

Wakatipu Wilding Conifer Strategy

2008-2012



Prepared for:
QUEENSTOWN LAKES DISTRICT COUNCIL

Prepared By:
Colin Day (Go-Green Consulting, Queenstown)

and
Nick Ledgard (Scion, Christchurch)

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Executive Summary

The first Wakatipu Wilding Conifer Strategy (2004-2007) was prepared for the Queenstown Lakes District Council (QLDC) by Dawn Palmer (Natural Solutions for Nature Ltd, Queenstown), Nick Ledgard (Forest Research, Christchurch) and Colin Day (Go-Green Consulting, Queenstown). This, the second Strategy (2008-2012) has been written by Colin Day and Nick Ledgard.

Objective

The Strategy was prepared to:

- Meet the local communities' desire to see wilding conifers controlled.
- Clarify the wilding control responsibilities of the QLDC, other land administering agencies, land owners/ managers and the general public.
- Determine a strategically scheduled and cost-effective control programme.
- Promote awareness and education relative to wilding issues, and to improve support for a wilding control programme.

Method

The 2004-2007 Strategy (plus the following year, 2008) was reviewed relative to control accomplished within the 46 Management Units (MUs) and the costs involved. Particular attention was paid to future control required (Table 2) and the prioritisation of that work (Tables 3 & 4). Where appropriate field visits were made, plus a helicopter inspection of the more remote units was undertaken.

Main Findings

- 1 The main spreading conifer species in the Wakatipu area are Douglas-fir (*Pseudotsuga menziesii*), Corsican and Scots pine (*Pinus nigra* and *P. sylvestris* resp.) and European larch (*Larix decidua*). Lodgepole or Contorta pine (*Pinus contorta*), New Zealand's most vigorous spreading conifer, and the only species listed as a pest in the Otago Regional Council's Pest Management Strategy, is present in a few relatively confined locations. However, during the last 4 years, contorta has been found in low numbers in many management units. This probably reflects improved identification.
- 2 During the 2004-2008 period, control work was carried out in 37 (80%) of the MUs, and 65 (73%) of the sub-units.
- 3 Control work was not carried out in 5 (17%) of the MUs to which funds had been budgeted in 2004 – usually due to lack of landowner support and decisions made to:
 - leave the Kawarau Gorge to DOC, and
 - concentrate on certain areas to make programmes more manageable and to achieve a minimum level of control in those areas.
- 4 Between 2004-2008, within the MUs which received funds, it is estimated that removals achieved an average of 65% (range 10 - 120%) of that needed for containment or total control.

- 5 Between 2004-2007, the amount spent on control was \$324,300, which is 109% of the funds budgeted in the Strategy (\$297,700).
- 6 A further \$118,700 was spent on control in 2007-08.
- 7 The average amount spent annually on wilding control between 2004-2008 was \$111,000.
- 8 Although total eradication of wilding conifers in the Wakatipu area will never be possible, and containment is the only solution in some areas, undoubtedly without the 2004 Strategy there would be substantially greater areas affected by wildings.
- 9 *Hence, it is considered that the Strategy has been largely successful in achieving the removal and containment goals set out in 2004, and that a review and rewrite for the 2008-2012 period is essential.*
- 10 Effectiveness of strategy implementation has been, and will continue to be, strongly related to the:
- High level of interest and commitment of the Manager
 - Continuity of management personnel involved, and hence greater understanding of the task ahead
 - Quality of records kept on daily control activities
 - 'Ownership' of strategy by key stakeholders, particularly the local land owners/managers and communities
 - Level of funding available.
- 11 Although the Strategy has been successful to date, experience elsewhere indicates that there needs to be greater awareness of the importance of wilding control, and 'buy-in' of the document by land owners/managers, land administering agencies and the public in general. To this end, it is recommended that:
- Presentations on the Strategy and its implementation (past and intended) be given to the QLDC, and as soon as it is approved by the Council, to community groups and the general public.
 - A formal and active Wakatipu Wilding Control Group (WWCG) be formed, involving community groups, farm owners/managers and interested members of the public, with representation from land management agencies, such as QLDC, DoC, ORC, LINZ.
- 12 Such end-user-driven environmental groups, often chaired by a respected member of the local community, have worked well elsewhere in NZ. Apart from greater local 'ownership' of the focal task, a major reason for their success has been better financing, due to their ability to access other sources of funds (eg., Lotteries Board), and more readily seek and accommodate donations from private businesses and individuals.
- 13 Field visits during the current review indicated that, although control and containment has been successful in many Units, there are certain important and historically clear sites which are becoming invaded more frequently eg., north faces of Cecil Peak, and north and west faces of the Remarkables. This is probably due to increasing seed production from maturing stands on exposed slopes and ridges ('take-off' sites) to the west of Queenstown.
- 14 Initial years of the Strategy have largely dealt with removing wildings from areas which have not been cleared before. However, a guiding principle of the Strategy is to retain control of cleared areas once swept of trees. Therefore, after the initial removals, return visits are needed to remove small seedlings missed, plus any new arrivals. For cost reasons, such return visits should be

carried out before wildings grow beyond 'hand-tool removal' size. Consequently, a significant portion of the budget in the 2008-12 Strategy will be apportioned to revisits, which on average cost 25% of the original removal cost, where the seed source has been removed.

- 15 After the top priority of keeping cleared areas free of conifers (not allowing any to reach coning age – usually age 8+), the next highest priority is accorded to units where large tracts of clear land are threatened by wilding invasion, particularly if the threat is from relatively few scattered outlier trees (i.e. the cost of removal is low). This is in accordance with the Strategy's motto 'A stitch in time saves nine' (SITS9).
- 16 The MUs to receive most attention between 2008-2012 are listed as:
 - 10f&g Gooseberry and Horse Gullies (Figure 22, Appendix 1)
 - 25 Coronet Slopes (contorta), (Figure 21, Appendix 1)
 - 5a&b Ben Lomond ridge and Bowen Peak (continuation), (Figure 7, Appendix 1)
 - 4b1 Wedge Peak (continuation)
 - 4a2 Upper Bushy Creek (continuation)
 - 6a Queenstown Hill (Figures 18 to 20, Appendix 1)
- 17 Whilst the 2004 strategy has undoubtedly been successful overall in achieving it's aims, and though the funding available to both agencies (DOC and QLDC) has been greater than budgeted, resources were still insufficient to complete all high priority areas and those containing contorta. In addition, the quality of the work and overall efficiency was not as good as it could have been if we had had one contractor for the whole period.
- 18 Wilding control experience has underlined the importance of a level where costs for future maintenance are minimized. In the past, incomplete removals have resulted in early revisits and excessive maintenance costs. Also, costs of control have increased by 66% during the period of the first strategy (since 2004).
- 19 In view of the above and the fact that the QLDC wilding tree control budget has remained at \$100,000 for 4 years, we recommend that the QLDC budget for wilding tree control be increased to \$120,000 per annum from 2009/10 onwards. Table 3 reflects this increase and assumes continued financial support from landowners.
- 20 Total expenditure between the agencies and landowners for 2007/08 (not including transport provided by landowners) was \$324,000 compared with \$155,000 in 2003/04 (an increase of 109%). Meanwhile average hourly rates have increased from \$25.33 to \$42.16 over the same period (66%). Meanwhile tree spread is exponential. Therefore it is our recommendation that a big push is made in one year by aiming for a combined total budget of \$1,000,000. In the long term this would reduce the annual cost of maintenance to a much more manageable level.

How to use this Strategy

- Section 1 provides the background and overview of the wilding conifer situation
- Section 2 provides information about wilding conifers, their threats and the history of control. It contains maps of Management Unit (MU) locations, and Table 2 which lists the MUs along with the density of wildings, control recommendations and estimated costs.
- Section 3 describes the Strategy's vision.
- Section 4 describes how the Strategy is to be implemented, with a prioritised Implementation Schedule and budget outlined in Table 3, together with a follow-up control list (Table 4).
- References are listed at the end of the Strategy, after the Appendices which contain photographs (1), and a basic conifer identification key (2).

WILDING CONIFER STRATEGY

SECTION 1

Background and Introduction

Background

Queenstown is renowned world-wide for its visual landscapes. In that context, wilding trees are unique from other components of that landscape, in that they are capable of rapidly and significantly affecting the visual appearance of every area of land visible from Queenstown and its surrounds (Figure 7, Appendix 1). Therefore their management is essential for the long-term well-being of this premier NZ resort town.

Over recent years, the District's land administration agencies; the Department of Conservation (DOC), Queenstown Lakes District Council (QLDC) and Otago Regional Council (ORC) have recognised the importance of responding to the issue of wilding conifers. The QLDC Partially Operative District Plan (PODP)¹ addresses the issue of forestry and wilding spread and these sections are detailed below.

ORC has included one species (Contorta pine – *pinus contorta*) in its Regional Pest Management Strategy (RPMS)² and DOC has produced its own wilding control strategy for the South Island³ as well as strategies for its Conservancies and Areas.

In June 2002, Council's Strategic Planning workshop – "Tomorrow's Queenstown" provided an additional mandate for Council to protect the Districts' landscapes, in part by controlling the spread of wilding conifers and discouraging activities that create additional wilding seed sources. A workshop held in Arrowtown during February 2003 similarly made recommendations for the removal and containment of conifers around slopes surrounding Arrowtown.

In May 2004, the first Wakatipu Wilding Control Strategy was produced for the QLDC by Natural Solutions for Nature (Dawn Palmer), assisted by Go-Green Consulting (Colin Day) and Forest Research (Nick Ledgard). The purpose of this strategy was to promote a co-ordinated inter-agency approach to future control, so that unwanted spread is removed in a cost-efficient and effective manner, before management becomes too onerous and prohibitively expensive.

The strategy gave an overview of the current extent of wilding conifer spread and then presented a vision and strategic goals for their removal or containment. An explanation, guiding principles and actions were assigned to each goal. The final section contained an Implementation Schedule and financial implications. Appendix 1 contained photographs which illustrate wilding spread and proposed containment lines.

As intended, the 2004 strategy has been implemented through to 2007, when it was to be reviewed. The implementation period was

extended to 30th June 2008, at the end of which time a review was undertaken by Nick Ledgard, assisted by Colin Day. A new Strategy, presented in this document, reviews the activities and accomplishments of the last 4 years, and then details the recommended management for the 2008-2012 period and follows the format of the 2004 Strategy.

It is intended that this strategy be cross referenced with other management plans, strategies and guideline brochures being prepared for the Queenstown Lakes District Council, including for example, the Ben Lomond and Queenstown Hill Reserves Management Plan. Policies, rules and guidelines being developed by Lakes Environmental Services to support the District Plan may also refer to this strategy or use it as a supporting resource.

**Scope and Purpose
of the Wilding
Conifer Strategy**

In its brief for compiling the strategy Council required the following:

- A review of wilding control for the 2004-2008 period
- A new Strategy for the 2008-2012 period, addressing the same issues as covered in the first Strategy, so that the Council has -
- Continuing guidance in the co-ordination of its activities with those of other stakeholder agencies (such as the Department of Conservation and Otago Regional Council) and other landowners / managers to achieve the control of wilding conifers in the Wakatipu region.

Annual fine tuning of the priorities will occur as each year's control programme is implemented. This is likely to result in updating of initial cost estimates, maps and tables by those who undertake wilding conifer control. To this end, greater use will be made of modern spatial data gathering tools and mapping systems, so that a current and accurate record of the known extent of the problem, and the most cost-effective future direction can be determined. The new strategy will require review after 4 years. Both the original strategy and this update required about 6 months until ratification. Therefore we recommend that the next review and update commences by August 2011, so that it can be included in the Council annual plan cycle for 2012/13.

Strategy Implementation

The strategy will enable a focused approach to the control of wilding conifers, allowing Council to be confident that funds expended are targeting the areas of greatest priority and bring the greatest benefit to the affected landscapes.

The strategy recommends the formation of a Wakatipu Wilding Control Group (WWCG) to implement the Strategy and co-ordinate the annual programmes and budgets of all affected stakeholders. The WWCG will comprise representatives of community groups, farm owners / managers, pastoral lessees and interested members of the public, with representation from land management agencies, such as QLDC, DoC, ORC and Land Information New Zealand (LINZ). Such end user-driven environmental Groups, often chaired by a respected member of the local community, have worked well elsewhere in NZ. Apart from greater local 'ownership' of the focal task, a major reason for their success has been better financing, due to their ability to access other sources of funds (e.g., Lotteries Board), and more readily seek and accommodate donations from private businesses and individuals.

By implementing the strategy the following long-term benefits can be realised;

- Areas previously cleared of unwanted spread can be kept free of wildings. Retaining control of cleared areas is a top priority of the new Strategy.
- Scattered wilding conifers will be removed from areas of open tussock grasslands and sub-alpine shrublands before they are able to produce cones and seeds and/or establish significant sites for further spread, thus protecting large areas of land from the probability of being infested. This **'stitch in time saving nine'** approach has driven the allocation of a high, medium or low prioritisation in the management and implementation schedules (summarised in Tables 2 and 3).
- Containment of denser infestations, where total removal is currently too costly or impractical.

Limitations & Mapping

The strategy has focused on the catchment of the Wakatipu Basin, the Shotover and Arrow River catchments and the Roaring Meg catchment at the eastern boundary of the Queenstown Lakes District Council. Where significant seed sources of conifers have been identified in the surrounding areas, they have been indicated in Table 2. Map 1 illustrates the boundaries of the strategy.

Existing infestations of wilding conifers have been mapped using the latest set of ortho-rectified photographs available on the QLDC GIS (Geographic Information System). The data was supplied in April 2008 from photography flown mostly in February 2006 and January 2007. Therefore this represents an excellent and accurate indication of known infestations within the limitations of the resolution of the photography. This is sufficient to identify small clusters of trees and occasionally single known outliers, but often not sufficient to differentiate Beech and conifer boundaries. Another limitation was imposed by the steepness of the terrain which caused shadows depending on the time photography was flown.

The mapped infestations were ground truthed in 2003 by the consultant team, reviewed in 2007, and supplemented by discussions with local land owners and managers, as well as the Department of Conservation (Doc). This represents the best estimate of the existing spread of wilding conifers available at the time of preparation. It is accepted that some conifers have been missed and that misinterpretation of the images on the aerial photographs may have occurred.

Control work completed has also been mapped. In 2003, as for infestations, this was drawn on paper maps and then digitised. Most control completed between 2003 and 2008 has been accurately mapped. However, there are considerable gaps in the information due to lack of data capture and mapping. For instance, there is very little information regarding private control operations.

Funding

The lack of a secure source of funding required to maintain ongoing control and sustain the gains of past control is the greatest risk to the long term success of this strategy and the financial investment it requires.

In the past, work programmes have been dependent on annual allocation of funds by Council through the three yearly and annual plan business cycles, and on co-operative wilding control by DoC and some landowners. In the future, it is hoped that the formation of a WWCG, will open up access to other sources of funds (eg., Lottery Board grants) and to donations from private businesses and individuals.

Methodology

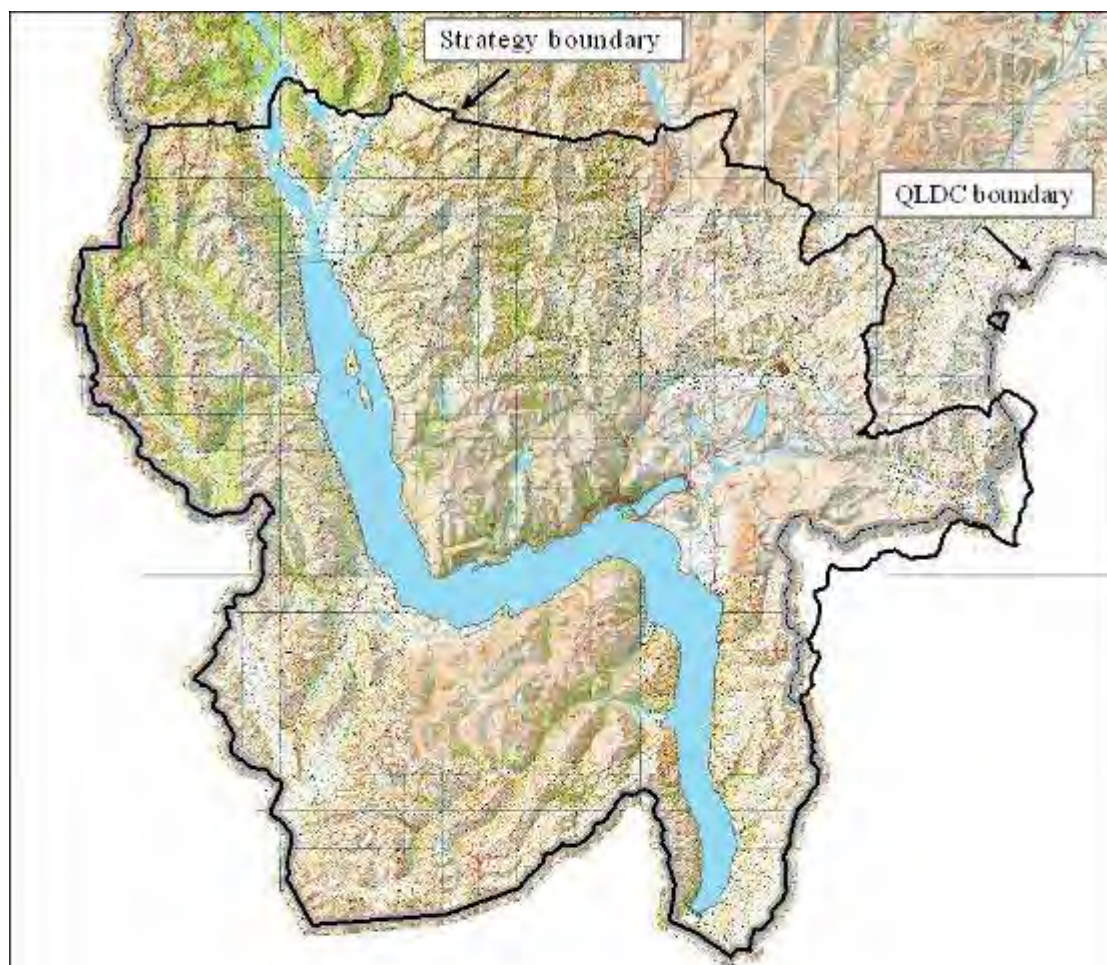
The preparation of the initial strategy in 2004 was managed by the Queenstown Lakes District Council, and undertaken by Natural Solutions for Nature Ltd (Dawn Palmer) in association with Nick Ledgard of Forest Research, Christchurch and Go-Green Consulting (Colin Day). The fieldwork, writing and presentation of the new Strategy (2008-2012), was carried out by Colin Day and Nick Ledgard. It included the following processes:

- Most of the background information documents and maps have been updated from the 2004-2007 strategy.

