maori culture	N	1	L	1	
Production	N no concern with low no's.	1	L	4	Cereal crops at risk
Recreation	N	1	N	1	
International trade	N	1	L	2	Only with export grain
Likelihood of human introduction					
Likelihood of spread by 2011					

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	N	1	M	1	H	1	N/A	N/A	N/A	N/A
Cost to individuals	H	2	L	1	L	1	N/A	N/A	N/A	N/A
Environment benefits	L	1	L	1	L	1	N/A	N/A	N/A	N/A
Commercial benefits	M	2	M	1	M	1	N/A	N/A	N/A	N/A

### 1.13 Feral cat

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	M	1	M	1
On species diversity	M	1	M	1
Soil resources	L	1	L	1
Water quality	L	1	L	1
Human health	M	1	M	1
Maori culture	M	1	M	1
Production	L	1	L	1
Recreation	L	1	L	1
International trade	M	2	M	2
Likelihood of human introduction	H	1	H	1
Likelihood of spread by 2011	H	1	H	1

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	N	2	N/A	N/A	N/A	N/A	N/A	N/A	M	2
Cost to individuals	L	2	N/A	N/A	N/A	N/A	N/A	N/A	L	1
Environment benefits	L	2	N/A	N/A	N/A	N/A	N/A	N/A	M	1
Commercial benefits	L	1	N/A	N/A	N/A	N/A	N/A	N/A	L	2

### 1.14 Feral deer

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	L	2	L	2
On species diversity	L	2	L	2
Soil resources	L	2	L	2
Water quality	L	2	L	2
Human health	L	2	L	2
Maori culture	L	2	L	2
Production	L	2	L	2
Recreation	L	2	L	2
International trade	L	2	L	2
Likelihood of human introduction	H	1	H	1
Likelihood of spread by 2011	H	1	H	1

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	N	1	N/A	N/A	N/A	N/A	N/A	N/A	L	1
Cost to individuals	L	2	N/A	N/A	N/A	N/A	N/A	N/A	L	2
Environment benefits	M	2	N/A	N/A	N/A	N/A	N/A	N/A	M	2
Commercial benefits	L	2	N/A	N/A	N/A	N/A	N/A	N/A	L	2



### 1.15 Feral goat

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	L	2	L	2
On species diversity	M	2	M	2
Soil resources	L	2	L	2
Water quality	L	2	L	2
Human health	L	2	L	2
Maori culture	M	3	M	3
Production	L	2	L	2
Recreation	L	2	L	2
International trade	L	2	L	2
Likelihood of human introduction	M	2	M	2
Likelihood of spread by 2011	M	2	M	2

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	L	2	N/A	N/A	N/A	N/A	N/A	N/A	M	2
Cost to individuals	H	3	N/A	N/A	N/A	N/A	N/A	N/A	M	3
Environment benefits	M	3	N/A	N/A	N/A	N/A	N/A	N/A	M	2
Commercial benefits	L	2	N/A	N/A	N/A	N/A	N/A	N/A	L	2

## 1.16 Feral pigs

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	L	2	L	2
On species diversity	M	2	M	2
Soil resources	M	1	M	2
Water quality	L	2	L	3
Human health	L	1	L	3
Maori culture	L	1	L	2
Production	M	1	M	2
Recreation	L	1	L	2
International trade	L	2	L	2
Likelihood of human introduction	H	1	H	1
Likelihood of spread by 2011	H	1	H	1

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	N	2	N/A	N/A	N/A	N/A	N/A	N/A	L	1
Cost to individuals	L	2	N/A	N/A	N/A	N/A	N/A	N/A	L	2
Environment benefits	N	2	N/A	N/A	N/A	N/A	N/A	N/A	M	1
Commercial benefits	N	2	N/A	N/A	N/A	N/A	N/A	N/A	L	1

## 1.17 Gambusia

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	L	5	H	2
On species diversity	L	5	H	2
Soil resources	L	2	L	3
Water quality	L	3	M	2
Human health	L	2	L	3
Maori culture	L	2	H	2
Production	L	2	L	2
Recreation	L	2	M	3
International trade	L	2	L	2
Likelihood of human introduction	H	2	H	2
Likelihood of spread by 2011	H	1	H	1

