

BEFORE THE CANTERBURY REGIONAL COUNCIL

IN THE MATTER OF: the Resource Management Act
1991

AND

IN THE MATTER OF: a submission on the Proposed
Canterbury Land and Water
Regional Plan

**EVIDENCE OF KEITH WILLIAM BRIDEN
FOR DIRECTOR-GENERAL OF CONSERVATION**

Dated 4 February 2013

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STATEMENT OF EVIDENCE OF KEITH WILLIAM BRIDEN

INTRODUCTION

- 1 My full name is **Keith William Briden**
- 2 I am a Technical Advisor at The Department of Conservation's National Office based in Christchurch. I have been the Department's key contact for invasive environmental weeds for 14 years.
- 3 I hold the following qualification which is relevant to this hearing: a Bachelor of Forestry Science (Canterbury).
- 4 I am a full member of the New Zealand Biosecurity Institute, the New Zealand Plant Protection Society, and the New Zealand Ecological Society.
- 5 I have provided a wide range of weed advice at national level for 14 years. This has included funding allocations for wetlands, aquatic ecosystems, and riparian vegetation, establishing a quality management system for weed control, development of weeds training material, and development of community involvement in weed work through the "Weedbusters" education and awareness programme.
- 6 I am therefore familiar with the management approaches for pest plant control related to wetlands, aquatic ecosystems, and riparian margins. I am also familiar with the management approaches in hill or high country and erosion-prone areas.
- 7 I am familiar with the proposed Canterbury Land and Water Regional Plan (pCLWRP) so far as it pertains to management of pest species.
- 8 I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in this evidence are within my area of expertise.

9 I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

10 My evidence will deal with the following:

- Discuss the Department of Conservation’s statutory duties to perform plant pest control;
- Provide an overview of the Department’s pest plant programme in New Zealand and in Canterbury in particular;
- Comment on the provisions of the Proposed Canterbury Land and Water Regional Plan that pertain to weed control and which arise in relation to Hearing Group 1.

THE DEPARTMENT OF CONSERVATION’S ROLE IN PEST PLANT MANAGEMENT

11 The Department of Conservation (“DOC”) is the leading central government agency responsible for the conservation of New Zealand's natural and historic heritage.

12 DOC has duties under several pieces of legislation to control pest plants on land that it manages (including lakebeds, riverbeds and riparian margins). It also has responsibilities to control pests on land which it does not manage but which it neighbours.

13 DOC’s primary legislative mandate for controlling pest plants is the Conservation Act 1987. Other key statutes, specifically the National Parks Act 1980 and Reserves Act 1977, also impose obligations upon DOC to manage pest plants.

- 14 DOC must also meet requirements for weed control under the Biosecurity Act 1993. Under this legislation Environment Canterbury has in place a Regional Pest Management Strategy (RPMS) 2011 – 2015. This strategy requires the control of a number of weed species that occur on DOC land, be they in aquatic, riparian or terrestrial locations (including those in erosion prone areas).
- 15 Recent amendments to the Biosecurity Act 1993 enable Environment Canterbury to prepare a Regional Pest Management Plan and Regional Pathway Management Plans which oblige Crown agencies to also perform weed control along boundaries with private landowners. Arrangements will also be made to undertake weed control actions on land not directly managed by DOC. This is known as the “good neighbour” principle.
- 16 The consequence is that DOC will have pest plant control duties which extend beyond its boundaries. In performing weed control on land **within** and **outside** its immediate control, DOC will need to comply with the rules contained in the pCLWRP. It therefore has an interest in the content of the rules, policies and objectives which touch upon pest plant management.
- 17 My role within DOC means that I have direct responsibility for working within those planning constraints.

DOC’S WEED MANAGEMENT PROGRAMMES

- 18 DOC manages around 8.5 million hectares of land which is almost one third of New Zealand’s land area. Accordingly, a wide range of freshwater wetlands, lakes, rivers and streams are covered by DOC. Likewise riparian margins, hill and high country and erosion-prone land are also within its statutory management functions.