- Map 2 shows the extent of wilding conifer spread to date and was prepared by combining existing data from 2003 with known areas of infestation identified on ortho-rectified aerial photographs (2006-07) on the QLDC Geographic Information System (GIS). These were “ground truthed” by field inspections in 2003 & again in September 2007 as well as from knowledge of infestations held by other local land managers or administrators.
- Areas of control and containment lines were determined in 2003. Photographs were taken and these containment lines were mapped on them – see 2004 Strategy, Appendix 1. Photographs were re-taken where practicable, but it was decided to exclude most of them in order to illustrate other points with photographs in this update and to limit the size and cost of reproducing this document. These photographs are a useful record of progress both of infestation and control and are available upon request.
- Areas in which control has been undertaken have been mapped into the QLDC GIS using ortho-rectified aerial photographs from the records held by Colin Day and the Department of Conservation. This mapping improves over the years as a result of improved data capture methods.
- Priorities for control have been based on principles and criteria outlined in Section 2 – *The extent and management of wilding conifer spread*.
- Discussions were held with those most affected by wilding spread, and with operators who have had experience with wilding control.
- Cost estimates for control and management have been based on the experience of local operators and DoC. Comparisons with the estimates of operations carried out elsewhere in the South Island have also been considered.

Status of this document

This is a non-statutory plan. Although it has no legal status, it is anticipated that it will be implemented by the WWCG, under the administrative umbrella of the Queenstown Lakes District Council.



Map 1: Boundary of the strategy and area administered by Queenstown Lakes District Council

SECTION 2

Conifer establishment and the nature and extent of current spread

Conifer Establishment

The Lake Wakatipu area favours the growth of woody species in general including a wide range of introduced conifer species, the earliest of which were established well over a century ago. The acclimatisation of Douglas-fir was initiated in the 1870s on the Plantation Reserve bounded by Park Street, Horne Creek and Coronation Drive by Lewis Hotop and others (pers. comm. Neil Clayton, 24/3/04). Their exceedingly good growth is well exemplified on the conifer-clad slopes (Figure 1 to 8, Appendix 1) which provide the backdrop to Queenstown. These trees were the result of plantings and deliberate seeding of Douglas-fir from the 1940s to about the 1960s, and their natural regeneration since that time. Part of the original intention was probably to provide Queenstown with some protection from rock fall and avalanches as well as clothe the perceived bareness of the surrounding landscape. (Figures 1-5, Appendix 1).

Another example is in the Mt Aurum area where the first introduced trees were planted around the Skippers cemetery about 1880. Small plantings were established close to the homestead and other local buildings soon after. Little natural regeneration occurred until the mid 20th century. Photographs taken (Figure 1 to 8, Appendix 1) in about 1960 show only localised spread, immediately adjacent to the early plantings and on some steep southerly slopes less attractive to grazing stock. A major advance of wilding spread occurred after 1982, when the station was declared a Recreation Reserve (of 9100 ha) and the land was retired from grazing⁵.

More recently (1986), local councils established a 140 ha commercial Douglas-fir forest on slopes between Coronet Peak and Arrowtown. Although very valuable in that it is now estimated to be worth many millions of dollars, it is also the source of seed which is giving rise to wildings some distance downwind.

It is from these and other smaller scale plantations, shelter belts or pockets of established wildings that further wilding conifers will emanate if containment or removals are not undertaken. Map 2 illustrates the extent of the known spread of wilding conifers throughout the strategy area.

Wilding Conifers As a Resource

It is acknowledged that conifers can provide shelter, stabilise steep slopes and protect structures from rock slide or storm damage. They can also, particularly if managed properly and reasonably accessed, provide a financial return from timber production. More recently, opportunities are arising for using trees for carbon storage and trading, plus there is increasing interest in their potential as a biofuel source. However, the Strategy takes the view that these benefits often do not outweigh the adverse effects which unrestricted spread can have on the district's biodiversity and landscape values, and where this is the case, wilding control and

containment are the preferred approaches. Although not yet formally tested, this approach is likely to be legally endorsed in the future, as the Resource Management Act and the Biosecurity Act will take precedence over legislation presently being considered – such as the Emissions Trading Scheme.

Wilding species known within the area

“Wildings” is the term used for the natural regeneration or seedling spread of introduced trees, occurring in locations not managed for forest production. The term is usually applied to members of the family *Pinaceae*, within which most of the major spreading forestry species of concern occur. Most wildings grow close to the parent seed source and are termed **fringe** spread (Figure 24, Appendix 1). Wildings further afield are termed **distant** spread. They grow from seed often wind-blown from exposed **take-off** sites and usually occur as scattered **outlier** trees (Figure 24, Appendix 1).

Table 1. Common and botanical names of conifers noted as spreading in the Lake Wakatipu catchment study area

Common name	Botanical name	Spreading vigour	Extent of spread
Lodgepole pine, or Contorta pine	<i>Pinus contorta</i>	High	<i>Only present in a few areas</i>
Corsican pine	<i>Pinus nigra</i>	High	<i>Common and dominant in some areas, scattered individuals common elsewhere</i>
Scots pine	<i>Pinus sylvestris</i>	High	<i>Common and dominant in some areas, scattered wildings elsewhere</i>
European larch	<i>Larix decidua</i>	High	<i>Common and dominant in some areas, scattered individuals common elsewhere</i>
Douglas-fir	<i>Pseudotsuga menziesii</i>	High	<i>Common and dominant in some areas, scattered individuals common elsewhere</i>
Maritime pine	<i>Pinus pinaster</i>	Medium	<i>Common in a few areas, scattered individuals elsewhere</i>
Radiata pine	<i>Pinus radiata</i>	Medium	<i>Scattered wildings throughout, mainly on warm north-facing slopes</i>
Ponderosa pine	<i>Pinus ponderosa</i>	Low	<i>Scattered individuals in a few areas, not a commonly spreading species</i>
Bishops pine	<i>Pinus muricata</i>	Low	<i>Rare individuals likely</i>
Mountain pine	<i>Pinus mugo</i>	Low	<i>Occurs (mostly planted) in a few areas; not a common spreading species</i>
Norway spruce	<i>Picea abies</i>	Low	<i>Rare – only seen in Moonlight Creek</i>
Western Red Cedar	<i>Thuja plicata</i>	Low	<i>Rare – only seen in Moonlight Creek</i>

Many other spreading species exist, including deciduous species such as hawthorn, sycamore, willows and poplar in addition to

gorse, broom and briar rose. Agencies such as the DOC and ORC through the Regional Pest Management Strategy support the control of significant weed species. DOC must prioritise and control a number of ecological weeds threatening a range of ecological sites, all of which compete for precious resources. Although priorities for weed control agencies may shift from time to time, depending on the public attitude, it is only wilding conifers that fall within the scope of this strategy.

The dominant wilding species is Douglas-fir (D-fir). Other conifer species present within the catchment of this strategy have been listed in Table 1 above, the more vigorous and widespread species being Corsican and Scots pine and European larch. It is fortunate that the most vigorous spreading conifer of them all, contorta pine (Figure 21 & 24, Appendix 1), is uncommon around Lake Wakatipu, although it was planted in at least three localities (Swiftburn, around the Coronet Peak ski huts, and in the Upper Roaring Meg). This species is now listed as a Pest Plant in ORC's Regional Pest Management Strategy (RPMS) and its removal is required under that strategy. Management units with contorta have been highlighted in Tables 2 & 3.

In many parts of the Wakatipu catchment, there appears to be a "cohort" of outlier trees now aged around 22-29 years old. Two known wind events in 1979 & 1981 were probably responsible for the broadcast dispersal of seed in a south – eastern direction from established seed sources. Many of those outlier trees have reached coning age and have fringe spread of second generation seedlings, 8 to 12 years of age; though most have now been removed.

Since 2004, some significant new invasions have been noted (e.g., on the northern faces of Cecil Peak and the western faces of the Remarkables). The suspicion is that the seed for these is coming from new sources, where trees on exposed 'take-off' sites have reached coning age. The distance between the sources and the resulting wildings can be many kilometres. It is important that these recently invaded areas are cleared before the second generation reach coning age, and that the seed sources are identified, so that, if possible, they can be managed to reduce the rain of seed disseminating from them. The uniform age class of the spreading trees suggests that seed arrival is not frequent, and that once outliers and their progeny are removed, the likelihood is that the site will remain clear for some time.

There is growing concern about the adverse impacts of wilding spread on landscape, conservation and pastoral grazing values (Figure 6, Appendix 1). Some landscapes, particularly the tall tussock grasslands and *Hebe-Olearia-Coprosma* shrublands in the mountain ranges of Remarkables & Hector's, Eyres, Thomson & Humboldt, Richardsons & Harris, contribute a strong 'sense of place' unique to this region. Tussock grasslands and open shrubland

(Figure 8 & 20, Appendix 1) are very susceptible to wilding invasion, particularly on sheltered faces with southerly aspects. Wildings appear to find establishment much more difficult on the warmer north-facing slopes – probably due to drier soil conditions over summer and the fact that these sites are more attractive to grazing animals. Wildings are also able to invade the fringes and gaps within native beech forests where disturbance or circumstance has opened the canopy and increased the light available to otherwise struggling seedlings.

Factors influencing spread

Conifers grow exceptionally well in the South Island high country compared to their countries of origin. This is due to there being more even rainfall distribution and considerably lower pathogen loads. In addition, the combination of warm days and cool nights promotes very efficient carbon absorption which translates to good growth rates. The suitability of the local conditions is also reflected in the ability of conifers to readily self propagate, or spread. The main factors influencing wilding spread³ are:

- Species present. Some conifer species spread far more readily than others (some rarely spread in New Zealand).
- Siting of seed source trees, particularly relevant to topographic exposure to strong prevailing winds. Hence the importance of not siting spread-prone conifers on exposed 'take-off' sites, as conifer seed is light and winged and well adapted for wind dispersal.
- Surrounding vegetation cover and land management. Spread is most likely to occur on undeveloped, lightly vegetated and / or lightly grazed land. Such conditions are most common on cooler, south facing slopes. Spread is least likely to occur within closed canopy shrublands or forest, and within improved pasture, or areas favoured by browsing animals (often warm, north-facing slopes).
- Presence of supporting mycorrhizal symbionts (fungi) in soils receiving seed. It is now believed that the 'ambient' levels of many mycorrhizal spores may be sufficiently high to ensure that most seedlings become mycorrhizal soon after germination. Douglas-fir, a vigorous spreading species today, but one which was not considered a wilding risk 20 years ago, has benefitted significantly from improved mycorrhizal availability.¹⁷
- Presence / absence of browsing stock and feral animals (goats, hares, rabbits). Trials have shown that some species are more palatable than others.¹⁴
- Combinations of temperature and wind. When mature, cones are opened by warm temperatures. If this occurs during strong winds then the opportunities for distant dispersal are much

higher. Hence the importance in New Zealand of the often-prevailing warm north-west winds.

History of Control

Conifer wildings readily lend themselves to control, as they are visually obvious, and their direction of spread (downwind), and age when significant seed production begins (usually 10-15 years) is very predictable. Hence there are good opportunities to intercept the spread sequence early in the cycle, and prevent wildings becoming dominant and uncontrollable. This potential for 'a stitch in time saving nine' is why DOC lists wilding control as one of the most cost-effective operations it can undertake.⁴ Unfortunately, such a realisation is comparatively recent, and comes after many years of uncontrolled spread, which has allowed the cost of control in some areas to become prohibitive.

Before the implementation of the 2004 control strategy, successful wilding control operations had been carried out in the vicinity of Queenstown for more than 20 years.⁵ There is no doubt that without them, the extent of wilding spread would be considerably greater than it is today. Some of the earliest removals were undertaken by a Lands and Survey team in the early 1980s. Funds have been allocated for wilding control by DOC over the past 20 years. The DOC spent approximately \$220,000 on wilding control operations within the Wakatipu between 2001/02 and 2003/04 of which \$60,000 was contributed from Biodiversity funding. Between 2004/05 and 2007/08 DoC spent approximately \$450,000 which was all provided by Biodiversity funding.

Funding was provided in 1998/99 for control on Queenstown Hill by the Lotteries Commission through a lotteries grant and New Zealand Employment Service (now WINZ) for a task-force green project. As a direct result of this project, QLDC made its first allocation for conifer control in the 1999/2000 Annual Plan.

The adoption of the first wilding Strategy in 2004, saw a significant rise in the level of wilding control, and there is little doubt that the present level of control could not have been achieved without it. Between 2004 and 2008, the QLDC has funded around 235 working days and spent over \$443,000 on controlling wilding spread on an estimated 5,300 ha. (Note: There are considerable differences in methodology of controlled area calculations). DoC has spent an additional \$450,000 on wilding removal operations.

It is important to note the significant increase in contributions to the overall control effort from private landowners since 2003 in the following ways:

- Financial contributions to QLDC (over \$40,000) and DOC programmes
- Support of same with transport (particularly helicopters and boats)

- Directly financing control operations using professional contractors (over \$75,000)
- Control work - often unrecorded, viz. Arthur Borrell and John Foster

In addition, there have been noteworthy efforts by private individuals, and frequent wilding removal field-days attended by volunteers, notably in the One Mile creek catchment. In this area, the considerable efforts of Arnold Randle in particular needs mentioning.

Map 3 illustrates the land over which known wilding control has been undertaken to date by all agencies overlaid on all known infestations historically including controlled areas.

The effectiveness of 2004-2008 strategy implementation has been strongly related to the:

- High level of interest and commitment of the Manager
- Continuity of management personnel involved, and hence greater understanding of the task ahead
- Quality of records kept on daily control activities
- 'Ownership' of strategy by key stakeholders
- Co-operation between agencies and landowners and managers

An unfortunate aspect of wilding control is that, the decomposition of felled trees quickly masks the "evidence" of the control work in areas that are cleared by these operations and so their effectiveness in restricting or eliminating spread is often hard to convey as time proceeds. Therefore, it is no surprise that in recent years there has been increasing pressure to provide more evidence of management or conservation achievements and greater justification for the merits of wilding control in order to win resources in increasingly competitive funding allocation rounds. This has resulted in a more structured approach and the ready availability of baseline information on which long-term control objectives can be based and measured. It is essential that the current positive impetus is maintained in this revised Strategy, by making better use of modern spatial data gathering and analytical technologies, plus technology transfer mechanisms. Considerable work has recently been undertaken to record and map the wilding conifer infestations and control work completed in the last 10 years. These records are now on the QLDC Geographic Information System. It is strongly recommended that this initiative is maintained and utilised.

Threats posed by wilding conifers

Uncontrolled wilding spread threatens existing landscapes, indigenous flora and fauna, and land use values (Figure 6, Appendix 1). The landscapes of the area, many of them characteristically treeless, contain a full range of values which in a cumulative sense, provide the distinctive and attractive essence of the District. Steep, rugged mountains, dissected valleys, terraces, roche montane, rolling hummocks and rivers underlay the mantle of

the Wakatipu's indigenous vegetation. The local flora includes species which are locally endemic and in some instances conserved within the protected area system of Reserve and Conservation land, or are present on Crown pastoral leasehold land.

The following is a description of the common vegetation communities in the area and some of their inhabitants.

Indigenous communities

The vegetation of the strategy area is generally characterised by open narrow-leaved snow tussock (*Chionochloa rigida*) dominated grasslands; however, closer inspection reveals a much greater diversity. At lower altitude fans and within gullies, mountain and red beech have remained where they escaped fires and land clearance activities which commenced in the late 1800s. Manuka shrublands are found across low to mid elevation slopes. The tall (snow) tussock and *Dracophyllum/ Hebe odora* shrublands can dominate above the tree line, particularly on west to south facing slopes. Shrubland and regenerating hardwood forests are also present along the south facing lakeshore slopes and include species such as Kohuhu (*Pittosporum tenuifolium*), mikimiki (*Coprosma propinqua*), wineberry (*Aristotelia serrata*), Fuchsia (*Fuchsia excorticata*), five finger (*Pseudopanex colensoi*), cabbage tree (*Cordyline australis*), shining karamu (*Coprosma lucida*), flax (*Phormium tenax*), koromiko (*Hebe salicifolia*) and mountain and red beech (*Nothofagus solandri* var *cliffortioides*, *N. fusca*).

Areas of *Coprosma/Olearia*/Matagouri shrubland also occupy shaded slopes with native broom (*Carmichaelia* sp), Inaka (*Dracophyllum longifolium*), mountain wineberry (*Aristotelia fruticosa*), *Cassinina* sp, snow berry (*Gaultheria crassa*), speargrass (*Aciphylla* sp), prickly shield ferns (*Polystichum* sp) and numerous herbs and grasses. Bogs and flushes range across the available altitudinal limits and also contain specialist species.

Ben Lomond and Mount Crichton Scenic Reserves, Coronet Peak and Mount Aurum Recreation Reserves, as well as a growing number of landscape covenant areas within the boundary of the strategy have representative examples of the range of vegetation that wilding conifers threaten.

These vegetation communities also host a range of bird species from the common forest and shrubland species like grey warblers (*Gerygone igata*), fantail (*Rhipidura fuliginosa*), tomtit (*Petroica macrocephala*), rifleman (*Acanthisitta chloris*), bellbird (*Anthornis melanura*), tui (*Prosthemadera novaeseelandiae*), kereru (*Hemiphaga novaeseelandiae*), silvereyes (*Zosterops lateralis*) and brown creepers (*Mohoua novaeseelandiae*), morepork (*Ninox novaeseelandiae*) to those species which range across the full spectrum of habitats like the New Zealand falcon (*Falco novaeseelandiae*), a species in gradual decline.⁷ The migrant shining cuckoo inhabits the nesting areas of grey warblers. The NZ pipit

(*Anthus novaeseelandiae*) inhabits the open grasslands. Others species affected by spreading conifers include game species like chuckor, pheasants and quail and numerous naturalised finch species which can benefit from the habitat provided at the interface of conifer forests, shrubland and grasslands. Ironically, many of these species also inhabit the habitat provided by conifers.

There are eight to ten species of lizard within the study area including four geckos and four to six skinks, some of which are in gradual decline⁷. Their habitats which include rock outcrops, slab schist areas, open grassland and shrubland are also vulnerable to invasion by wildings which tend to dominate sites and deprive these animals of essential sunlight needed to warm their metabolism. Wildings can also displace berry-bearing shrubs which host a range of invertebrates.