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	N	2	N/A	N/A	N/A	N/A	N/A	N/A	H	2
Cost to individuals	M	3	N/A	N/A	N/A	N/A	N/A	N/A	L	2
Environment benefits	L	2	N/A	N/A	N/A	N/A	N/A	N/A	L	3
Commercial benefits	L	2	N/A	N/A	N/A	N/A	N/A	N/A	L	1

## 1.18 Koi carp

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	L	5	H	2
On species diversity	L	5	H	2
Soil resources	L	2	L	3
Water quality	L	3	M	2
Human health	L	2	L	3
Maori culture	L	2	H	2
Production	L	2	L	2
Recreation	L	2	M	3
International trade	L	2	L	2
Likelihood of human introduction	H	2	H	2
Likelihood of spread by 2011	H	1	H	1

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	N	2	N/A	N/A	N/A	N/A	N/A	N/A	H	2
Cost to individuals	M	3	N/A	N/A	N/A	N/A	N/A	N/A	L	2
Environment benefits	L	2	N/A	N/A	N/A	N/A	N/A	N/A	L	3
Commercial benefits	L	2	N/A	N/A	N/A	N/A	N/A	N/A	L	1

## 1.19 Rabbits

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	L	1	M	3
On species diversity	L	1	M	3
Soil resources	L	1	H	2
Water quality	L	1	M	3
Human health	L	1	L	1
Maori culture	L	1	M	2
Production	L	2	H	2
Recreation	L	1	L	1
International trade	L	1	H	2
Likelihood of human introduction	L	1	L	1
Likelihood of spread by 2011	L	1	L	1

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	L	1	N/A	N/A	N/A	N/A	N/A	N/A	M	2
Cost to individuals	H	1	N/A	N/A	N/A	N/A	N/A	N/A	L	2
Environment benefits	M	2	N/A	N/A	N/A	N/A	N/A	N/A	M	2
Commercial benefits	M	2	N/A	N/A	N/A	N/A	N/A	N/A	M	2

## 1.20 Red eared slider turtle

Key:

N = None  
L = Low  
M = Medium  
H = High

1 = High  
5 = Low

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	L	5	M	4
On species diversity	L	5	M	4
Soil resources	L	5	L	2
Water quality	L	5	L	2
Human health	L	5	L	2
Maori culture	L	5	M	3
Production	L	5	L	2
Recreation	L	5	L	2
International trade	L	5	L	2
Likelihood of human introduction	H	3	H	2
Likelihood of spread by 2011	M	3	H	2

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	L	2	L	5	H	2	M	3	L	2
Cost to individuals	L	2	L	2	H	2	L	3	L	2
Environment benefits	L	3	M	4	M	2	L	3	M	2
Commercial benefits	L	3	L	2	L	2	L	3	L	2

## 1.21 Rainbow skinks

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	N/A	N/A	M	4
On species diversity	N/A	N/A	M	4
Soil resources	N/A	N/A	L	1
Water quality	N/A	N/A	L	1
Human health	N/A	N/A	L	1
Maori culture	N/A	N/A	M	3
Production	N/A	N/A	L	1
Recreation	N/A	N/A	L	2
International trade	N/A	N/A	L	2
Likelihood of human introduction			H	1
Likelihood of spread by 2011			M	2

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	L	2	N/A	N/A	N/A	N/A	M	4	N/A	N/A
Cost to individuals	L	2	N/A	N/A	N/A	N/A	L	3	N/A	N/A
Environment benefits	M	5	N/A	N/A	N/A	N/A	M	2	N/A	N/A
Commercial benefits	L		N/A	N/A	N/A	N/A	L	2	N/A	N/A

## 1.22 Argentine ants

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	L	4	M	5
On species diversity	L	4	M	5
Soil resources	N	2	N	2
Water quality	N	2	N	2
Human health	L	3	L	3
Maori culture	L	3	L	3
Production	N	2	L	5
Recreation	L	3	L	3
International trade	N	3	N	3
Likelihood of human introduction				
Likelihood of spread by 2011				