- 19 DOC's Annual Report for the year ended 30 June 2011 shows that 475,439 hectares of land received treatment for weeds using a site-led approach.
- 20 In addition, the total area receiving weed control over a number of years, called "land under sustained weed control", is reported to be 1,748,522 hectares.
- 21 Furthermore, 114 weed control work plans were completed using a "weed-led" approach. A "weed-led" approach is used when a weed is new to New Zealand or a geographical area is at an early stage of invasion. Objectives of a "weed-led" project are usually eradication or containment.
- 22 DOC's total weed expenditure for the year ended 30 June 2011 was \$19,086,000.
- 23 DOC does not specifically track how much of this work is carried out in aquatic, estuarine, and riparian ecosystems, nor on erosion-prone land or on hill/high country which are the focus of this evidence. However, I can say that 21 of the 114 weed-led projects in New Zealand are directly related to aquatic, estuarine or riparian weed species. Furthermore, 21% of weed sites funded via DOC biodiversity strategy funding was directly related to weed work related to aquatic, wetland, estuarine, or, riparian sites in New Zealand. 40% of the national weed budget is spent controlling wilding conifers in the high country.

DOC's Pest Plant Programme in Canterbury

- 24 DOC carries out a wide range of plant pest control throughout Canterbury.
- 25 Examples of the main weeds controlled in riparian areas and in the beds or lakes and rivers in Canterbury are:
- Spartina in estuaries;
 - lupin on braided riverbeds and riparian areas;
 - grey and crack willows on riparian areas and within riverbeds or lakebeds; and
 - purple loosestrife on riparian areas.
- 26 Many other weed species which are controlled on terrestrial sites may also require control on the margins of rivers, lakes, wetlands and estuaries. The main weed species in this category are:
- wilding conifer;
 - cherry; and
 - heather.
- 27 Some weed species are controlled on hill and high country land (i.e. over 600m and exceeding a 25 degrees slope), and on erosion-prone land. The main control here is for wilding conifers.
- 28 In Appendix 1 I have included a list of significant pest plants that affect riparian areas, riverbeds, lakes and hill or high country in Canterbury. These species are also the ones that are likely to be affected by the rules contained in the pCLWRP.

Effective and practical methods for controlling pest plants

- 29 Some examples of recognised effective and practical weed control are listed in Appendix 2. I mention Appendix 2 at this point because it provides background for my comments below regarding the provisions of the pCLWRP.

COMMENTS ON THE PROVISIONS OF THE pCLWRP FROM A WEED MANAGEMENT PERSPECTIVE

- 30 I note that there are three policies in the pCLWRP which touch on pest plant management: Policy 4.21, Policy 4.22, and Policy 4.85. The first of these policies relates neatly to the topics covered by Hearing Group 1. However, Policies 4.21 and 4.22 are more naturally related to the “Pest Control and Agrichemical Discharges” topic which is dealt with at Hearing Group 2 as they largely pertain to the rules regarding application of herbicides and pesticides to water.
- 31 I have been asked to prepare evidence for Hearing Group 2 which will specifically address the issues under the “Pest Control and Agrichemical Discharges” topic. I will, at that hearing, comment more fully on the rules which reflect Policies 4.21 and 4.22. In the interim though I will make these general comments on them.

Policy 4.21

- 32 Policy 4.21 concerns the discharge of hazardous substances (in circumstances where they may enter water) to control a plant or animal pest or other unwanted organisms. It provides that discharges of this nature may only occur when: the substance is registered;

adverse effects are avoided as far as practicable; and good management practices are used.

“4.21 - The discharge of a hazardous substance to water, or onto or into land where it may enter water, to control a plant or animal pest or other unwanted organism only occurs:

(a) if the substance is registered under the Hazardous Substances and New Organisms Act 1996 for use against the target organism;

(b) if adverse effects on non-target organisms, Ngāi Tahu cultural values, or the use and consumption of water by humans or livestock are avoided as far as practicable; and

(c) where good management practices are used to minimise the risk of accidental discharge to water.”