Invertebrates of the Wakatipu include many host specific species.⁹ There are at least 9 species, including geometrid moths and shield bugs found on *Hebe odora* host plants, a bat-winged fly (found near streams in low to alpine meadows), flightless ground beetles (found in tussock grasslands and montane and sub-alpine herb fields and beech forest).¹⁰

All the above vertebrates and invertebrates are vulnerable to habitat loss resulting from the invasion of wilding conifers which tend to create a monoculture largely inhospitable to the plant life that hosts these and other species.

The 29 October, 1999 Environment Court decision RMA C180/99 for Landscape Policy established a three tier division for landscapes. These are Outstanding Natural Landscape (ONL) and Visual Amenity Landscape (VAL) from Sections 6 and 7 RMA (respectively) plus a third tier which is unrepresented within the QLDC. Wilding conifers threaten the integrity of the ONL and possibly the VAL landscapes of the Wakatipu and could potentially alter their basic character so that they resemble those of North American landscapes (ie., conifer dominated) rather than those of the District, with its unique attributes.

Who is affected?

The spread and control of wilding conifers has far-reaching implications for everyone. In particular, the unique landscapes of the Wakatipu area contain large open, treeless slopes which can readily be invaded and significantly transformed by wilding spread.

Those who recreate within the Lakes District will be affected if tracks like Ben Lomond, Queenstown Hill, Sawpit Gully and Seven Mile are permitted to become increasingly shaded. There would be adverse impacts on track surfaces, and views towards the lakes and mountains will be lost.

A conifer-dominated landscape would have implications for the industries reliant on tourism and filming; these may be positive or negative depending on the expectations and awareness of visitors or clients. This strategy takes the position that the spread of wildings into the surrounding landscape would result in too many negative impacts which are likely to outweigh benefits associated with wilding stands.

The adverse impacts on recreational and landscape amenity values created by felling programmes can cause temporary losses or degradation of well used areas. Where possible, operational planning should aim to avoid such negative impacts.

**Responses by
land managers
and agencies**

Land managers of pastoral properties stand to lose grazing opportunities as open tussock grasslands are colonised by wildings. Land threatened by conifer invasion will require additional management inputs such as over-sowing or top dressing to encourage stock to graze areas where seedling numbers are increasing. Infestations may force managers to invest limited resources in contract staff to hand-clear conifers, re-align farm subdivision (fencing) or burn slopes.

Government agencies also have responsibilities which are described in the discussion of Action 1 in Section 4.

Farm management regimes can be effective in controlling the spread and preventing the establishment of conifers, but this is at a cost to the farming operation as a whole and can induce decreased biodiversity of the infested site. For example, a regime of top dressing will improve the vigour of the existing vegetation cover and encourage preferential grazing, which in turn will suppress wilding numbers, but this can come at a cost to any native species present. Similarly, oversowing with nitrogen-fixing clovers and pasture grasses will further improve the pasturage values but will obviously introduce an exotic component within the vegetation. However, where land is managed primarily for farming, such outcomes may be desirable and beneficial.

In general, the over-sowing exotic pasture species should be discouraged where it has not occurred in the past, particularly where indigenous grasses are dominant, because of the potential to negatively impact on significant biodiversity values.

Where land is managed for conservation purposes, the application of fertiliser, exotic pasture species, stock, fencing and the use of fire is at odds with the traditional approaches to protective management. Therefore, where conservation lands are threatened by conifer infestations, managers are faced with a considerable challenge to protect biodiversity, landscape and cultural values.

In either event, the fundamental need to control wilding conifers remains. Unless conifers are removed, the maintenance of biodiversity, landscape, recreational and historical values within susceptible areas will continue to be at risk.

**The extent
and management
of wilding conifer
spread**

The purpose of a control programme is to protect the quality and integrity of the values at a particular site by implementing a system to eradicate, contain or reduce the extent (and therefore negative impacts) of wilding conifers.

For the purpose of this strategy, the whole of the Wakatipu catchment has been divided into 46 management units (Table 2). In many cases it has been pragmatic for control purposes to further divide management into sub-units. Wilding conifers are present in every unit (but not every sub-unit). In a few they are the dominant feature of the landscape, but in most their presence is minor, and if containment or removal is carried out relatively soon, ('a stitch in time saving nine'), worthwhile results will be both possible and practically attainable.

Map 2 and Table 2 present the scale and extent of wilding conifer spread within the study area. Table 2 also lists the major species of spreading conifers found in each area, the estimated area affected, the level of control carried out between 2004-2008 (%), management recommendations for 2008 to 2012 and an estimated cost based on local experience. Section 4 and Table 3 rank areas which require control as a matter of greatest priority.

The GIS database provides a benchmark of wilding spread, to which future data can be easily added, and summaries of changes can be readily prepared enabling the information to be summarised as required in the future. Map 3 illustrates the densities of infestation described in Table 2 at present (2008). Table 2 is a summary which can be correlated to the mapped infestations.

The following notes are provided to assist in the interpretation of Table 2. For each sub-unit:

DOC land units originate from the Otago Conservation Management Strategy.¹⁶

High country station names were identified from local knowledge and station maps provided on the LINZ website.

Area affected. This has been divided into four categories depending on the density of the infestation, based on trees greater than 2m tall and correlated to the mapped data as shown in Table 1A below.

Where the presence of isolated trees or clumps of trees are known, these have been mapped.

Control carried out 2004-08 (%). Amount of control completed during the strategy period is expressed as a percentage of the total control planned for each unit (as of 2004).

Likely further spread if no change in management. This is an indicator of threat to the surrounding landscape if no action to contain or control spread is taken.

In most cases (except where stated otherwise), reinvasion after removal of seed bearing trees and their seedlings is likely, but may be infrequent. Therefore, once an area is cleared resources have to be made available to keep it that way – probably by checks and removals every 4 - 6 years (depending on the species). This is a high priority between 2008-2012 (see 'Prioritisation' below).

Where the retention of grazing pressure has been recommended, this recognises that wilding conifers are held in check by the current grazing regime of sheep, deer (and feral goats and hares). If this grazing pressure is diminished, then the risk of spread will increase. In such circumstances, it is strongly recommended that seed source trees and any regenerating seedlings are removed before grazing pressure is reduced. The risk assessment of likely further spread represents the estimated risk under the current management regime.

Review Comments. Indicate what control and changes have occurred during the strategy period and the current status.

Recommendation 2008. Guidelines for this strategy.

Cost Estimate. The figures provided represent a best guesstimate, due to the limited time available for ground-truthing. Estimates for the four 'mature' tree **infestation density** levels, including the removal of associated regeneration < 2m tall, are as follows:

\$2,000/ha (>2000 stems/ha)

\$800/ha (100-2000)

\$60/ha (1-100)

\$5/ha (<1/ ha)

The costs are based on actual removal operations carried out locally between 2004-2008, and on recent costs reported from elsewhere in the country.

Prioritisation

Between 2004-2008, the Strategy largely dealt with removing wildings from areas which have not been cleared before. However, as a guiding principle of the Strategy is to retain control of cleared areas once swept of trees, return visits are needed to remove small seedlings missed, plus any new arrivals. For cost and practical reasons, such return visits should be carried out before wildings grow beyond 'hand-tool removal' size ie., usually between 4-6 years after the initial control operation. To illustrate what happens when a return visit is left too long, Queenstown Hill is a "good" example (Figure 20, Appendix 1). Here the re-work started in May 2006, 6 to 7 years after the previous re-work which was 8 to 9 years after initial clearance in 1990/91. This has been the most salutary lesson of the first strategy.

Consequently, a significant portion of the budget in the 2008-12 Strategy will be apportioned to revisits (Figures 18 & 19, Appendix 1), which on average cost 25% of the original removal cost **as long as they are carried out in the 4-6 year timescale**, after which costs escalate.

Due to the sheer volume of seed and subsequent fringe spread along established containment lines, this strategy strongly recommends limited use of aerial spraying. A strip of mature trees between 10 metres wide along the containment lines would be sufficient, on steep slopes to stem the large volume of seed. A short-term drawback of this is a somewhat unsightly and obvious strip of standing dead trees. However, this is a small price to pay compared with the potential of dispersal of millions of seeds. Additionally, where appropriate (Queenstown Hill, for example) it is recommended the fringe spread itself is sprayed (either boom sprayed from a helicopter or using a ground crew). An alternative would be to spray the fringe spread at periodic intervals – in the 4 to 6 year timescale of re-visits.

Fringe spraying of this nature is limited - to a maximum width of 20 metres.

The DoC is already using this method in Mt. Aurum reserve and the mouth of Lewis Creek (Long Gully).

Note: spraying is still not yet a totally proven method. (see "Control Methods" below).

Fringe spraying is recommended currently for already established containment lines in the following areas:

- Mt Aurum
- Long Gully, and
- Queenstown Hill, &
- One Mile Creek catchment could be considered, but these are very sensitive areas popular for recreation.

Similar treatment will be considered for the following areas, once work in progress is completed:

- Home Hill
- Arrowtown (or Coronet) Forest,
- Coronet Slopes (Figure 21, Appendix 1),
- Mt. Dewar,
- Bowen Peak,
- Ben Lomond ridge (above Fernhill/Sunshine Bay),
- Five Mile Creek.

This strategy takes the view that, after the priority of keeping controlled areas clear, the next priority is to remove the smallest infestations with the greatest potential to spread into un-infested areas of high landscape and biodiversity value. Areas were prioritised accordingly with either a low, medium or high value (as indicated in Table 2).

Other considerations (as indicated in Table 3) included:

- Field observations and local knowledge of the factors affecting spread described on page 19,
- Proximity to large downwind sites susceptible to infestation, particularly those with high ecological values,
- The presence of contorta pine which requires complete control under the ORC's RPMS,
- Visibility (particularly from major tourist routes),
- Any public relations merits associated with a particularly prominent area.

It is acknowledged that the prioritisation system described above involves an element of subjectivity; however, all "objective" systems rely on individual judgements at some level. The above represents a system that will provide Council and the WWCG with a reasonably robust guidance for prioritising the sites requiring management.

Table 1 A Relationship between density categories in Table 2 and those shown on Map 2.

Infestation Density - Table 2	Infestation Density – Map 2
closed canopy (>2000 stems/ha)	* Closed canopy – mature conifers with fringe spread from second/ third generation trees
close spaced individuals (100-2000 stems/ha)	* Open canopy (> 50% open) with fringe spread, and * Scattered outliers with fringe spread from second/ third generation trees, and * Fringe spread where seeding trees have been removed
wide-spaced individuals (1-100 stems/ha)	* Scattered outliers, sometimes with fringe spread
widely scattered outliers (<1/ha).	* Isolated outliers, and * Scattered outliers present but location is yet to be confirmed
areas not provided	* Plantations / Shelterbelts

Where Table 2 identified shelterbelts or plantations as potential wilding seed sources requiring containment, the issue is more one of advocacy than an edict to remove them from private property. The current Proposed District Plan addresses restrictions in planting shelterbelts, forests and wilding species in general as outlined above.

Table 2. Management units requiring the removal and or containment of wilding conifers

Abbreviations: SITS9 – 'stitch in time saves nine' AOSTD - aerial over-sowing and topdressing

WINR - Wakatipu Islands Native Regeneration

* R=Re-work, FSS = Fringe Spread Spraying

Refer to further explanations on pages 18 and 19 above. Estimated costs are based on hand or chain saw removal. Helicopter and travel time have been included in some instances.

Name	Unit No	DOC land unit/ High Country Station	Major spread species	Area affected – hectares (stems / ha)				Control Carried Out 2004-08 (%)	Likely further spread if no change in mgt	Review Comments	Recommendation 2008	Cost Estimate * (\$k)	Priority
				>2000	100-2000	1-100	<1						
Upper Wakatipu	1	GY- QT Road - E40050D, Mt Alfred CA62, E41090 QT-GY Road Rec Res, E41085 GY Road Rec Res	Corsican, Radiata, D-fir	0	90	80	<10	1	Medium	Mt. Creighton Fire Nov 05 burnt some seedlings. No significant increase in affected area? Some control work completed south of Glenorchy airstrip. Doc planning control work with scattered trees in scrub.	Most wildings scattered or in small patches. Little work involved in total removal. If carried out, indications are that reinvasions will be infrequent.	\$ 26,000 \$ 400R	Medium to High
Upper Wakatipu – (Pigeon, Pig & Tree) Islands	1a	Mount Earnslaw, Rees Valley, Temple Peak, Wyuna, Mt Creighton	D-fir, Corsican?				?	60	Low	A number of wildings removed on Pigeon Island. A check for wildings on Pig Island needs to be made.	Control on islands by WINR Trust in conjunction with landowners. Contact WINR Trust regarding Pig Island.	\$ Nil	High
Moke/ Kirkpatrick Valley	2a	Mt Crichton; Dispute; 5,7, 12 Mile; Kirkpatrick - E41098 Bobs Cove Rec Res; E41107-108 CA62, Rec Res; E41096 Mt Crichton SR	Scots, Corsican, Larch, D-fir	< 20	0	0		100	Medium under present farmland management – high if it changes.	Doc have started clearing stand opposite wool shed. Large stands being contained.	Maintain containment.		Medium

Name	Unit No	DOC land unit/ High Country Station	Major spread species	Area affected – hectares (stems / ha)				Control Carried Out 2004-08 (%)	Likely further spread if no change in mgt	Review Comments	Recommendation 2008	Cost Estimate * (\$k)	Priority
				>2000	100-2000	1-100	<1						
Hanley Faces	2b		Scots? Corsican			c.100		75		Doc have cleared significant portion in skid-hopping operations	Maintain current control.	\$7,000	High
W. branch Moke Stream / Fan Ck	2c	Closeburn, Mt Creighton, ben Lomond	Scots, Corsican, (2 origins), Contorta	-	-	< 5	40	90		Cleared as part of 3a. Some scattered trees remain TRB lower Moke Creek. CONTORTA?	Maintain current control. Return to dense patches (see GPS pts). TRB Moke Ck: Clear remaining outliers.	\$ 1,000 + helicopter \$ 700R	High
Bobs Cove	2d	E41098 Bobs Cove RR, Closeburn	D-fir	-	<10	<20	<30	Not known	High-alongside road – from recent Bob's Cove plantings	Some clearance around Bobs Cove & sub-divisions and Twelve Mile Delta.	Remove all conifers along road reserve and remainder at 12-mile delta. Survey remainder to determine spread risk into sensitive neighbouring areas, especially 2b & 2e	\$8,000	Medium
Mt. Chrichton	2e	Mt Creighton		-	-	-	-	N/A	High	New management unit. No known infestations.		Nil	N/A
Lower Moke Creek / Moonlight Creek	3a	Mt Creighton, Ben Lomond	D-fir	-	-	-	-	Unknown (Some cleared by Ben Lomond Station)	High	Pro-active control by lessee.	Maintain current control.	Nil	High
Darkeys Terrace	3b	Mt Creighton	Norway spruce; maritime Western red cedar	2		c. 100		0	Medium	Needs Reviewing. Leaseholders now concerned.	Survey and adjust priority if necessary	\$11,000	Medium

Name	Unit No	DOC land unit/ High Country Station	Major spread species	Area affected – hectares (stems / ha)				Control Carried Out 2004-08 (%)	Likely further spread if no change in mgt	Review Comments	Recommendation 2008	Cost Estimate * (\$k)	Priority
				>2000	100-2000	1-100	<1						
Five-Mile Creek	4a1	Dispute; 5, 7, 12 Mile, Closeburn - E41 Lake Dispute, E41102-105 Seven Mile Rec Res, Closeburn	Corsican Scots D-fir	-	120	65	<10	120 (Cleared further than 2004 containment line)	Medium – but only if improved grazing continued in clear country, and no disturbance s lower down. Since 2004 higher trees now coning.	Taken to below containment line intended.	Clear small area of open canopy (3 ha) at southern end to complement work already completed. Maintain current containment line. Need to start clearing re-gen upper 5-mile soon.	\$3000 \$ 11,100R+ helicopter \$ 16,380FSS	High
Bushy Creek	4a2	Ben Lomond	Scots, Corsican, D-fir, Larch	<20	20	35	150	40		Cleared from top of Upper Bushy around to South face. Future control line needs to be determined TLB Bushy Creek.	Continue momentum achieved to date - up to 2004 containment line (bush edge).	\$ 52,000, \$ 8,500R+ helicopter	High
Wedge Peak - "Bob's Peak"	4b1	Ben Lomond	Corsican Scots D-fir	75	40	<10	<10	50	Medium – as above	Closeburn Station is very proactive with control – including private contracting with digger & manual method, also contributions to significant removals have occurred in dense lower areas between Glenorchy Road and Alpine Retreat due to development and consent conditions.programmes. On north face, control work was completed in 2006, but quality was mediocre. Containment in progress. Trees along current edge of control now starting to cone.	Look at spraying containment block on Wedge Peak to reduce seed rain and accelerate control effort - to achieve 2004 recommended containment. Encourage neighbouring landowner on South side & Alpine Retreat community to clear mature trees above suburb to reduce seed rain onto cleared areas such as Five-Mile Creek and Cecil Peak.	\$34,250 \$150,000 (For complete removal) \$ 11,300R+ helicopter	High, Medium

Name	Unit No	DOC land unit/ High Country Station	Major spread species	Area affected – hectares (stems / ha)				Control Carried Out 2004-08 (%)	Likely further spread if no change in mgt	Review Comments	Recommendation 2008	Cost Estimate * (\$k)	Priority
				>2000	100-2000	1-100	<1						
Home Hill	4b2		Corsican, Scots	240	20	165		80	Medium – as above	Doc & landowners have combined to control this area with considerable success. The containment line determined in 2004 has been achieved.	Complete and maintain containment.	\$10,000	High - containment
Closeburn / Seven-Mile Reserve	4c		Corsican, Scots, D-fir	90 (no further control planned)	35 (no further control planned)	-	-	100	Low	Doc removed scattered trees amongst native bush in the Reserve between Road and lake from Sunshine Bay to Seven Mile Creek. Remainder of unit is dense, mature stands. No intention to clear any more in this area.	Maintain current control.	Nil	Low
Ben Lomond	5a	E41110 Ben Lomond SR, E41120 Oxenbridge Tunnel RR, E41121 sewage treatment LP; E41125 McChesneys CA62, Ben Lomond	D-fir, Scots	c. 20 contain	40	<5	75	60	High under BL, and on lower slopes east of Horn Creek	Landownership in One-Mile Creek currently under review. Remaining areas to clear are TRB One-Mile Creek & Two-Mile (continuing containment from Five-Mile) & TRB Horn Creek. Considerable voluntary effort TLB One-Mile Creek.	Complete and maintain containment. Encourage continued voluntary effort –especially One-Mile TLB from Ben Lomond Saddle down.	\$ 31,500 + helicopter	High
Bowen Peak / Horn Creek	5b	Ben Lomond	D-fir, Corsican	50	10	20	125	10	Very High	Literally millions of seedlings pouring off mature forest on Bobs Peak.	New containment line running from Bowen Peak Ridge to Gorge Road - see photograph. Remove loan pine outlier with its surrounding island of seedling, larch outliers and mature trees in the next gully to the north.	\$ 11,430 + helicopter, \$112,000	High (Medium in 2004 was an oversight - area was not surveyed properly), Medium