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	L	2	M	3	H	1	M	3	N/A	N/A
Cost to individuals	M	3	L	3	L	2	L	3	N/A	N/A
Environment benefits	L	5	L	3	L	3	L	4	N/A	N/A
Commercial benefits	L	5	L	3	L	3	L	2	N/A	N/A



### 1.23 Darwin's ants

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	N/A	N/A	M	5
On species diversity	N/A	N/A	M	5
Soil resources	N/A	N/A	N	2
Water quality	N/A	N/A	N	2
Human health	N/A	N/A	L	3
Maori culture	N/A	N/A	L	3
Production	N/A	N/A	L	5
Recreation	N/A	N/A	L	3
International trade	N/A	N/A	N	3
Likelihood of human introduction	N/A	N/A		
Likelihood of spread by 2011	N/A	N/A		

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	L	2	N/A	N/A	N/A	N/A	M	3	N/A	N/A
Cost to individuals	M	3	N/A	N/A	N/A	N/A	L	3	N/A	N/A
Environment benefits	L	5	N/A	N/A	N/A	N/A	L	4	N/A	N/A
Commercial benefits	L	5	N/A	N/A	N/A	N/A	L	2	N/A	N/A

## 1.24 Mynas

Key:

N = None      1 = High  
 L = Low        5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	L	2	L	2
On species diversity	L	2	L	2
Soil resources	N	2	N	2
Water quality	N	2	N	2
Human health	N	2	N	2
Maori culture	N	2	N	2
Production	N	2	N	2
Recreation	N	2	N	2
International trade	N	2	N	2
Likelihood of human introduction	L		L	
Likelihood of spread by 2011	M	5	M	5

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	N	3	M	3	M	3	L	4	L	3
Cost to individuals	N	3	L	3	N	3	N	2	N	2
Environment benefits	N	3	N	5	L	5	L	3	L	3
Commercial benefits	N	3	N	5	M	3	N	3	N	2

## 1.25 Subterranean termites

Key:

N = None            1 = High  
 L = Low            5 = Low  
 M = Medium  
 H = High

	Current Impact	Certainty (1 – 5 range)	Potential Impact	Certainty (1 – 5 range)
On endangered species	N/A	N/A		
On species diversity	N/A	N/A		
Soil resources	N/A	N/A		
Water quality	N/A	N/A		
Human health	N/A	N/A		
Maori culture	N/A	N/A		
Production	N/A	N/A		
Recreation	N/A	N/A		
International trade	N/A	N/A		
Likelihood of human introduction				
Likelihood of spread by 2011				

	No RPMS		Containment		Eradication		Surveillance		Site Led	
	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)	Impact	Certainty (1 – 5 range)
Cost to the council	N		N/A	N/A	N/A	N/A	M	3	N/A	N/A
Cost to individuals	H		N/A	N/A	N/A	N/A	L	3	N/A	N/A
Environment benefits	L		N/A	N/A	N/A	N/A	M	3	N/A	N/A
Commercial benefits	H		N/A	N/A	N/A	N/A	M	3	N/A	N/A

## Reference:

Landcare Research

Otago Regional Council

Department of Conservation

Auckland Regional Council

Global Invasive species database <http://www.issq.org/database/species/search>

Water, air, earth and energy: elements in Greater Wellington's logo that combine to create and sustain life. Greater Wellington promotes **Quality for Life** by ensuring our environment is protected while meeting the economic, cultural and social needs of the community.

#### FOR FURTHER INFORMATION

Greater Wellington  
34 Chapel Street  
PO Box 41  
Masterton 5840  
T 06 378 2484  
F 06 378 7994  
W [www.gw.govt.nz](http://www.gw.govt.nz)

Greater Wellington  
1056 Fergusson Drive  
PO Box 40847  
Upper Hutt 5140  
T 04 526 4133  
F 04 526 4171

Greater Wellington is the  
promotional name of the  
Wellington Regional Council

Published November 2007  
GW/BIO-G-07/288