This policy was supported by the Director-General for Conservation and, as a pest management expert; I too can see the logic in it. It is now the case that a number of herbicides and piscicides are approved by the Environmental Protection Authority for direct application in water. In fact, DOC already uses a number of these in its management regime (please refer to Appendix 2). In the future there will be more such substances likely to gain approval from the Environmental Protection Authority.

In order to be approved for use in water these substances have to undergo rigorous assessments under the Hazardous Substances and New Organisms Act 1996. Accordingly, it would be unnecessary for the pCLWRP to seek to add significant additional controls to the manner or location in which they may to be used.

- 33 Many of our aquatic weeds can infest a new waterway from a single fragment. If aquatic weeds do enter new water bodies or riparian areas there is a very short period of time to eradicate or contain a weed infestation. An effective control method is essential. In most cases an effective herbicide is required for immediate use. Methods that can be used for widespread aquatic weeds such as mechanical

control and digging are not often suitable for an eradication attempt as the risk of creating fragments only exacerbates the spread of the weed. Whereas, a translocating herbicide is able to penetrate all parts of the plant and ensuring 100% kill. For an eradication attempt 100% of all plants must be killed.

- 34 A recent successful eradication was carried out on hornwort from two localised infestations in the South Island. In this case *endothall* proved effective. Without an effective herbicide, this serious aquatic weed would have established and spread throughout many South Island waterways. A small quantity of an effective herbicide used early to eradicate a new weed can eliminate the need to use large quantities of herbicide later to manage the ongoing impacts of widespread weeds. The control of weeds in these situations needs to be enabled and delays in obtaining consents mean the weeds can spread. This creates additional costs and risks the weed spreading to the extent it can no longer be eradicated or contained.

Policy 4.22

- 35 Policy 4.22 deals with the use, storage or discharge of hazardous substances, requiring those activities to be undertaken using best practicable measures to avoid the discharge into water and spillage.

“4.22 Activities involving the use, storage or discharge of hazardous substances will be undertaken using best practicable measures to:
(a) as a first priority, avoid the discharge (including accidental spillage) of hazardous substances onto land or into water, including reticulated stormwater systems; and
(b) as a second priority, to ensure, where there is a residual risk of a discharge of hazardous substances including any accidental spillage, it is contained on-site and does not enter surface water bodies, groundwater or stormwater systems.”

36 Although this Policy is not directly relevant to plant pest management it does somewhat contradict the provisions of the previous policy. As a matter of clarification it should be clear that intentional use of herbicides or pesticides which do satisfy Policy 4.21 should be exempted from the requirements in 4.22(b) above regarding the prevention of them entering surface water

Policy 4.85

37 Regarding Policy 4.85 – The pCLWRP provides the following:

“Plant species listed in the Biosecurity NZ Unwanted Organisms Register or the Regional Pest Management Strategy are not introduced or planted in the beds or margins of lakes, rivers, hapua, coastal lakes, and lagoons, or wetlands.”

38 As I explained in previous sections of this evidence, DOC expends considerable effort and money attempting to control weeds in these locations. It is important that the deliberate introduction of any species listed in either of those registers is banned.

39 While I support the wording of the Policy, I do wish to add two notes of caution:

- First, not all species listed in the NZ Register are also listed in the Regional Pest Management Strategy. Crack willow, for instance, only appears on the NZ Register but not in the RPMS. However, I support the notion that irrespective of which register the weed is mentioned in it should not be introduced to Canterbury’s freshwater bodies.
- Second, in my experience it is possible, and even common-place, for organizations to apply for exemptions under the Biosecurity Act 1993 to plant species of weeds noted in the

Register. This has been a regular practice where flood control works are concerned and has allowed the use of pests like crack and grey willow to be deliberately introduced in Canterbury rivers. These particular species are very difficult to control and I support the policy as worded because it would preclude the introduction of those species even if an exemption is obtained.