Name	Unit No	DOC land unit/ High Country Station	Major spread species	Area affected – hectares (stems / ha)				Control Carried Out 2004-08 (%)	Likely further spread if no change in mgt	Review Comments	Recommendation 2008	Cost Estimate * (\$k)	Priority
				>2000	100-2000	1-100	<1						
Bowen Peak - Arthur's Point	5c		D-fir and others		10	<5	50	0	High	Large quantities of seedlings spreading from mature trees above residential area.	Establish containment line above residential area.	\$22,000	Medium to High
Sunshine Bay / Fernhill	5d	?	D-fir, Eucalypts, Hawthorn	2		25		N/A	N/A	Non priority area of eucalypts and hawthorn removed whilst manager overseas.	N/A	Nil	Low
Queenstown Hill	6a	E41124 Big Beach CA62, Queenstown Hill Covenant and Recreation Reserve, Queenstown Hill	D-fir, Larch, Corsican, Scots, Contorta, Lawson Cypress	200	65	40	100	80 (In terms of area, but dense fringe spread remains)	High – especially close to D-fir margin	Good control apart from dense fringe strip. Some voluntary and community services work above Queenstown. Thursday Club volunteers cleared above Goldfields. CRT looking at spray trials.	Determine more cost-effective fringe control (spray?). Continue control efforts.	\$ 56,000 \$ 18,500R \$ 36,855FSS	High
Queenstown Hill - Marina Heights	6b	Queenstown Hill, John Grant	D-fir, Larch	2	7	30	15	75	High – from 6a	Now significant seeding from the other side of the gully. Possible replacement of D-fir in slip zone.	Determine containment line. Maintain control. Consider removal of patch of Radiata above Queenstown Hill station.	\$1,000, (above saddle) \$2,500 (slip zone), \$ 8,500 (remainder)	High Medium
Long Gully	7	E41184 Long Gully MS, Mt Dewar, Coronet Peak	D-fir, Larch	35 (main forest to remain for now)	1	110	-	95	High, esp. if stocking rates reduced	Very significant control efforts by contractors of Doc & Mt. Dewar Station. Doc have sprayed a large area at the bottom of Lewis Creek and spot sprayed other areas including Falcon Rock. However, no control on Coronet Peak Station since QLDC clearance (2001).	Maintain current control. Remove all trees on Coronet Peak Station a.s.a.p. Recommend spraying area of dense regen below Dirty Four Hut and area TL above Long Gully bridge in 2 to 3 years (before coning).	\$ 17,777 \$ 14,500R \$ 16,380FSS	High

Name	Unit No	DOC land unit/ High Country Station	Major spread species	Area affected – hectares (stems / ha)				Control Carried Out 2004-08 (%)	Likely further spread if no change in mgt	Review Comments	Recommendation 2008	Cost Estimate * (\$k)	Priority
				>2000	100-2000	1-100	<1						
Lower Shotover - TR	8	E41114 Hakaria Stream CA62, Ben Lomond	Larch	-	-	-	3	75	Low, if stock management regime continues	Low invasion risk. Farmer using sheep mob stocking to control. Further work completed on Stony Creek Terrace.	Complete Stony Creek Terrace. Maintain current control.	\$ 1,400, \$ 1,600R	High
Lower Shotover - TL	9	Mt Dewar - E41118 Shotover MS, Mt Dewar	Larch, D-fir	-	-	-	-	95	Low, <i>but only if stock management regime continues</i>	Significant control efforts by contractors of Doc (Devil's Creek spot spraying) & Mt. Dewar Station.	Complete and maintain control.	Nil	High
Mid Shotover – TL	10	E41115 Maori Point CA62	Larch, D-fir							Medium, if on-site mature trees removed, but gets higher where removals (mostly below road) are not possible, and as Mt Aurum seed source gets closer			
McCarrons Beach to Deep Creek	10a	Coronet Peak	Larch, D-fir	<1	-	<5	-	95 (not including Re-gen)	High – until mature trees around squatter removed	Squatter trees still remain. Some seedlings from these have been removed (volunteers April 08 & squatter?)	Revisit discussion of removal of seed source with squatter. Clear re-gen above McCarrons Beach (last cleared in 2003) asap.	\$ 1,000 \$ 1,600R	High
Lower Deep Creek	10b	Coronet Peak	Larch, D-fir	-	-	<1	-	95	Low - dense bush in confined area	1 Mature D-fir remains adjacent to the toilet block. Several wildings between Scheib and road.	Remove all remaining trees. Maintain control. Check for Re-gen up lower Deep Creek.	\$ 1,000 \$ 1,600R	High
Stapletons Terrace	10c	Coronet Peak	Larch, D-fir	<1	-	-	<1	75	Low due to residences and high grazing pressure	3 very large D-fir remain. Good grazing pressure? Small number of maturing D-fir remain close by in the bluffs.	Discuss removal/replacement and maintaining control with owner. Spot spray cliff overhanging trees.	\$ 2,000 \$ 300R	Medium
Sainsburys Terrace	10d	Coronet Peak	Larch, D-fir	-	10	<5	?	20	Medium - confined area	1 owner co-operative, other 2 not.	Continue negotiation with owners about removal of source trees. Maintain control.	\$ 8,000 \$ 400R	High

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				>2000	100-2000	1-100	<1						
Wire Rope Gully / Dredge Slip	10e		Larch, D-fir	-	15 (below Skippers Road)	-	-	100 (Some clearance by DoC below road?)	High	Removal of trees below road?	Maintain containment. Consider removal of trees below road.	\$12,000	High
Goosebury Gully	10f	Coronet Peak	Larch, D-fir	-	20	<30	-	c.50 (In ha, but dense stand remains)	Very High	No further control due to uncooperative leaseholder. Gooseberry Gully is now the edge of containment on the Southern end of the upper Shotover.	Discuss further control with owner. Highly recommend complete removal above Skippers Road as per 2004 Strategy.	\$40,000	High
Horse Gully	10g	Coronet Peak	Larch, D-fir	1	<5	<20	-	c.50 (In ha, but dense stand remains)	Very High	Some funds from 10f spent here.	Discuss further control with owner. Highly recommend complete removal above Skippers Road as per 2004 Strategy.	\$8,500	High
Horse Gully - below Road	10h	Coronet Peak	Larch, D-fir	1	5	1		0? (Some clearance by DoC?)	High	Need to clear 10f & g first.	Consider removal after 10f & g as this is a relatively small, confined and manageable area.	\$7,000	Medium (High when 10f & g completed)
Deep Creek / Maori Gully	11	Coronet Peak	Larch	-	-	2	800	80 (In time, skid-hopping remains)	Very high	Change in Station manager facilitated access (2008).	Complete, remove re-gen and maintain control.	\$ 4,000 + helicopter \$ 1,600R+ helicopter	High

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				>2000	100-2000	1-100	<1						
Wong Gong Creek	12a	Coronet Peak	Larch, D-fir	5	15	?	?		High	Need to clear 10f,g,h first. Grazing is possibly a major controlling influence.	Removal after 10f,g & h.	\$23,000	High above road, Low below
Blue Slip	12b	Coronet Peak	Larch, D-fir	22	10	?	?	0	Medium – esp., close to D-fir margin	Remove all trees, above road (esp., in Cotters Ck), but may not be possible to remove trees below road.	Removal above road possible (plus maintained with help of AOSTD), but might be too expensive below. Also, closer to river, chances of seed arriving from Mt Aurum immediately opposite are higher.	\$51,000	Medium
Cotters Creek	12c	Coronet Peak	Larch	-	-	-	-	100	c) -	Cleared by QLDC (03) Follow up by 2011, As for 10, aim for AOSTD and increase grazing pressure in most spread susceptible areas	c) Re-infestation very likely due to proximity of seed source (Mt Aurum)	\$ 1,850R	High
Upper Shotover TL	13	Coronet Peak											
Smiths & Shepherds Terraces	13a	Coronet Peak	Larch, D-fir	1	-	-	-	100	High	Remaining hectare sprayed when Nuggets Point was sprayed. Removal of re-gen on Smiths Terrace completed at the same time.	Maintain current control.	\$ 1,150R	High
Dead Mans Creek	13b	Coronet Peak	D-fir, Larch, Norway spruce	-	-	-	-	100		Grasses precluding spread where mature trees were removed. Surrounding areas thick re-gen.	Re-visit to clear re-gen.	\$ 3,000R	High
Branches Road	14	Coronet Peak, Branches	Larch, D-fir	-	-	-	-	100	High	Since clearance & no local seed sources, reinvasion opportunities unlikely. Arthur Borrell regularly cleared. Further clearance of seedlings completed 2007Doc	Maintain current control. Determine success of spraying and ascertain what remains. Maintain current control.	Nil	High

Name	Unit No	DOC land unit/ High Country Station	Major spread species	Area affected – hectares (stems / ha)				Control Carried Out 2004-08 (%)	Likely further spread if no change in mgt	Review Comments	Recommendation 2008	Cost Estimate * (\$k)	Priority
				>2000	100-2000	1-100	<1						
Nuggets - East faces	15a	Aurum - E40059, Aurum Rec Res;		-	-	-	?	80	High	Spraying completed by both Doc & QLDC. Success rate has yet to be determined.	Maintain current control.	\$ 10,000?	High (to complement work completed to date)
Nuggets – SW face	15b			c.20	Sprayed by DoC	c.10	?	100?		Spraying completed by Doc. Success rate has yet to be determined. Also Doc has completed spray trials in Skippers Creek.		?	
Branches Station	15c	Branches		-	-	-	-	100	Low	Considerable control completed by Arthur Borrell has ensured that the station was clear. However, this needs to be maintained.		Nil	High
Bullendale	16	E40059 Aurum Rec Res;	mt pine (P uncinata)	-	Sprayed by DoC	Sprayed by DoC	-	95	Low	Spraying completed by Doc 3 times (Reglone).	Doc will respray again 2009/10 \$25K	\$ 25,000R	Medium
Mt Aurum	17a	E40059 Aurum Rec Res;	Larch, D-fir	c. 200 contain	-	<20	?	60	High – mainly to S and SE	Considerable control achieved - more than expected prior to 2004 – mainly due to change in control methods - using poison spraying – and increased funding	Maintain current programme of establishing containment and clearing re-generation. Encourage removal of trees from take-off site on Skippers Point as recommended in 2004 Strategy. Encourage removal of trees from take-off site on Skippers Point as recommended in 2004 Strategy.	\$? On-going programme s and containmen t c\$ 328,000 for complete removal	Medium to high, Low
Western Upper Stony Creek	17b			No known wildings present						New management unit. No known infestations.	Monitor	Nil	N/A

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				>2000	100-2000	1-100	<1						
Macetown / Upper Arrow	18	F41125 Arrow Rr- Macetown MS, F41127 Macetown CA62, F41128 Macetown HR, Mount Soho, Coronet Peak	Larch, D-fir	-	-	-	-	100?	High – esp., if mature trees left in situ. Low if removed	Area cleared previously. Doc are maintaining control. Doc Wanaka also contributing on Mt. Soho Station.	Maintain current control. Liaise with Doc.	\$ 2,000R	High
Soho Creek	19	Mount Soho, Glencoe, Cardrona Ski	Larch, Scots Contorta, Radiata, D-fir	-	-	-	<1	99	High	Mature Radiata remain. New Glencoe Station manager happy to see them removed.	Liaise with landowner.	\$ 800 \$ 660R	High
Middle Arrow	20	Mount Soho, Coronet Peak	D-fir, Larch	-	-	-	-	100?	High	Mature trees just below 8-mile junction all? removed.	Maintain current control.	\$ 2,700R	High
8 Mile/ Coronet Ck	21	Coronet Peak	Larch	-	-	c. 300	-	0	High	Mature Radiata at Hut and outliers around the saddle with Deep Creek remain.	Remove all remaining trees. Maintain control.	\$ 2,000 + helicopter	High
German Hill	22a	F41124 Arrow River TL MS, F41126 Arrow River TR MS, Coronet Peak, Glencoe	Larch	30	20	-	-	0	Medium to high	Mature Larch on top of German Hill needs removing. Locals keen to see containment - line needs setting.	Remove mature outlier and set containment line.	\$18,000	Medium

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				>2000	100-2000	1-100	<1						
Arrow River	22b	Coronet Peak, Glencoe, Cardrona Ski	Larch, D-fir	<5	1	5	?	50	High out of the gorge, Low in the gorge	All trees in New Chums Gully removed. Dense stand in Swipers Gully remains. Some difficult trees remain overhanging river near junction of Sawpit Gully.	Remove dense stand in Swipers Gully and all remaining trees. Maintain control.	c\$ 10,000 \$ 2,500R	High
Hayes Creek	22c		c) D-fir, radiata	<2	cleared 2001-03	cleared 2001-03	?	0	High	New Glencoe Station manager has agreed to removal of dense stand opp. Hayes Creek.	Remove all remaining trees. Maintain control. Doc intend to clear this site.	\$ 7,000 \$ 750R	Medium
Bush Creek / Big Hill	23	Coronet Peak	Larch, D-fir Contorta	10	15	15-20	15-20	0	High (Brow Peak/Big Hill), Medium (remainder)	In-filling of remaining trees. Now almost closed canopy.	Maintain containment especially Contorta. Re-visit further containment or complete removal of dense stand if more funding becomes available.	\$ 1,800+ helicopter, (Big Hill), \$ 32,200 (complete removal), \$ 7,500R+ helicopter	High, \$ 7,500R+ helicopter

Name	Unit No	DOC land unit/ High Country Station	Major spread species	Area affected – hectares (stems / ha)				Control Carried Out 2004-08 (%)	Likely further spread if no change in mgt	Review Comments	Recommendation 2008	Cost Estimate * (\$k)	Priority
				>2000	100-2000	1-100	<1						
Coronet Plantation	24	CODC and QLDC	D-fir	209 (planted)	<20	<20	?	5	High - to NE	An area at the far (Eastern) end at the top of the ridge has been cleared. Forest Sub-Committee has declared that they will start harvesting upper trees for posts from 2009? These trees started to cone in 2006. Significant number of D-fir seedlings have been found since 2004 in Bush Creek and top of Sawpit Gully area - very likely to be coming from Arrowtown Forest. It is questionable whether ridge top removal will significantly reduce seed rain.	Liaise with Sub-Committee & Forestry Manager. There needs to be recognition that as long as the forest remains, it will be necessary to commit annual funding to the control of wildings in MU 23.	(To come from Forestry budget)	High
Coronet Slopes	25	Coronet - F41123 Coronet Peak RR, Coronet Peak, Southern Alpine Recreation Ltd	Contorta, Larch, D-fir, Corsican, Scots	20	50	c.100		10	Very high	Doc have almost completed containment on Reserve. Major control on Coronet Peak Station is unlikely under present management.	DoC intend to complete in the next year or so.	\$ 176,000 \$ 4,000R	High
Coronet Peak – Ski Huts	25a	Coronet - F41123 Coronet Peak RR, Coronet Peak, Southern Alpine Recreation Ltd	Contorta, Others?	-	-	?	-	90	High	Southern Alpine Recreation in co-operation with DoC have almost completed removal around ski lodges and on the ski slopes.	Maintain current control.	Nil	High

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				>2000	100-2000	1-100	<1						
Dirty Four Creek (Maher's Camp)	25b	Coronet - F41123 Coronet Peak RR, Coronet Peak, Southern Alpine Recreation Ltd	Contorta	-	-	-	-	100	High	Patch of Contorta. All seed trees and seedlings removed? (2001 & 2007). Needs monitoring.	Maintain current control. Monitor carefully.	\$ 600R	High
Mt. Dewar	26	Mt Dewar, Atley's Tce - Devils Creek, Mt Dewar TR, E41118 Shotover Rr MS, E41119 Arthur's Pt plantatin CA62; E41122 Morning Star RR, F41049 Shotover River – Big Beach TL MS, E41123 Lower Shotover – Big Beach CA62	Larch, D-fir, Corsican, Radiata, Contorta, Maritime	c.100	<20 outside containment boundaries	25 outside of containment boundary	35	75	High	Compared with 2004 when Mt. Dewar Station had minimal control, massive effort by a combination of DoC, QLDC & landowners has been achieved, especially in the last year. This is demonstrated by the amount of expenditure (approx. \$107,000 over 4 years). Doc component is 90% complete in Devil's Creek and covenanted areas. If the program is continued at this rate, containment as per strategy will be achieved within 2 years.	Continue co-operative program. Maintain current control in Devil's Creek & covenanted areas.	\$ 102,000 \$ 12,000R	Medium to high

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				>2000	100-2000	1-100	<1						
Coronet Peak Road Reserve	26a		D- fir, Larch, Corsican, Radiata, Contorta	2	15	-	-	90	Low to Medium (until mature trees removed from Mt. Dewar side)	Cleared twice (1999 & 2006). Very few re-gen as local seed sources were removed (1999). Dagg forest below Coronet Peak Road now 15 years old, started to vigorously cone. Can expect an explosion of seedlings in next few years especially in exposed batter slopes along the road. 1-3year old seedling found in 40m stretch opposite armco barrier. Frequent seedlings now found in road reserve b/w forest & road.	Maintain current control. Liaise relative to Dagg forest especially if management changes. Control needs to be carried out when they are at hand tool size. Staged annual clearance of roadside reserve starting from the top end of remaining mature infestation.	\$ 22,200 \$ 1,500R	Medium (top end) Low (bottom end)
Arrowtown	27	Glencoe	Larch, D-fir, Corsican, Radiata	c. 20	503 to be cleared to achieve containment	3010 to be cleared to achieve containment	-	0	Medium	Work was completed at top of backdrop to Arrowtown on Glencoe Station. QLDC looked at completing the work scheduled in 2004 and requested by locals in the 2001 Community Workshop, but deemed it to be largely pointless b/c the face is covered in a mixture of exotic woody species & there are higher priority areas to clear. Also of consideration is that removal of all conifers would affect the autumn colour. The Arrowtown Community Association discussed possible felling of pines only. Between Mt. Beetham and the zig-zags an area of mixed conifers is spreading locally.	Revisit the possibility of removing more trees at the top edge of the Crown Terrace to reduce likely seed rain onto Glencoe Station and establish the containment line as per 2004 Strategy. Locals to decide on pine removal (outside of this budget). Consider removal of area between Mt. Beetham and zig-zags.	\$10,500	Medium