Rule 5.143 (Vegetation in Lake and Riverbeds)

- 40 This rule raises two issues from a pest management point of view. The first is that it gives effect to Policy 4.85 by essentially banning (or “prohibiting”) the introduction of pest plants to lakebeds and riverbeds if those species happen to be mentioned in either the NZ Register of Unwanted Organisms or the Regional Pest Management Strategy. The comments I made above regarding Policy 4.85 are therefore relevant here.
- 41 The rule (5.143(3)) also provides that: “No woody vegetation is disposed of in, on over or under the bed of a lake or river.” I was unable to locate a definition of “disposal” in the plan. In the absence of such a definition it is possible that *in situ* death of weeds could qualify as “disposal”.
- 42 In my experience it is normal practice to kill a variety of water-based weeds and allow them to breakdown *in situ*. Even large weed species, such as willow, are commonly left to die *in situ*. In fact, for the following reasons, it is actually considered to be good pest management practice to do so.

- It is impractical to remove large quantities of vegetation especially from remote sites;
- Removal of vegetation is expensive to carry out on a large scale. Weed control budgets are fixed funds. Money spent removing the weeds would mean that other important weed work would simply not be carried out.
- Disturbance of soil around pest vegetation is a major factor contributing to the spread of some weeds. Requiring that vegetation be removed rather than being allowed to die *in situ* may actually aggravate the problem.
- Removal of weeds creates weed fragments. This is particularly concerning in riparian and aquatic ecosystems where fragments can be carried downstream and one small fragment can create new weed infestations. Hand weeding or mechanical weed removal can be used for small patches of weeds before they become widespread but extreme care must be taken to remove all weed fragments.
- It can be dangerous from a health and safety perspective to require weeds to be removed from lakebeds and riverbeds.

43 I appreciate that there is a difference between, allowing a poisoned weed (like a willow) to die where it grew and, dumping woody weed waste from elsewhere into a lakebed or riverbed.

44 My interest here is in making sure that *in situ* death of poisoned weeds is not treated as “disposal” in terms of this rule. If it was then the implications for weed management programmes, like DOC’s, could be profound.

Rules 5.147 – 5.149 Earthworks and Vegetation Clearance in Erosion-Prone Areas

45 Rule 5.147 (1) is concerned with vegetation clearance in riparian areas. I have noted the submissions made by the Director-General in relation to this rule which I will comment on in turn.

Limits on the scale of removal

46 DOC wishes to be able to remove an unlimited number of pest plants from riparian areas. It therefore supported the rule in so far as the rule allowed pest plant spraying to occur without the need to comply with the requirement that no more than 10% of an area be cleared at any one time. As I reiterate below, it is usual practice in conifer control for instance, to remove 100% of the weeds from an area. Failing to do so simply continues the infestation.

47 If only 10 % of conifers, for instance, could be removed this would exclude aerial herbicide application meaning physical thinning of conifers would be necessary. Manual control costs would be approximately 5-10 times the cost of herbicide application. Aerial application results in dead standing trees.

Limit on the method of removal

48 However, there are many species of weed in these riparian areas that it is better (from a weed management perspective) for us to **mechanically** remove rather than simply spray.

49 For instance, we often mechanically remove weeds near waterbodies as a means of defining the boundary for subsequent aerial spraying. In other situations we prefer to mechanically remove the weeds to prevent the discharge of herbicide into surface water.

50 In my expert opinion it is important that mechanical removal of woody weeds, in particular wilding conifers, be enabled in these riparian areas and not just spraying.

Limits on removing on land over 900m

51 The Director-General expressed the view that Rule 5.147(2) was too restrictive in so far as it effectively precluded the clearance of weeds on land over 900m.

52 Wilding conifer control is regularly carried out on land over 900m above sea level. What is more, it is normal practice to remove 100% of wilding conifers. Failing to do so will leave a seed source and a perpetual wilding conifer problem. Wilding conifers are listed in the Canterbury Regional Pest Management Strategy. Rule 8.13.6 of the Strategy requires landowners to prevent spread of wilding conifers. It would be difficult to comply with this rule and rule 5.147(2) of the pCLWRP.