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				>2000	100-2000	1-100	<1						
Wakatipu Basin	28	F41114 Feely Hill SR;	Variety of species in shelter belts and small plantations	-	-	-	-	N/A	Very low	Some clearance of stands has taken place - perhaps recognition of possible wilding problem? There are stands of mature DF along Kawarau TLB before the Gorge which need to be monitored. D-fir on Feelys Hill removed 07/08. D-fir on Feelys Hill removed 07/08.	Establish risk from these plantations and shelter belts. Liaise with landowners, esp. wrt trees at the entrance to Kawarau Gorge.	-	Low
Crown Terrace	29	Glencoe, Royal Burn, Cardrona Ski	Larch	-	-	c.100	c.200	25	Medium to high	Next creek west of upper Royal Burn cleared. More scattered outliers present from Brackens Gully to here on the flanks of Crown Peak. Glencoe Station prepared to contract clearance.	Monitor clearance. Maintain control.	\$5,500	High
Swift Burn	30	F41083-85 Arrow Junction CA62	Contorta	5	<5	<10	?	0	Medium to high	In-filling and thickening has occurred. However, the infestation has not spread significantly further. As predicted, this infestation appears to be spreading eastwards into 31.	Inspect site. Liaise with ORC and landowners about removal.	\$24,000	High

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				>2000	100-2000	1-100	<1						
Kawarau TL - Remainder	31a	Waitiri/ Eastbourne	Radiata Corsican Contorta D-fir	-	-	<2	c.300	25	Low	Most trees around Waitiri bend have been removed by Waitiri Station with assistance from Doc. However widely scattered mature wildings from the bend to Muddy Creek have not been cleared. 1 large, prominent D-fir east of Waitiri entrance requires removal. A large number of seedlings are now visible between Kawarau Bridge and Muddy Creek. Probably Contorta from Swift Burn?	DoC have sprayed some patches. Recommend complete removal of remainder asap. Has become higher priority. Consider removal of scattered trees.	\$ 7,000 + helicopter	High
Kawarau TL - Muddy Ck	31b		mugo in Muddy Creek Contorta	-	-	-	c.200	60?	High	Doc sprayed most of the infestation in Muddy Creek. Fringe spread requires attention according to the station manager	Continue complete removal - as recommended.	\$? \$?R	High
Kawarau TR	32	Glenroy, Mt Rosa	Radiata, D-fir	-	<40	<150	<10	??	Medium	Doc have carried out a large amount of control on the upper slopes. Lower areas (private land in Gibbston Valley) have not been cleared. Some trees removed in the Victoria landfill area.	Continue removing few scattered outliers with fringe spread. Remove 2 patches of D-fir. Liaise with landowners regarding removal of shelter belts and outliers lower down. Check Victoria landfill area for remaining wilding species..	\$10,000	Medium to high
L. Kawarau TR	33	Mt Difficulty		-	-	-	-	90	Medium to high	Doc have almost completed control.	Maintain current control. Doc will complete control (esp. opp. Roaring Meg).	\$1,000	Medium to high

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				>2000	100-2000	1-100	<1						
Gentle Annie	34	Waitiri-Eastbourne	Contorta	-	-	-	<1	0	High	We now know that DoC cleared trees in this area prior to 2004.	Maintain current control. Check Victoria landfill area for remaining wilding species..	\$500	High
Mid Roaring Meg	35	F41095 Roaring Meg Rec Res											
Mid Roaring Meg – Upper Hut	35a	Waitiri-Eastbourne, Lowburn	D-fir Contorta Larch	-	-	?	?	? (DoC Wanaka)	High	DoC Wanaka have carried out control in this area.	Maintain current control. Check whether the Contorta around Meg Hut have been removed (DoC Wanaka)	Nil	Medium (apart from Contorta)
Mid Roaring Meg – Planted trees above HEP plant	35b		D-fir	10	-	-	-	0	High	No control work to date. Central Otago Electricity are considering removal.	Liaise with Central Otago Electricity.	\$19,000	Medium
Mid Roaring Meg – Remainder spread around plantation	35c		D-fir Contorta Larch	2	25	100	?	? (DoC Wanaka)	High	DoC Wanaka have carried out control in this area, especially above generation plant and TRB (including spraying) to a containment line along the Creek.	Maintain Control. Encourage further control. Liaise with DoC Wanaka.	\$30,000	Medium (apart from Contorta)
Lower Roaring Meg	36	Waitiri-Eastbourne	D-fir, Larch	c. 25	c. 100	<20	<5	0	Medium - low	No known control work to date. Existing areas have thickened considerably since 2004. Of major concern now are trees spreading down TLB Kawarau Gorge, some are already coning. Apparently Cromwell community are concerned about this area.	Liaise with DoC Wanaka and CODC. Determine and establish containment line.	\$ 130,000 (for complete removal)	Medium

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				>2000	100-2000	1-100	<1						
Remarkables	37	Remarkables; Hectors; Cone Peak -F41 057 Remarkables CA7(1); F41055 Rastus Burn RR; F42031 Wye Creek CA62, Remarkables, Cone Peak	Corsican; few D-fir and Scots Contorta mugo ponderosa radiata	-	-	c. 700 (Rastus Burn & below Road)	?	50	High	On-track on DoC Reserve (70% complete). No control so far on leasehold (Cone Peak & Jardine Stations) apart from that resulting from grazing. Now considerable number of seedlings appearing in mid-Rastus Burn on both sides - of mixed species. Source unidentified.	Doc to continue control and maintenance. Need to control whilst of hand-tool size. Upgrade to higher priority now than 2004.	c\$ 20,000 plus helicopter	High
Wye	38	Remarkables F41057, Remarkables, Loch Linnie	Corsican, D-fir?, Larch	-	-	Cleared by Doc		100	Medium	DoC have completed clearance of upper Wye. Infestation at Wye Creek mouth requires removal.	Remove mouth infestation. Maintain current control.	\$3,000	High
Hectors – Upslope Wildings	39a	Loch Linnie, Glen Nevis, Kingston	Radiata, Contorta, other pines	-	13	c. 800 (Loch Linnie) DoC have cleared large areas		50?	High	4,500 Contorta seedlings removed from Loch Linnie Station up to 15 years old. Source trees (of Contorta) need to be located - suspected to be alongside SH.	Continue control to containment. Remove source trees (MU 39b).	\$ 15,000 plus helicopter (part)	High

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				>2000	100-2000	1-100	<1						
Hectors – Roadside Plantings	39b			12	-	-	?	0	Medium	Mature trees above the road causing problems.	Identify source of Contorta in 39a and determine problem trees. Discuss removal of all these trees with landowners.	\$9,500	Medium (apart from Contorta)
Kelvin Heights - Lake Reserve	40a	Lakeside Reserve	Remove source trees (MU 39b).	-	2	1	-	40	Low	LINZ have agreed to the removal of all conifers.	Remove all remaining conifers as recommended in 2004. Maintain control. KHPA to provide volunteers.	\$ 9,000 \$ Nil R	Medium
Kelvin Heights - Jardine Park	40b	Jardine Park	Remove source trees (MU 39b).	24	<1 to clear to achieve containment	-		80	Low? (Possible source for Remarkables)	KHPA have agreed to removal of seed source (of Lakeside reserve). All seedlings within the park were removed.	Maintain control	\$2,000	Medium
Peninsula Hill	41	Kawarau (Deer Park Heights), Remarkables	Radiata & Others	<5	<5	60		0	Low	Most of this unit has not changed significantly apart from some in-filling around existing groups of trees and adjacent to Jardine Park where 2nd generation fringe spread is starting to appear around outliers. The hill is considerably grazed.	Remove outliers and fringe spread adjacent to Jardine Park. Monitor Peninsular Hill, especially if grazing regime changes.	\$4,000	Low

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				>2000	100-2000	1-100	<1						
Cecil Peak	42a	c.600 remain	Corsican (mostly), Radiata, D-fir, Lawson Cypress		-	c.1,500 McKinlays Creek	c.1,000 Re-Infested	95 Not including regen	High	Initial control of first wilding arrivals (1979&81) now very near completion. Further invasions of considerable seed now appear to be more frequent since 2000 (most likely from Closeburn area as was the initial invasion). TRB McKinlays Creek & has not yet been cleared.	Continue complete removal. Start clearing new invasion.	McKinlay Creek \$ 7,300 + helicopter Lake faces \$ 10,000R + helicopter	High
Cecil Peak - Bayonet Peaks	42b	c.600 remain	Corsican D-fir			¾ Cleared by QLD C, c.600 remain		65	High	Ongoing removal of first wilding arrivals (1979&81).	Continue complete removal and maintain control. Subject to aerial inspections.	\$ 5,700 + helicopter	High
Eyre Mountains - South of Lochy	43a	Halfway Bay, Allendale	Corsican	-	-	?	?	20?	High	Some outliers remain in Short and Long Burns.	Maintain control. Subject to aerial inspections. Identify potential source trees at Halfway Bay homestead.	\$ 5,000 + helicopter	High
Eyre Mountains - Kingston Faces	43b					-		100	High	Cleared by Doc 2003?	Maintain control.	Nil	N/A
Walter Peak	44a	Eyre Mts - E42055 Beach Bay RR, Walter Peak	Radiata, Corsican, D-fir	13	<20	c.800 McKinlays Creek		0	High (McKinlays), Medium (Remainder)	TLB McKinlays Creek has not yet been cleared. See 2004 Strategy	Remove outliers in McKinlays Creek and east of homestead as recommended in 2004 strategy.	McKinlays Creek \$ 7,300 + helicopter	High

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				>2000	100-2000	1-100	<1						
Walter Peak - Beach Point	44b		D- fir	16	70			0	High	See 2004 Strategy. As trees mature on windward side of Beach Point, seed rain further afield is likely to increase, especially on the faces of Walter Peak.	See Initial Strategy	30000 for complete removal	Medium
Mt Nicholas - Lakeside faces	45a	Walter Peak, Mount Nicholas	Radiata, Scots?			<5 (lake faces) Most removed by QLD C		90	Low (lake faces)	All outliers beyond homestead removed.	Maintain current control. Remove lone outlier on island in the lagoon?	Nil	High
Mt. Nicholas - Von Valley	45b		Contorta	c. 3	c. 16	20		50	High	Everything outside of the central infestation removed except for one island. Farmer withdrew support 2007/08.	Liaise with landowner.	\$19,000	High
			D-fir					(In terms of cost, 85 in terms of area)		DoC Southland earmarked Douglas fir infestation at Hut at mouth of Black Spur Creek for removal.	Liaise with DoC Southland re: Black Spur Creek infestation. Remove loan outlier(s) on East face of Pasture Hill.	\$ 5,500R+ helicopter	
Humboldt / Thomson - Remainder	46	Mt Nicholas, Elfin Bay, Woodbine	N/A	-	-	-	-	0		New management unit. No known infestations.	Monitor	Nil	

Name	Unit No	DOC land unit/ High Country Station	Major spread species	Area affected – hectares (stems / ha)				Control Carried Out 2004-08 (%)	Likely further spread if no change in mgt	Review Comments	Recommendation 2008	Cost Estimate * (\$k)	Priority
				>2000	100-2000	1-100	<1						
Humboldt / Thomson - Lake faces	46a	Routeburn	D-fir	Oct-15	25	?	?	10?	Medium	Evidently the farmer on Mt. Elgin Station has cleared an area for grazing on the uphill side of the infestation. See 2004 Strategy.	Doc to monitor. As per 2004 strategy, area of containment needs decision. As per 2004 strategy, area of containment needs decision.	c\$ 29,000	Medium to high

SECTION 3

A Vision

The Wakatipu Basin and surrounding landscapes will continue to be characterised by a blend of indigenous short and tall tussock grasslands, shrublands, beech forests, pastoral and arcadian farming vistas.

Wilding spread will be contained to the most densely infested locations:

- The slopes above Queenstown (Bowen Peak, Ben Lomond and One Mile Creek)
- Queenstown Hill,
- Fernhill/ Sunshine Bay,
- Corsican Cove/ Alpine Retreat, Five-, Seven- and Nine- Mile Creeks,
- Arthur's Point, Mount Dewar
- The lower Arrow Gorge and the slopes behind Arrowtown,
- Long Gully,
- Mid-Shotover River TL and
- Mount Aurum.

Containment of these areas will reduce the occurrence of spread. The extent of these areas may be reduced by commercial milling. Their replacement with appropriate pasture or indigenous communities will be encouraged.

Areas of scattered outlier infestations will be removed before they can spread into the surrounding open landscapes.

The Wakatipu Wilding Control Group will effectively carry out the implementation of the Strategy, integrating the resources of the community, landowners and managers, and private individuals and local businesses, together with key stakeholder agencies such as the QLDC, DoC, LINZ and the Otago Regional Council.

Otago Regional Council's Regional Pest Management Strategy will give greater recognition to the magnitude of the wilding conifer issue and extend requirements for the control of unwanted spread in progressive updates of the RPMS. The Queenstown Lakes District Council wilding control strategy and GIS will help to facilitate this.

Statutory land management agencies will fulfil their roles on land they administer (including ORC and LINZ).

The cost of control is shared amongst all stakeholders, with additional funds obtained from appropriate outside sourcing.

SECTION 4

Implementation

The vision for containing wilding conifer infestations in the Wakatipu area can be attained by using this Strategy to guide implementation of the following actions:

1. Forming a co-operative stakeholder body (the Wakatipu Wilding Control Group) to address the Wakatipu Wilding issue.
2. Implementing a strategically scheduled control programme, as described in the Strategy.
3. Promoting achievements, and raising awareness and education to increase and maintain community support for a control programme.

Action 1

Forming a co-operative stakeholder body (the Wakatipu Wilding Control Group) to address the Wakatipu Wilding issue.

In order to establish an inter-agency approach, a lead agency is required with which others can liaise. Once the 2008-2012 Strategy is accepted by the QLDC, the Council should move to form a co-operative stakeholder body, which could be called the Wakatipu Wilding Control Group (WWCG). It would consist of representatives from the community, landowners and managers, and private individuals and local businesses, together with key stakeholder agencies.

The WWCG would consist of representatives of:

- Affected landowners, lessees and managers
- Local community groups including environmental organisations, mountain bike clubs, Wakatipu Trails Trust, historical trusts and societies,
- QLDC (Queenstown Lakes District Council)
- DOC (Department of Conservation)
- LINZ (Land Information New Zealand)
- ORC (Otago Regional Council)
- Community associations such as Arrowtown Village Association & Kelvin Heights Peninsular Association

Note: This is by no means a definitive list of organisations which could have representation.

Such enduser-driven environmental Groups have worked well elsewhere in NZ. Apart from greater local 'ownership' of the focal task, a major reason for their success has been better financing, due to their ability (particularly if they become Incorporated) to access other sources of funds (eg., Lotteries Board), and more readily seek and accommodate donations from private businesses and individuals.

The WCCG should be led by a local 'champion' with a natural and strong interest in wilding control. Ideally, if this can be a person from the community (not from an Agency), the Group is likely to be

more readily accepted, attract maximum co-operation, and therefore be in a better position to effectively implement the Strategy.

The WWCG should quickly position itself to be able to access all sources of funding. This could well mean becoming Incorporated. The Group should also look to solicit 'donations' from local individuals and businesses.

Once formed, the WWCG should look to obtaining funds to employ a manager (part-time or full-time, depending on funding), who would be contracted to implement appropriate parts of the Strategy. Elsewhere, such funds have been given by a local business, who benefit from the promotion gained from their name being displayed on a 'Group' vehicle or signs. If necessary, the funds for this contract could be administered through a recognised agency such as the QLDC or DoC. Such a process has worked well for similar community-driven environmental groups elsewhere.

Apart from implementing the Strategy, the WWCG may well commission research of particular importance to wilding control in the Wakatipu region. Such work is often well suited for one-off funding via local 'donations'.

QLDC support & Regulatory Options

The QLDC can support the strategy, and the WWCG through the Resource Management Act (RMA) processes, the Resource Consent process, and by endorsing locally driven initiatives.

RMA

The Resource Management Act 1991 aims "to promote the sustainable management of natural and physical resources". In achieving this, Council must manage use, development and the protection of natural and physical resources in a way that, among other things safeguards the life-supporting capacity of ecosystems (*from S 5 RMA*). Section 6 of the RMA requires that matters of national importance be recognised by Councils in relation to their management of "use, development, and protection of natural and physical resources". The Act recognises the following matters as being of 'national importance':

Section 6 (b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use and development, and (c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.

The NZ Forest Owners Association Code of Practice (2007) includes a requirement to manage wilding trees from forestry. The Ben Lomond and Queenstown Hill management plan¹⁹ includes a commitment to wilding control in and around the forests in those reserves. The plan supports an ongoing programme of wilding control in the tussock grassland and sub alpine areas including the

provision of signs to inform the public of the wilding conifer issue and the steps they can take to contribute to control.

The RMA requires Council, through its District Plan to be responsible for managing the adverse effects of land use activities.¹ The Partially Operative District Plan (August 2008) provides Council with discretion over forestry and tree planting and thereby the management of wilding conifers (directly and indirectly) through Section 5 Rules for Rural Areas as follows:

- v Significant indigenous vegetation
 - vii Forestry and shelterbelt planting,
 - x Indigenous vegetation,
 - xii Alpine environments,
 - xiii Planting of tree species with wilding potential
- There shall be no planting of the following tree species:
- Contorta or lodgepole pine (*Pinus contorta*)
 - Scots pine (*Pinus sylvestris*)
 - Douglas fir (*Pseudotsuga menziesii*)
 - European larch (*Larix decidua*)
 - Corsican pine (*Pinus nigra*)
 - Radiata Pine (*Pinus Radiata*)
- xxix 2. Planting of exotic trees and/or shrubs in the alpine environment
 - xxx Site Standard – Planting of tree species with wilding potential

Resource Consents

The Resource Consent process provides a means by which QLDC can assist the implementation of the goals of this strategy by encouraging land owners/managers to avoid, remedy or mitigate any potential adverse effects associated with shelterbelt, woodlot or larger tree planting applications.

This may include the following obligations:

- Shelterbelt, woodlots and plantations must have management plans that identify the risks to down-wind landscapes, biodiversity, recreational and historic values,
- The use of non-wilding species or species less prone to wilding spread,
- Avoidance of planting in take-off sites or exposed places,
- Use non-wilding species (e.g. 2-4 rows deep) around woodlots or plantations to reduce fringe spread,
- Requirements to control wildings on neighbouring land within 2 kilometres of a known seed source.

More detail of the wilding spread process and how to prevent unwanted spread are available in a freely-available booklet : 'Wilding Prevention – guidelines for minimising the risk of unwanted wilding spread from new plantings of introduced conifers' (Ledgard and Langer, 1999). This booklet should be made available from the

QLDC, and used in the resource consent process, as well as being promoted to all those managing trees in the District.

Local initiatives

In June of 2002 a community workshop ('Tomorrow's Queenstown'¹³) was held with the aim of providing Council with "a strategic vision, strategic goals and priorities for a ten to twenty year span so that Council can align activities and priorities to those of the Community". The workshop involved a cross section of the community but may not represent all sectors of the community. The strategic goals of the workshop gave support to approaches that "respect the dominance of our magnificent mountain, lake and rural landscape". Participants at the workshop recognised that "the spread of wilding conifers is a significant threat to the ecology of the Wakatipu Basin" (p 30).

The removal of conifers from the slopes of the Crown Range adjacent to Arrowtown was identified as a goal in the February 2003 Arrowtown workshop.

There are acts other than the RMA which govern the obligations of agencies and landowners in the matters of pest plant control and/or management, such as the Regional Pest Management Strategy (RPMS), the Reserves Act 1977 and the Conservation Act 1987.

ORC RPMS

The Otago Regional Council is the "lead pest management agency in terms of pests that justify a regional response" and its roles and responsibilities are outlined in section 3.3 of their RPMS which has power over the entire Otago region. All land occupiers are "responsible for ensuring any pest plants on land they occupy are controlled in accordance with the rules of the RPMS".² ORC as the administrator of the RPMS is responsible for ensuring compliance with the requirements of the RPMS.

Lodgepole/ Contorta Pine (*Pinus contorta*) has been declared under the RPMS to be a pest plant and is subject to total control within the area encompassed by the Wakatipu Wilding Conifer Strategy (under Section 4.1 (iii)).² QLDC unofficial policy is that it is the legal responsibility of the landowner to remove contorta. However, where contorta is present, QLDC and the WWCG, in co-operation with ORC, may decide to assist landowners to fulfil their obligations under the RPMS by contributing resources. As such contorta is very high priority.

Reserves Act

The Reserves Act 1977 is subject to the control of the Minister of Conservation and is administered by the Department of Conservation. Under Sections 16 and 28 of the Reserves Act local authorities (QLDC in this instance) in which reserves are vested or which are appointed to control and manage reserves, must do so in accordance with the particular purpose for which the reserve has been classified.

The Act requires the Department of Conservation and the local authority to, amongst other things, preserve areas possessing indigenous flora and fauna, or areas of environmental and landscape amenity or interest that are protected as reserves under the Act. The Act specifically requires that the exotic flora and fauna shall as far as possible be exterminated from scenic reserves (section 19(2)(a)), nature reserves (Section 20(2)(b)), and scientific reserves (Section 21(2)(a)).¹²

Conservation Act

The Conservation Act 1987 provides for the management, protection, preservation or restoration of natural areas and resources administered under it. This includes the preparation of management plans or management strategies which more closely describe that management.

Action 2

Implementing a strategically scheduled control programme as outlined in this Strategy.

Achievement of this goal requires priorities to be set for the control of wilding conifers. The recommendations, priorities and cost estimates given in Table 2 have been used to compile an Implementation Schedule, which is presented in Table 3. This table sets out control operations in descending order of priority in the following order:

- Follow-up or re-work,
- Fringe spread control,
- High priority, high spread areas, etcetera.

The problem of wilding conifers is ongoing, requiring a long term commitment of funding. It is important to appreciate that the strategic action initiated in the 2004-2008 Strategy needs to be maintained in order to avert an even larger and more costly problem. To some extent the current situation is a result of the failure to recognise this before 2004.

The Strategy will be implemented by a community-driven stakeholder group – the Wakatipu Wilding Control Group – the operation of which is outlined above.

It is strongly recommended that additional sources of funding be explored. This will be facilitated by the ability of the WWCG to access other sources (eg., Lotteries Board), and more readily seek and accommodate donations from private businesses and individuals.

Guiding principles

The principles of prioritisation for wilding control are essentially to firstly maintain control of areas already cleared, and secondly to start with the lightest infestation and those sites posing the greatest risk of spread onto the surrounding land first. Control efforts will

then progress to increasingly dense infestations until the containment of the most established infestations can be achieved.

Eradication of all wilding conifers from the Wakatipu area is a goal that is unlikely to be achieved. Therefore, where removal is not practical, the primary objective will be containment.

“Do nothing” is not a logical and reasonable option given the inevitable consequence of rapid and widespread infestation of significant areas of unaffected land.

Spread is more likely onto undeveloped, lightly vegetated or grazed land than into closed canopy shrublands/ forest/ improved pasture and regularly mob stocked land.^{14,3}

See Section 2 for more details about natural wilding spread processes.

Control Methods

The main factors influencing choice of control technique are:

- species of conifer present
- extent of infestation
- density of infestation
- size and age of trees
- access to, and ground conditions within sites
- whether infestations threaten indigenous vegetation, landscape values and/ or farm production
- skills and resources available for control

Depending on the above factors, there are a variety of methods for controlling wildings, and because many factors can be present at one site, a mix of methods is often needed. The final choice of mix is best left to those most familiar with the area in question, but a guideline as to choice is available.¹⁷ (Ledgard and Woods, 2007)

An outline of control methods is as follows:

- Burning. The cheapest tool but only appropriate where land has already been considerably modified and has low ecological values. Results can also be variable and/or ineffective, due to varying terrain, fuel density and weather. It may also result in reduced native biodiversity.
- Grazing. Wildings are difficult to kill by grazing after 2 years. Intensive or mob stocking at regular intervals keeps seedlings in check, and when combined with oversowing legumes and topdressing with fertiliser, can be an effective means of maintaining control, especially around containment areas
- Fertilising. Use of fertilisers alone will increase competition of existing vegetation (especially grasses), and can reduce wilding emergence by 50%. Best when combined with grazing.
- Physical
 - Hand pulling seedlings (usually <50cm tall);
 - Hand tools (loppers, bow-saws, hand saws, axes, slashers). For small trees up to 60 mm diameter at base of stem.
 - Ring-barking (bark peeler, slasher, axe, chainsaw). Requires the total removal of a ring of bark at least 2 cm or 1 inch wide, can be employed for large, isolated trees but deep cuts are needed to ensure success, and results often variable.
- Physical (using power tools to remove *all* green foliage).
 - Chainsaw. For all trees too large for hand tool use.
 - Scrub bar. For small seedlings up to trees with 100 mm diameter at base of stem. Much easier to use than chainsaw, but only good for flat, largely rock-free sites.
- Machine – tractor plus mulcher, bulldozer and diggers. Most appropriate for dense areas of readily accessible large trees.
- Herbicides. Application of chemicals to the foliage, cut stump surfaces or as a stem poison or soil injection.
 - Foliage. Depending on species and application times, this method produces variable results, and trials are ongoing. It can be expensive but is effective in reducing seed production. More than one spray application often required to totally kill trees. In the Wakatipu area, DoC has used this method successfully on closed canopy wildings and where valued non-target species are absent.
 - Cut stump application. Most useful on low numbers of either multi-stemmed trees or where small to medium sized trees are growing in stony ground or slip areas such as gold tailings.
 - Stem poisoning. Mostly used with good success for medium to large trees in shrublands or very rocky terrain, particularly where access is difficult. Consideration must be given to visual acceptance of dead trees, and to hazard of falling debris as trees decay.

- Soil injection. A new technique using Formula 4. Appropriate for scattered small to medium sized trees where access is difficult - results still to be fully proven.

Follow-up control	A guiding principle of this Strategy is to retain control of areas which have been cleared of wildings. Therefore, return visits will be needed to remove small seedlings missed, plus any new arrivals. For cost reasons, such return visits should be carried out before wildings grow beyond 'hand-tool removal' size ie., usually between 4-6 years after the initial control operation. As with first removals, costs vary from site to site, but on average, return visits cost 25% of the original removal cost.
Costs	Due to the wide variety of factors involved in any control operation, accurate field costings are notoriously difficult. Consequently, most operators are now paid by the hour – usually around \$40/hr for a person using chainsaw or scrub-bar, plus any significant transport costs (often helicopter). Costs used in both Tables 2 and 3 are provided in Section 2 (p.26).
Prioritisation	The reasoning behind this is also addressed in Section 2, just prior to Table 2.
Records / Reporting	<p>Good records are essential for accurate reporting and monitoring of control operations, plus the ability to learn from experience and improve efficiency. Records should be kept by the WWCG manager/administrator, and should include information such as:</p> <ul style="list-style-type: none"> • The management unit name, ownership and location – making full use of the latest GIS technologies. • When the work was undertaken. • Who carried out the operation and with what resources (labour and tools), • The area cleared and the species involved. • The wilding density and age classes. • The likely origin of the seed which caused the invasion. • The cost of control per site. • Quality control results – successful or not? • Photographic record if appropriate (befores and afters). • Recommendations for further work or longer term follow up.
Reviews	The Implementation Schedule (Table 3) should be reviewed annually to ensure that new information is incorporated as it becomes available, management unit prioritisation is confirmed or amended, and that limited resources are used as cost-effectively as possible. A review of the whole Strategy is planned for 2011/2012.

Action 3

Promoting achievements, and raising awareness and education to increase and maintain community support for a control programme.

Queenstown is renowned world-wide for its visual landscapes. In that context, wilding trees are unique from other components of that landscape, in that they are capable of rapidly and significantly affecting the visual appearance of every area of land visible from Queenstown and its surrounds. The necessary ownership or 'buy-in' of the Strategy will only be attained with improved awareness and education about the wilding situation in the Wakatipu area.

There are some in the community who hold the opinion that "any tree is a good tree" whilst others consider wildings a contributor to this country's carbon credits.

This strategy takes the position that the spread of wildings into the surrounding landscape usually results in negative impacts which can be avoided.

One of the most important means of "getting this message across" is by keeping the local community informed of the issues, particularly due to the transient nature of the population.

How to promote

Once the Strategy is approved, presentations on its purpose and implementation will be given to the Council, community groups and the general public, with regular updates as appropriate. Digital, 'real life' modelling of future spread would be an excellent way of illustrating the danger of a "do nothing" approach.

Local schools and tertiary education institutions will be specifically targeted with presentations (including a dedicated Powerpoint address), opportunities for student projects, plus participation in control operations.

Media articles will be written for both local, national and international consumption.

Wilding control workshops will be held to explain the Strategy, and to instruct on the best wilding prevention techniques and removal means for varying tree sizes, densities and locations.

Other promotional outlets will be explored, such as regular screen vista screenings at the start of film showings in local cinemas.

Signs and interpretation panels in the field may also help elevate awareness in places where tracks pass through areas of wilding infestations; particularly high profile areas such as Ben Lomond/ One-Mile and the Skippers Road. These would explain why trees are being removed and could show pictures of the area prior to the

spread of wilding Douglas-fir. Walkers could be encouraged to pluck seedlings during their outings.

Alternative species, such as the Leyland Cypress clones 'Ferndown' and 'Stape Hill', will be promoted as non-spread-prone species suitable for the likes of shelterbelts and small plantations. They grow well in the moister, better soils of the high country, are fast growing and produce timber which is durable above ground.

Volunteer days will be held to keep the community involved in the control of wildings. Ben Lomond and Queenstown Hill are two locations that have severe problems and are easily accessible to visitors and resident.

Table 3 Implementation Schedule

- GREEN - Doc has undertaken control on all or part of area. Opportunities for “co-operative” wilding control with Doc are limited to discretionary funds or bio-diversity / bio-security funds where this Strategy has been used to support the allocation of funds.
- Costings have not been provided for all land administered by the Department of Conservation as Council is unlikely to undertake control in these areas. However, some units have mixed tenure and cost sharing is a possibility.
- All areas with pastoral lease or freehold land are subject to Council policy requiring landowner / lessee support for control programmes, especially in the case of **Contorta** infestations which are the responsibility of the landowner / lessee according to the current Otago Regional Council Pest Management Strategy (RPMS).
- All cost estimates are based on the use of manual methods (hand pulling / loppers / hand-saws / chain-saws / scrub-cutters) except where indicated and exclude transport costs (e.g. helicopter) EXCEPT for fringe spread spraying which includes helicopter costs.

H Helicopter transport required (Cost not included except for fringe spread spraying)

MU #	Prioritised sites requiring control	Total Estimated Cost	Possibility for liaison with DOC	2008/09	2009/10	2010/11	2011/12	H	Follow up Scheduled	Additional Reasoning
Follow-up										
23	Bush Creek / Big Hill	5,500		-	5,500	-	-		2008	RPMS weed
23	Brow Peak	2,000		-	2,000	-	-	H	2008	RPMS weed
25	Coronet Slopes	4,000	*	-	4,000	-	-		2008	RPMS weed
19	Soho Creek	660	*	-	660	-	-		2009	RPMS weed
25b	Dirty Four Creek - Mahers Camp	600	*	-	-	-	600		2011	RPMS weed
26	Mt Dewar	12,000	*	-	-	-	3,000		2011	RPMS weed
26a	Coronet Peak Road Reserve	1,500	*	-	-	-	1,500		2011	RPMS weed
45b	Von Valley	5,250	*	-	-	-	5,250	H	2011	RPMS weed
25a	Coronet Slopes - Ski Huts	?	*	-	-	-	-		Annual	RPMS weed
17a	Mt Aurum	?	*	-	-	-	-	H	On-going	On-going maintenance programme
5a	Ben Lomond	Voluntary		-	-	-	-		On-going	On-going maintenance

MU #	Prioritised sites requiring control	Total Estimated Cost	Possibility for liaison with DOC	2008/09	2009/10	2010/11	2011/12	H	Follow up Scheduled	Additional Reasoning
7	Long Gully	14,500	*	-	7,250	7,250	-		2008	
10a	McCarrons Beach to Deep	1,600		-	1,600	-	-		2008	
10b	Lower Deep Creek	1,600		-	1,600	-	-		2008	
11	Deep Creek/ Maori Gully	1,600		-	1,600	-	-	H	2008	
40a	Kelvin Heights - Lake Reserve	-		-	-	-	-		2009	Voluntary (KHPA)
40b	Kelvin Heights - Jardine Park	9,000		9,000	-	-	-		2008	Already completed Sept 2008
42a	Cecil Peak	10,000	*	1,832	1,832	-	-	H	2008	4 teams scheduled March 09, Doc support
4a1	Five Mile Creek	11,100		-	5,550	5,550	-	H	2009	
8	Lower Shotover TR	1,600		-	1,600	-	-		2009	
12c	Cotters Creek	1,850		-	1,850	-	-		2009	
13a	Smiths & Shepherd Terraces	1,150		-	1,150	-	-		2009	
13b	Dead Mans Creek	3,400		-	3,400	-	-		2009	
16	Bullendale	25,000	*	-	-	-	-	H	2009	
20	Middle Arrow	2,700	*	-	2,700	-	-	H	2009	
22b	Lower Arrow- Arrow River	2,500	*	-	2,500	-	-		2009	
22c	Lower Arrow- Hayes Creek	750	*	-	750	-	-		2009	
1	Upper Wakatipu	400	*	-	-	-	-		2010	
2c	West branch Moke/ Fan Ck	700	*	-	-	700	-		2010	
10c	Stapletons Terrace	300		-	-	300	-		2010	
10d	Sainsburys Terrace	300		-	-	300	-		2010	
4a2	Upper Bushy Creek	8,500		-	-	-	4,250	H	2011	
4b1	Wedge Peak	11,330		-	-	-	5,665	H	2011	
6a	Queenstown Hill	18,500		-	-	-	9,250		2011	RPMS weed
Sub-Totals Follow-up		159,890		10,832	45,542	14,100	29,515			

MU #	Prioritised sites requiring control	Total Estimated Cost	Possibility for liaison with DOC	2008/09	2009/10	2010/11	2011/12	H	Follow up Scheduled	Additional Reasoning
Fringe Spread Spraying										
6a	Queenstown Hill	21,000	*	7,000	-	-	-	H	?	Note: Proximity to town and high use of area for recreation. Share Costs
7	Long Gully	16,380	*	-	8,190	-	-	H	?	Share Costs
4a1	Five Mile Creek	16,380	*	-	8,190	-	-	H	?	Share Costs
17a	Mt Aurum	?	*	-	-	-	-	H	On-going	On-going maintenance programme
4b2	Home Hill	?	*	-	-	-	-	H	?	
Sub-Totals Fringe Spread Spraying				7,000	16,380	0	0			
High Priority - High Spread										
5b	Bowen Peak / Horn Creek	11,430		11,430	-	-	-	H	2012	need to contain, support work done to date, highly visible from Queenstown
10f	Gorsebury Gully	40,000		-	13,333	13,333	13,333		2012	support work done to date
10g	Horse Gully (above rd)	8,500		-	-	8,500	-		2012	support work done to date
25	Coronet Slopes	176,000	*	-	20,000	25,000	30,000			RPMS weed , ORC may also contribute. Need to limit further spread. Landowner should be approached to share cost.
11	Deep Creek/ Maori Gully	4,000		4,000	-	-	-	H		Support to work done in 2003 & 2008
42b	Cecil Peak - Bayonet Peaks	5,700		5,700	-	-	-	H	2012	
37	Remarkables	20,000	*	-	-	-	-	H	2013	RPMS weed Work undertaken by DOC to continue
39a	Hectors - Upslope Wildings	15,000	*	-	-	-	-	H	2013	RPMS weed
43a	Eyre Mts S of Lochy	5,000	*	-	-	-	-	H	2018	
12a	Wong Gong Ck - above Road	23,000		-	-	-	-			support work done to date