The requirement to revegetate

53 In steep erosion-prone areas bare ground or scree is often the natural state of the land and removal of pines back to bare ground or scree is restoration. One of the historical reasons for planting wilding conifers was for erosion control. However, later research found that in most instances erosion was a natural process and bare areas and scree slopes are natural ecosystems.

54 With dead standing pines (i.e. conifers), following herbicide application, it is usual for introduced grasses to establish and there is some increasing evidence that native vegetation can also establish

beneath them. (In some instances trees are ground sprayed or mechanically cut for the purpose of avoiding spraying herbicide directly into water.) In some instances the conifers were planted or aurally seeded for erosion control.

- 55 Control of weeds, including wilding conifers, should be enabled on land above and below 900m. In my view there should be no limits placed on how much weed control can occur in these riparian areas either. In many cases 100% eradication will be necessary so limiting the size of the area that can be cleared at any one time (whether by mechanical or spraying means) would be counter-productive.

Rules 5.150-5.154 – (Vegetation Clearance and Earthworks in Erosion-Prone Areas)

- 56 Rule 5.150 essentially enables unlimited spraying (including of pest plants) on land with a slope less than 15 degrees. However, on land with a steeper gradient than 15 degrees the area capable of being sprayed at any one time is limited to 200m².

Limits on the area that can be sprayed i.e. 200m²

- 57 As I noted in relation to Rules 5.147 (2) it is important that wilding conifer removal, in particular, is allowed to occur on steep (over 15 degrees) and less steep areas (under 15 degrees) without limits being placed on the total area that can be sprayed. It would be almost impossible to undertake a wilding conifer removal programme in a particular area if we had to ascertain which parts of the area we are treating are above or below the 15 degrees threshold. The most important thing to achieve is 100% eradication whatever the nature of the slope.

58 For this reason I can see sense in the Director-General’s request that the limits on spraying not apply to plant pests listed in the NZ Register of Unwanted Organisms or tin the Canterbury Regional Pest Management Strategy nor to “woody weeds”.

59 It should be noted that DOC supported other submitters (LINZ and Federated Farmers) who sought to enable removal of pest plants from erosion –prone areas so long as the species were:

- listed in the in the NZ Register of Unwanted Organisms; or
- listed in the Canterbury Regional Pest Management Strategy; or
- were a “woody weed”.

60 The reason for this is because some species of conifers, which are woody weeds, are not listed in either of these documents. Larch is one example. Other examples include sycamore, cherry and hawthorn. This is largely because listing them would impose obligations on parties to control them and that would have ramifications for the forestry sector which deliberately plants conifers. The fact that they are not listed on either the Register nor in the Strategy does not mean they do not require controlling.

61 There is a partnership between DOC, Environment Canterbury, Federated Farmers, and Land Information New Zealand to coordinate wilding conifer control programs.

Requirement to revegetate

62 I am also aware that DOC has supported other submitters who raised the point that revegetation of areas cleared of pests in erosion-prone land is not always appropriate.

- 63 For reasons mentioned earlier it is not appropriate to revegetate in some locations: bare areas and scree slopes are natural ecosystems. What is more, the costs associated with revegetating areas where conifers have been removed is prohibitive (around \$15,000/ha)¹.
- 64 In any event, sprayed conifers left to die *in situ* are likely to revegetate naturally in exotic grasses. There is also evidence from Marlborough Sounds that native hardwoods can regenerate under dead standing pines or conifers. The same may apply in other locations.
- 65 Weed control budgets are limited. If revegetation is required there will be even less money available to carry out the control of species like wilding conifers.

CONCLUSIONS

- 66 Vast amounts of money and resources are expended by DOC and others to control pest plants in Canterbury.
- 67 Initiatives in the pCLWRP such as Policy 4.85 and Rule 5.143, which preclude the introduction of pest species to riparian areas, lakes and rivers are wise and worthy of support.
- 68 Policy 4.21 is also sensible in that it enables the application of herbicides and pesticides directly to water where those have been approved for use in that way.