MU #	Prioritised sites requiring control	Total Estimated Cost	Possibility for liaison with DOC	2008/09	2009/10	2010/11	2011/12	H	Follow up Scheduled	Additional Reasoning
15a	Nuggets - East faces	10,000?	*	-	-	-	-	H		
15b	Nuggets - SW faces	?	*	-	-	-	-	H		
17a	Mt Aurum	?	*	-	-	-	-	H		On-going programme of containment
19	Soho Creek	800	*	-	800	-	-			RPMS weed
21	8 Mile (Coronet Creek)	2,000		2,000	-	-	-	H?		To complete work already done
24	Coronet plantation	Nil		-	-	-	-			Recommend Forestry Sub-Committee allocates annual budget for ridge line clearance and wilding control
34	Gentle Annie	500	*	500	-	-	-			RPMS weed
45b	Von Valley	19,000	*	9,500	-	-	-	H?		RPMS weed, very exposed, threatens Eyres, easily controlled, support work done to date
5a	Ben Lomond	31,500		8,750	5,250	8,750	8,750			need to contain, support work done to date, combine with volunteer days
6a	Queenstown Hill	56,000		-	-	14,000	14,000			RPMS weed
6b	Queenstown Hill - Marina Heights (above saddle)	1,000		-	1,000	-	-			
7	Long Gully	17,777	*	-	-	17,777	-			
10a	McCarrons Beach to Deep	1,000		-	1,000	-	-			
23	Big Hill	1,800		-	-	1,800	-	H		complete work done to date
31b	Kawarau TL - Muddy Creek	?	*	-	-	-	-	H		RPMS weed- landowner to be approached to share cost.
42a	Cecil Peak (McKinlays Creek)	7,300	*	7,300	-	-	-	H		support to work done to date
44a	Walter Peak (McKinlays Creek)	7,300	*	7,300	-	-	-	H		complement work on Cecil Peak Station

MU #	Prioritised sites requiring control	Total Estimated Cost	Possibility for liaison with DOC	2008/09	2009/10	2010/11	2011/12	H	Follow up Scheduled	Additional Reasoning
High Priority - Medium Spread										
38	Wye	2,000	*	-	-	-	-	H		
29	Crown Terrace	5,500	*	-	-	-	-		2013	
30	Swift Burn	24,000	*	-	-	-	12,000			RPMS weed- landowner to be approached to share cost. ORC may also contribute.
2b	Hanley faces	7,000	*	-	-	-	-	H	2012	
4b2	Home Hill	10,000	*	-	-	-	-	H	2012	
45a	Mt Nicholas - lake faces	Nil		-	-	-	-		2016	
2c	West branch Moke/ Fan Ck	1,000	*	-	-	-	-			RPMS weed support work done to date
4a1	Five Mile Creek	3,000		-	-	3,000	-			
4a2	Upper Bushy Creek	52,000		9,000	7,700	11,767	11,767			
4b1	Wedge Peak	34,250		6,000	9,417	9,417	9,417			
10d	Sainsburys Terrace	8,000		-	-	-	-			support work done to date
22b	Lower Arrow- Arrow River	10,000		-	-	-	-			continue work done to date
High Priority - Low Spread										
1a	Upper Wakatipu - Islands	Nil		-	-	-	-		2012	
31a	Waitiri / Eastbourne	7,000	*	-	-	7,000	-			RPMS weed- landowner to be approached to share cost. ORC may also contribute.
8	Lower Shotover TR	1,400		-	-	-	1,400			farm operations controlling wildings
10b	Lower Deep Creek	1,000		-	-	-	1,000			
Medium Priority - High Spread										
5c	Bowen Peak - Arthur's Point	22,000		-	-	-	-	H		high profile site, high spread risk
26	Mt Dewar	102,000	*	-	-	-	-			Continue working towards containment

MU #	Prioritised sites requiring control	Total Estimated Cost	Possibility for liaison with DOC	2008/09	2009/10	2010/11	2011/12	H	Follow up Scheduled	Additional Reasoning
33	Lower Kawarau TR	1,000	*	-	-	-	-	H?	2015	RPMS weed- CODC- outside QLDC boundary
5b	Bowen Peak / Horn Creek	112,000		-	-	-	-	H	2012	need to contain, support work done to date, highly visible from Queenstown
10h	Horse Gully (below rd)	7,000	*	-	-	-	-		2012	support work done to date
2d	Bobs Cove	8,000	*							
22c	Lower Arrow- Hayes Creek	7,000	*	-	-	-	-			
35b	Mid Roaring Meg - Planted trees above generation plant	19,000	*	-	-	-	-			
35c	Mid Roaring Meg - Remainder spread around plantation	30,000	*	-	-	-	-			RPMS weed
44b	Walter Peak - Beach Point	30,000	*	-	-	-	-			
Medium Priority - Medium Spread										
32	Kawarau TR (Mt Rosa)	10,000	*	-	-	-	-	H	2015	
1	Upper Wakatipu	26,000	*	-	-	-	-			
46a	Humboldt / Thomson - Lake faces	29,000	*	-	-	-	-			
22a	Lower Arrow - German Hill	18,000		-	-	-	-			Arrowtown community want to see some control
2a	Moke/ Kirkpatrick Valley	27,000	*	-	-	-	-			
4b1	Wedge Peak	150,000		-	-	-	-			

MU #	Prioritised sites requiring control	Total Estimated Cost	Possibility for liaison with DOC	2008/09	2009/10	2010/11	2011/12	H	Follow up Scheduled	Additional Reasoning
12b	Blue Slip - above Road	51,000		-	-	-	-			support work done to date
17a	Mt Aurum	c328,000	*	-	-	-	-	H		On-going programme of containment
3b	Darkles Terrace	11,000		-	-	-	-			
6b	Queenstown Hill - Marina Heights (slip zone)	2,500		-	-	-	-			
23	Bush Creek	34,000		-	-	-	-			for removal - containment completed 2003/04 includes RPMS weed
27	Arrowtown	10,500		-	-	-	-			
39b	Hectors - Roadside Plantings	9,500	*	-	-	-	-			RPMS weed
3b	Lower Roaring Meg	130,000	*	-	-	-	-	H		
Medium Priority - Low Spread										
40a	Kelvin Heights - Lake Reserve	9,000		1,000	8,000	-	-		2012	support community wishes and complement work to date
40b	Kelvin Heights - Jardine Park	2,000		-	2,000	-	-		2012	
10c	Stapletons Terrace	2,000	*	-	-	-	-			support work done to date
Low Priority - High Spread										
10e	Wire rope gully / Dredge Slip	12,000	*	-	-	-	-			
Low Priority - Medium Spread										
26a	Coronet Peak Road Reserve	22,200	*	-	-	-	-			
6b	Queenstown Hill - Marina Heights (remainder)	8,500		-	-	-	-			

MU #	Prioritised sites requiring control	Total Estimated Cost	Possibility for liaison with DOC	2008/09	2009/10	2010/11	2011/12	H	Follow up Scheduled	Additional Reasoning
Low Priority - Low Spread										
41	Peninsula Hill	4,000		-	-	-	-			
			TOTAL BUDGET 2008-2012							
TOTAL COST ESTIMATES \$		1,686,847	486,358	90,312	130,422	134,444	131,182			

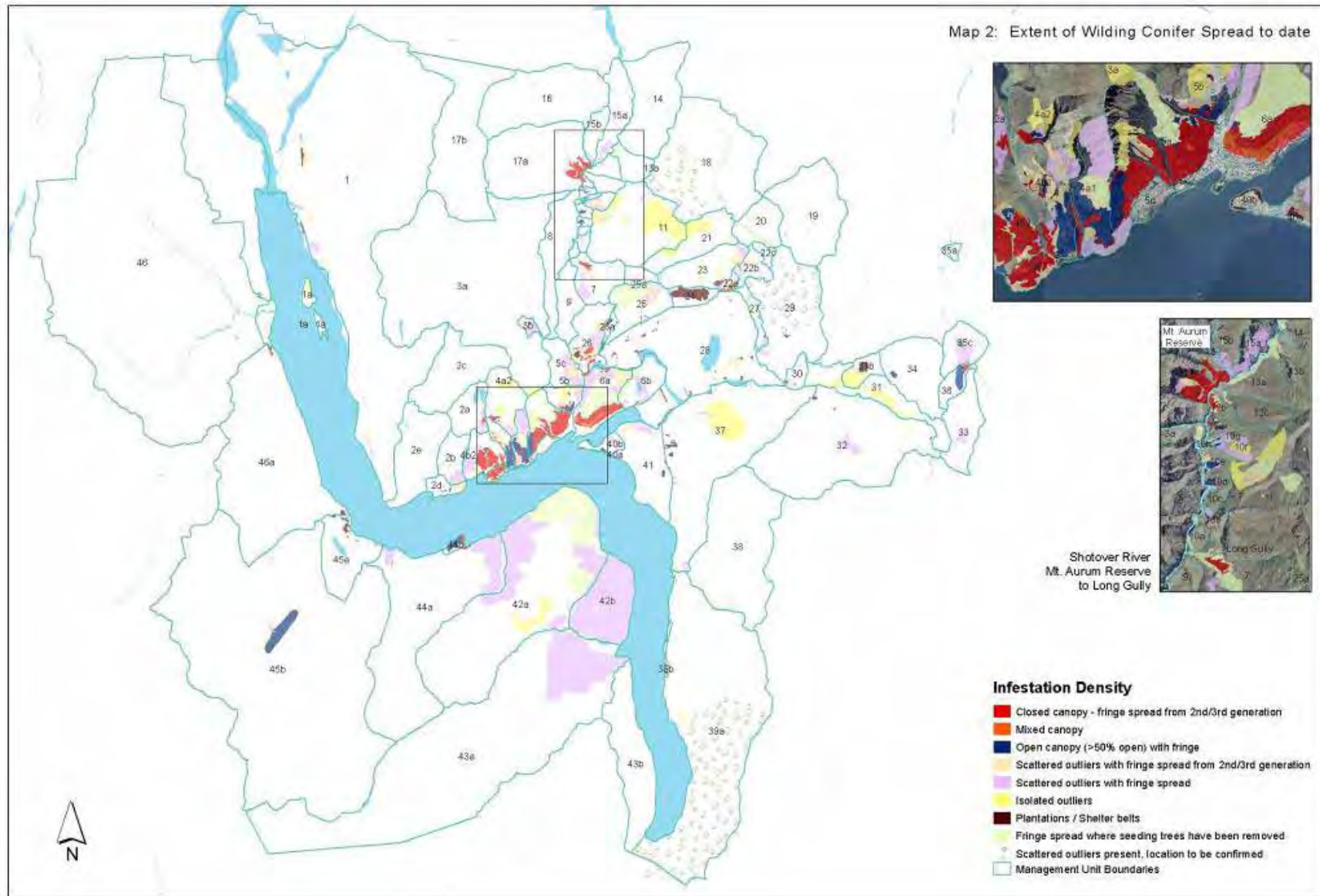
Table 4 Follow up Schedule

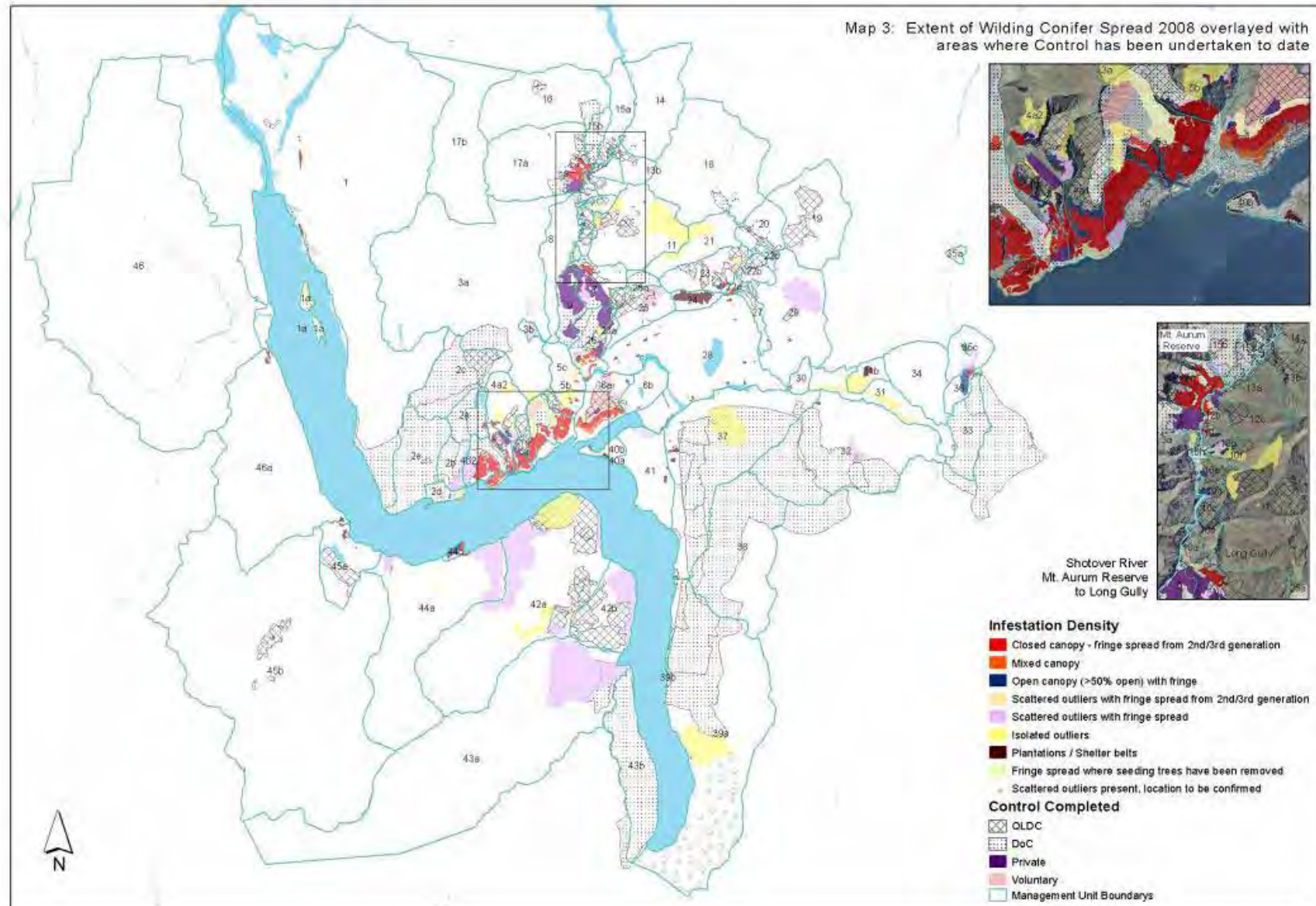
MU #	Management unit	last control date	last control by	Follow up date	Notes
1	Mt Alfred	2004?	DOC	2010	
1	Pigeon Island	2006-08	QLDC/WINR	2012	Volunteers
2a	Moke / Kirkpatrick Valley	2007	DOC/Stn	2013	
2b	Hanley Faces	2007 WIP	DOC/Stn	2012	Contorta
2c	W. branch Moke Stm/ Fan Creek	2005	QLDC	2010	Contorta?
4a1	Five-Mile Creek	2003-06	QLDC	2009	Start at the valley head and work down
4a2	Upper Bushy Creek	2005 WIP	QLDC	2011	Start at the valley head and work down
4b1	Wedge Peak	2005 WIP	QLDC	2011	
4b2	Home Hill	2007-08	DOC	2012	
5a	Ben Lomond	2001-08	EA	On-going	Voluntary
5a	Ben Lomond ridge	2006 WIP	QLDC	2012	
5b	Bowen Peak / Horn Creek	2006 WIP	QLDC	2012	
6a	Queenstown Hill	2005 WIP	QLDC	2011	Contorta. Well behind schedule
6b	Queenstown Hill - Marina Hts	2006	QLDC	2012	
7	Long Gully	2001 WIP	QLDC	2008	Some volunteer contribution
8	Lower Shotover – Stony Ck Tce	2003-05	QLDC	2009	
9	Lower Shotover – TL	Dec 2007	Stn	2018	Larch
10a	McCarrons Beach to Deep Ck	April 2003	QLDC	2008	
10b	Lower Deep Creek	April 2004	QLDC	2009	
10c	Stapletons Terrace	2004-05	QLDC/Private	2010	

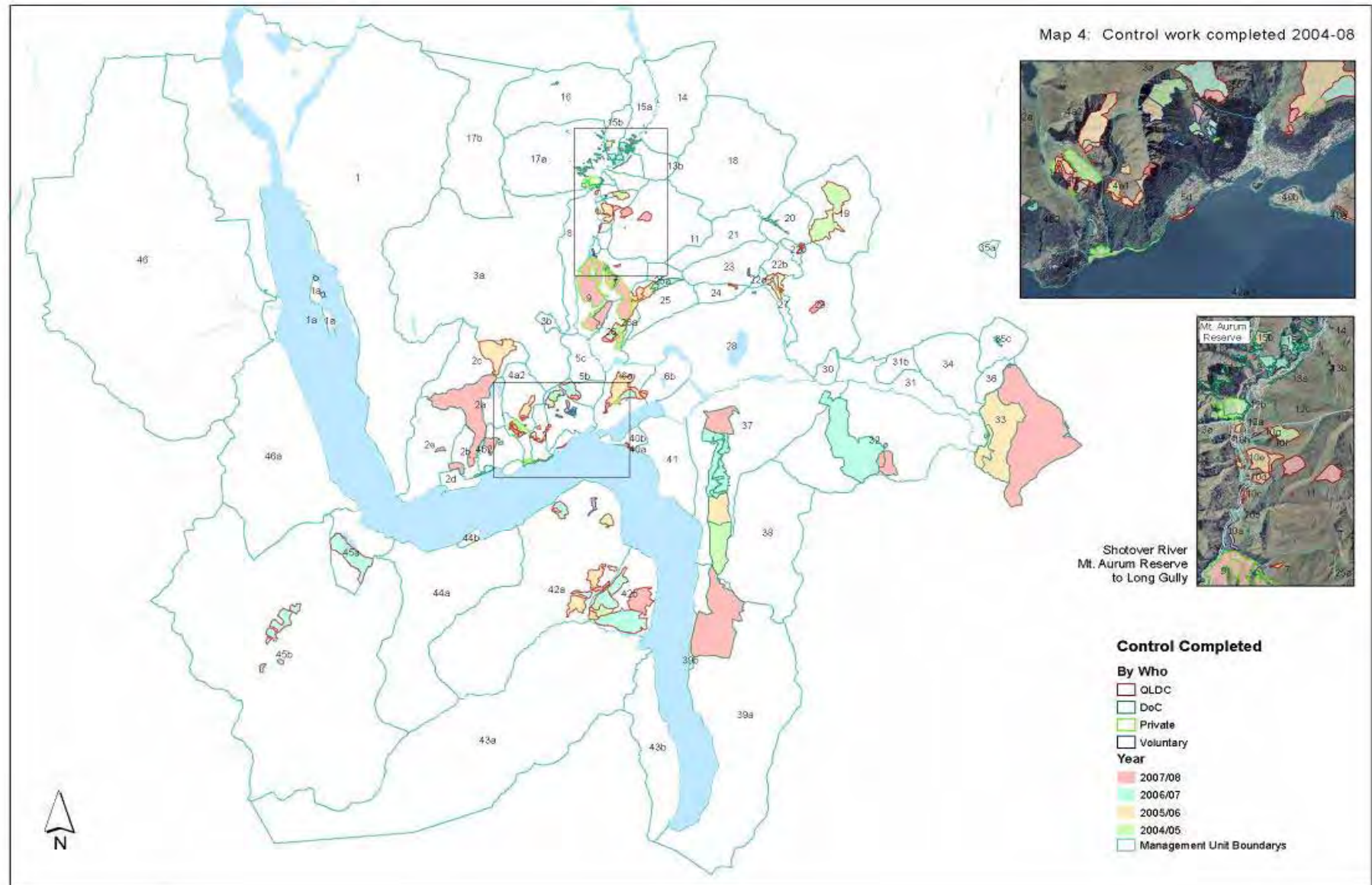
10d	Sainsburys Terrace	2004-05	QLDC	2010	Around Private Property
10e	Wire Rope Gully / Dredge Slip	Nov 2005	QLDC	2012	Larch
10f	Gooseberry Gully	2005	QLDC	2012	Larch
10g	Horse Gully	2005	QLDC	2012	Larch
10h	Shotover Maori Pt	2006?	DOC	2012	
11	Deep Creek / Maori Gully	May 2003	QLDC	2008	
12c	Cotters Ck	2003	QLDC	2010	
13	Smith's/ Shepherds Tces/ Deadmans Ck	2002-04	QLDC	2009	
14	Branches Rd	2008	QLDC	2015	
15	Nuggets	2006-08	DOC/QLDC	2013	
16	Bullendale	?	DOC	2010	
17a	Aurum- Pleasant Creek Tce	On-going	DOC/Pte	2010	Annual maintenance
17a	Aurum - Skippers	On-going	DOC	On-going	Constant maintenance over large area
18	Macetown / Upper Arrow	2007-08	DOC/QLDC	2013	
19	Soho Creek	2005	QLDC	2010	
20	Middle Arrow	2001-04	DOC/QLDC	2009	
22b	Arrow River	2001-04	QLDC	2009	
23	Bush Creek & Big Hill	2001-05	QLDC	2008	Contorta
23	Brow Peak	Nov 2003	QLDC	2008	Contorta

25	Coronet Slopes - below fence	2001-02	QLDC	2008	Contorta - overdue, station unco-operative
25	Coronet Slopes - above fence	2007	DOC	2012	Contorta
25a	Coronet Slopes - Ski Huts	2007-08	SAR	Annual	Contorta
25b	Dirty Four Creek- Mahers Camp	Jan 2006	QLDC	2011	Contorta
26a	Mt Dewar - Coronet Pk road	2006	QLDC	2011	Contorta
26b	Mt Dewar	2005 WIP	QLDC/Stn	2010	Contorta
29	Crown Terrace	Feb 2008	QLDC	2013	
31b	Kawarau TL - Muddy Creek	?	DOC	2009	Contorta
32	Mt Rosa	2007-08	DOC	2015	
33	Kawarau TR	2007-08	DOC	2015	
34	Gentle Annie	?	DOC	2015	
35	Mid Roaring Meg	?	DOC	2012	Contorta
37	Remarkables	2004 WIP	DOC	2013	Contorta
38	Wye Ck	2006-07	DOC	2013	
39a	Hectors - upslope wildings	2006 WIP	DOC	2013	Contorta?
40a	Lakeside Reserve	May 2005	QLDC	2008	
40b	Jardine Park	July 2005	QLDC	2010	Already completed Sept 2008
42a	Cecil Peak	1999-2007	QLDC	2008	More frequent re-invasions
42b	Bayonet Peaks	2005 WIP	QLDC	2012	
43a	Eyre Mts - S of Lochy	?	DOC	2018	
43b	Kingston Faces	?	DOC	2009	
45a	Lakeside Faces	Sept 2006	QLDC	2016	
45b	Von Valley - Pasture Hill	2006 WIP	QLDC/Stn	2011	Contorta

Note: this table provides an indication of the sites at which control has been undertaken, and follow up is required. Each area requiring follow-up in the next 4 years is included in Table 3. Control at sites administered by the Department of Conservation will be undertaken subject to the availability of funding.







APPENDIX 1

Photographs

Figure 1: History of Wildings



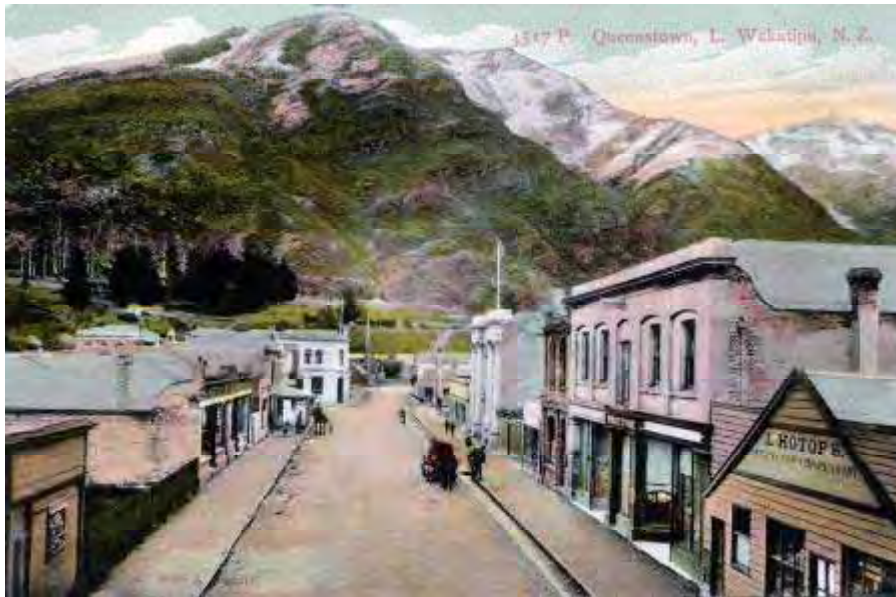
Rees Street during the flood of 1878

Note treeless backdrops

Trampers near Ben Lomond saddle around 1900



Figure 2: History of Wildings



Around 1900

Bob's Peak from Rees Street



Figure 3: History of Wildings



Launching of SS Earnslaw, 1912
Ben Lomond Ridge
from Queenstown Bay

2008

Note: Beech remnants



Figure 4: History of Wildings

Douglas fir did not start
spreading until 1970's



1950's

Ben Lomond Ridge
from Hallenstein Street

2008



Figure 5: History of Wildings



1984

Ben Lomond Ridge
from Botanical Gardens

2008



Douglas fir spreading
significantly by 1980's

Figure 6: Values

- 
- Eco-Logical - biodiversity, native eco-systems & wilderness
 - Farming - grazing, etc.
 - Aesthetic - visual, variety, geology
 - Recreational - walking, running, cycling, etc.

Figure 7: Need for a strategy



Wilding spread into pristinewilderness

Bowen Peak - Upper Horn (Bush) Creek with Queenstown Hill centre background

Figure 8: What might happen without a strategy?

Long history of zero recognition and hence zero wilding control



1980s

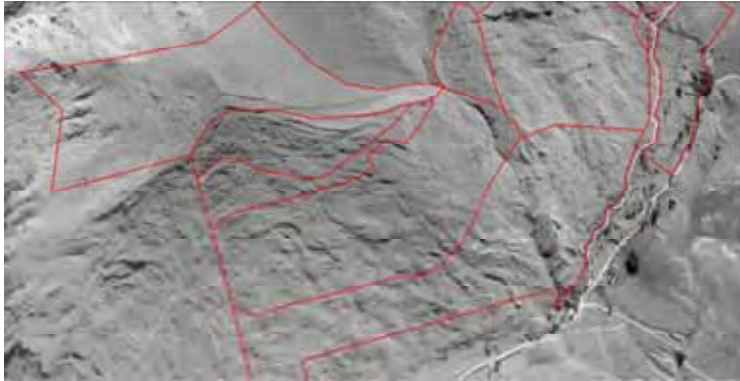


2004

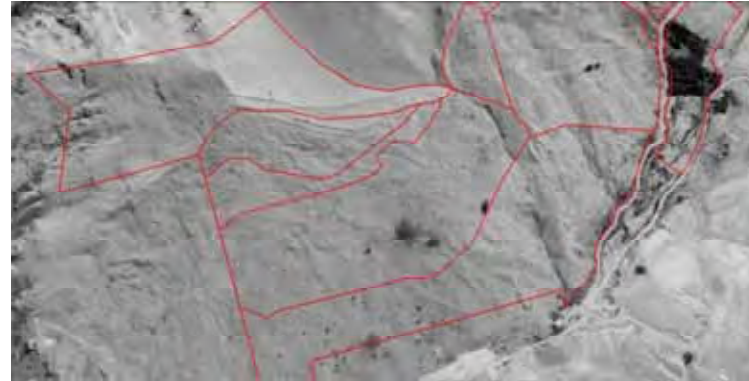
Bowen Peak from Bob's Peak

Nick Ledgard

Figure 9: What might happen without a strategy?

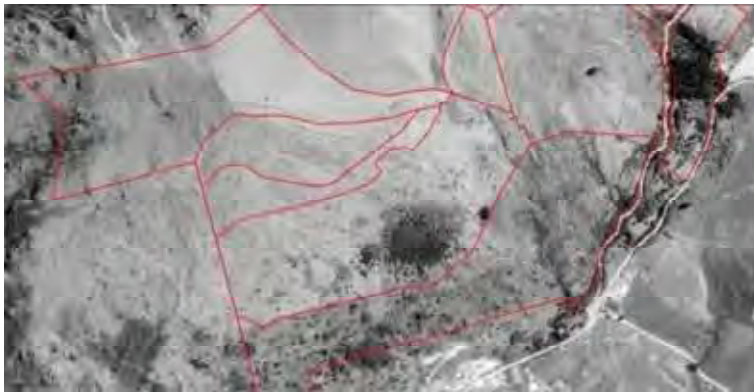


1954



1976

Mt. Dewar Station: larch outliers developing into closed canopy



1988



2004

Figure 10: Objectives of strategy

To:

- Clarify wilding control responsibilities and priorities
- Determine most cost-effective control option and costs
- Improve education and awareness of wilding issues

Figure 11: Wilding Control (2004-2008)



Cecil Peak Station, 2006

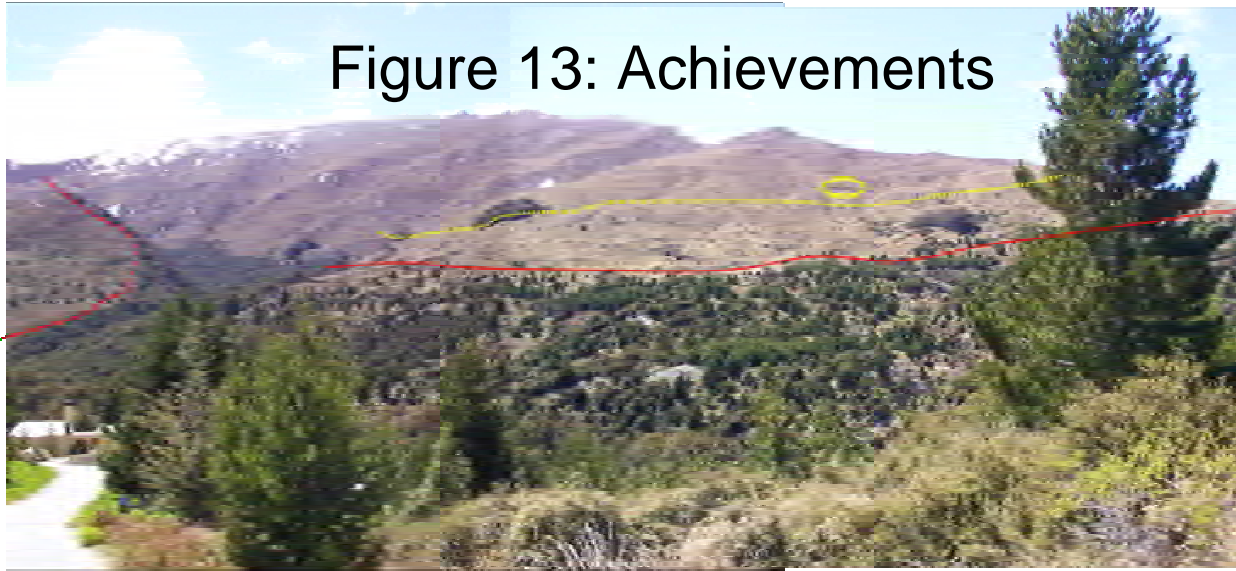


Figure 12: Achievements



Wedge Peak, 2007

Figure 13: Achievements



2003

Five-Mile Creek from Alpine Retreat



2008



Figure 14A: Management Unit 4, Wilson Bay, after fire Dec 2005 (compare with Figure 1A, 2004 Strategy)

Figure 14B: Co-operation: Closeburn Station cleared lower wilding spread with a digger whilst QLDC cleared the upper area by hand



Figure 15: Achievements



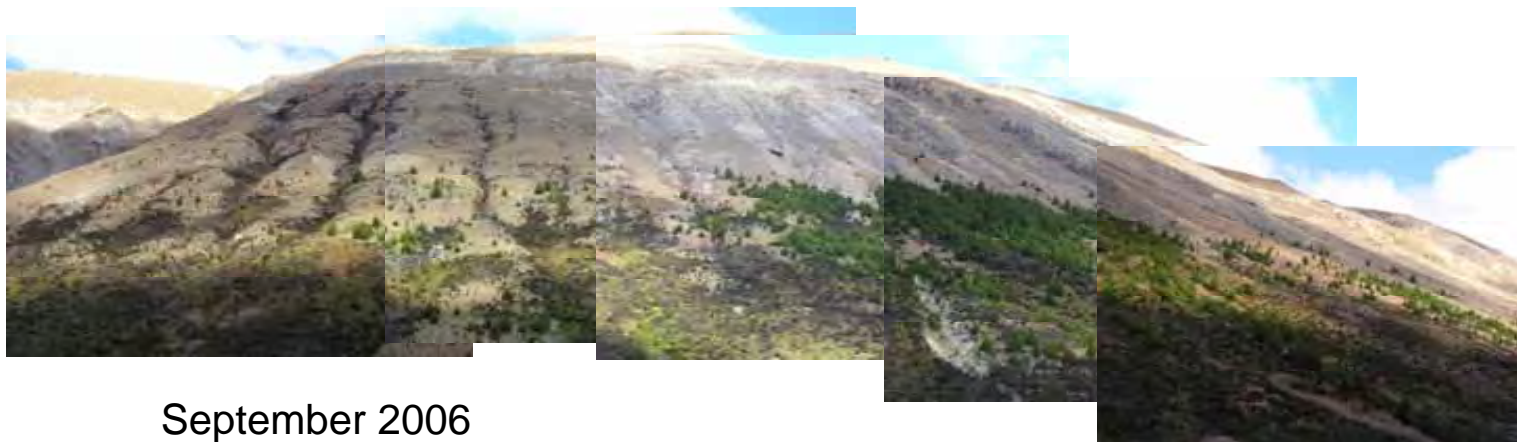
2003

Kowarau Gorge (Department of Conservation)



2007

Figure 16: Achievements



September 2006



December 2006

Pasture Hill, Von Valley, Mt. Nicholas Station

Figure 17: 2008-2012 Strategy



Bayonet Peaks, Cecil Peak Station, 2006

Figure 18: Clearing Re-generation



Queenstown Hill, work-in-progress, May 2006

Figure 19: 2008-2012 Strategy:
1. Re-Visits



Queenstown Hill Š Contorta re-generation
This patch cleared 7 years after lone tree removed in 1999

Figure 20: 2008-2012 Strategy:
2. Fringe Spread Spraying



Queenstown Hill, May 2006

Figure 21: 2008-2012 Strategy:
3. Contorta



Coronet Slopes, January 2006

Figure 22: 2008-2012 Strategy:
4. Continuation of 2004 Strategy



Horse & Gooseberry Gullies, Shotover River after first control
operation, 2005



Lakeside Reserve and Jardine Park, Kelvin Heights Peninsular, 2008

Figure 24: Examples of Contorta scattered outliers



A & B: with 2nd and 3rd generation seedlings



C: with 2nd generation fringe spread



D: Scattered outliers

(MacKenzie , South Canterbury)

APPENDIX 2

Common conifer identification (Nick Ledgard's) (using minimum number of distinctive features)

Common name	Latin name	Tree habit	Needles		Winter bud *		Cone		Comments
			Number / fascicle	L'th(mm) long >60 short <60	L'th(mm) long >10 short <10	Colour/ reflexed scales	Large > 70mm, small <70	Spike on scale	
Radiata pine	<i>Pinus radiata</i>	erect	3	long	long	brown	large	no	Persistent branch cones
Ponderosa pine	<i>Pinus ponderosa</i>	"	3	long	long	whitish	large	yes	Cones shed annually
Corsican pine	<i>Pinus nigra</i>	"	2	long	long	white/whitish	small	no	Cones shed annually
Muricata pine	<i>Pinus muricata</i>	"	2	long	long	brown	large	long spike	Persistent branch cones, v prickly
Maritime pine	<i>Pinus pinaster</i>	"	2	long	long	brown, scales reflexed	large	broad spike	Stout needles, persistent branch cones
Lodgepole pine	<i>Pinus contorta</i>	"	2	short	long	brown (often resinous)	small	v. fine spike	Cone often persistent on branches. Best diagnostic feature – scale spike.
Scots pine	<i>Pinus sylvestris</i>	"	2	short	short	brown, scales reflexed	small	no	Cones with short stalk, shed annually Silvery appearance to foliage
Mountain pine	<i>Pinus uncinata</i>	"	2	short	short/long	white (resin)	small	no	Cone scales can be very hooked
Dwarf mountain pine	<i>Pinus mugo</i>	many leaders	2	short	short/long	white (resin)	small	no	No stalk on cone (cf., Scots pine). 10 mm sheath at base of young needles.
Douglas-fir	<i>Pseudotsuga menziesii</i>	erect	1	short, in one plane	short	brown	small	no	Cone soft and hanging down, with obvious bracts longer than scales
European larch	<i>Larix decidua</i>	"	10+	short	short	NA	small	no	Deciduous. Cone soft, persistent

* Don't be too worried about the bud colour/ scale column. There is considerable variation in bud colour, amount of resin and degree of reflex of scales

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