¹ Douglas, B Dodd, M. and Power, L – New Zealand Journal of Ecology (2007) 31(2): 143-153.

69 Similarly, policies and rules which enable the removal of pest plants with a minimum of formality and cost are also justified and sensible. However, amendments to Rules 4.147 and 5.150 will be needed if that aim is to be achieved.

A handwritten signature in blue ink, appearing to read "Keith Briden".

Keith William Briden

4 February 2013

APPENDIX 1

Description of some of the Main Pest Plan Species Affecting Canterbury's Riparian areas, Riverbeds, lakebeds and Erosion-prone land.

Purple Loosestrife - riparian

Purple loosestrife is a weed that is controlled by DOC that invades riparian strips and lake margins. The native range of this species is Eurasia; throughout Great Britain, and across central and southern Europe to central Russia, Japan, Manchuria China, Southeast Asia and northern India.

Purple Loosestrife is rated in the top 100 alien invasive species worldwide. (Global Invasive Species Database, IUCN).

Legal status in New Zealand under the Biosecurity Act 1993 is: Unwanted Organism.

Where it has invaded other countries such as Canada and the USA it has become a serious environmental weed. It is one of the worst agricultural and environmental weeds in North America, invading large areas and displacing other plants. This plant rapidly invades damp ground, wetlands and shallow water. It overtops native species with dense bushy growth, is long-lived and produces millions of long lived highly viable seeds from an early age. It tolerates hot or cold conditions and low to high nutrient levels in the water, but is intolerant of salt water.

Fortunately there are very few places in New Zealand so far where purple loosestrife is growing in the wild. However, if no action is taken, this species may spread out of control. Seeds are dispersed by water, but may also be spread by wind and birds and on machinery. Because it has so many seeds, once established, purple loosestrife can quickly form a dense stand that excludes most other vegetation. A single plant can produce over a million seeds a year.



Image of purple loosestrife infestation in Minnesota USA *Courtesy of spinner.cofc.org*

The Department of Conservation (DOC), Ngai Tahu, Environment Canterbury and the Christchurch City Council are working together to try to eradicate purple loosestrife from Canterbury. Purple loosestrife thrives in damp places, particularly river or lake margins, and can clog drains and irrigation ditches. It also crowds out native plants, and changes habitat for wetland birds and fish.

Spartina – Estuarine

(*Spartina anglica* *S. alterniflora* and *S. x townsendii*).

S. alterniflorais is native of eastern North America. Other species of hybrid origin are from England. *S.anglica* is the most common spartina species in NZ and is naturalised from Nth Auckland to Invercargill and Stewart Island. Spartina was introduced to many countries for the purpose of estuarine reclamation. It has become weedy in many countries including the western seaboard of the USA, the Mediterranean, Australia and New Zealand.

Spartina is rated in the top 100 alien invasive species worldwide. (Global Invasive Species Database, IUCN)

Legal status in New Zealand under the Biosecurity Act is: Unwanted Organism.

In New Zealand there is no equivalent native grass species that establishes on extensive intertidal estuary zones. If uncontrolled, spartina can form dense stands completely replacing bare mud flats used by wading birds and flounders. Once spartina is established as the dominant vegetation it traps sediments, altering water courses and can eventually replace estuaries with grassland. In the

Bay of Plenty farmers have fenced areas and have introduced cattle to graze the spartina. Increased sedimentation in the New River Estuary near Invercargill was cited as a contributing cause if the Invercargill flooding event that occurred in 1988. The spartina infestation was in the order of 800 hectares at that time. Spartina infestation can completely eliminate wading bird habitat, whitebait fisheries, eel habitat, and flounder habitat. It affects recreational activities such as bird watching, kayaking white baiting and floundering, and, kai moana gathering by Iwi. In Canterbury spartina infestations have been largely removed and control is now at a scale of individual plants to small clumps.

Image. New River Estuary spartina infestation near Invercargill



Entire Marshwort – riverbeds/lakebeds

Entire marshwort is a perennial aquatic plant with roots in the bed of the water body and leaves that float on the surface. If uncontrolled it has the potential to choke waterways, deoxygenate the water, kill aquatic life and prevent recreational use.

African Feathergrass -

African feathergrass prefers moist locations and seed can be distributed via water. If uncontrolled the plant is very persistent and will form dense stands that will exclude all other plants.

Lagarosiphon – Lakebeds and Riverbeds

Lagarosiphon is an aquatic oxygen weed. It is a bottom rooted perennial, which can form mono-specific growths up to 5m tall and reach the surface. If uncontrolled it replaces native macrophytes and affects recreational use of rivers and lakes.

Egeria

Egeria is a submerged, bottom-rooted perennial, which can form mono-specific growths up to five metres tall upon reaching the water surface. It propagates through stem fragments being carried on water currents, boats, aquarium and pond escapes and deliberate planting. Egeria is abundant in the water bodies of the Waikato Region and is scattered throughout other water bodies in the North Island, with infestations recorded in Marlborough and Canterbury. The only known infestation still in existence in Canterbury is in the Kerrs Reach part of the Avon River in Christchurch. Two occurrences of this plant were found in 1999, one in a garden pond and the other in a pet shop fish tank. The plants were destroyed. If uncontrolled, egeria is a potential threat to the aquatic environment because it forms dense, mono-specific colonies. These, by definition, exclude other parts of the aquatic ecosystem, and it further slows water and wave movement and causes local deoxygenation. While most slow moving water ecosystems are already heavily modified in New Zealand, it still represents a threat to the remaining biodiversity in these ecosystems. Egeria has the potential to clog waterways. Additional control costs will occur where the water carrying capacity of waterways needs to be maintained. The Christchurch City Council already operates weed cutters in the major waterways where egeria is an immediate threat, and estimates that its costs in respect of weed clearance will double if nothing were done to remove the weed. Egeria changes the visual amenity of slow moving water locations particularly when the weed reaches the surface of the water. Rotting weed thrown up on the shore can reduce the amenity values associated with those locations, and the build up of weed within the water body can limit the recreational opportunities available.

Wilding conifers

The description “wilding conifers” encompasses 25 species of wilding conifers present in Canterbury. Contorta pine, Corsican pine, Douglas fir, radiata pine, larch, Scots pine and mountain pine are the most common and widespread.

If uncontrolled wilding conifers replace native ecosystems, replace farmland and impact on landscape values and ecosystem services such as water yield. Some species of mountain pine are capable of seeding and establishing at altitudes over 2,000m. Few wilding conifer species are unwanted organisms. Species such as Douglas fir cannot be an unwanted organism because this species is both a valuable timber species and a wilding conifer. The Canterbury Regional Pest Management Strategy 2011- 2015 loosely encompasses all wilding conifer species as “introduced conifer species that are self sown or growing wild”

however only 3 are specifically mentioned. Other species of woody weed, like sycamore, cherry and hawthorn, are not mentioned at all

Carex – wetlands and riparian areas

Carex is a tall, exotic, shade tolerant, perennial sedge which grows in damp areas. It is the tallest growing sedge in New Zealand with stems up to 2.5m long. If uncontrolled carex will invade riparian margins and wetlands.

Puna Grass – riparian areas and grasslands

Puna grass is a tall tussock-like grass that grows up to 1m tall. If uncontrolled it will invade riparian margins and grasslands. Its distribution in Canterbury is limited but has the potential to be as bad a weed species as nassella tussock.

Russell Lupin - riverbeds

Russell lupin is a perennial that can grow up to 1.5m tall. If uncontrolled Russell lupin can invade Canterbury's braided riverbeds. This can impact on threatened native birds such as black stilt and wrybills.

APPENDIX 2

Willow control

Willows are normally controlled by drilling holes and applying herbicide. In recent years new herbicide formulations has meant aerial herbicide applications of willows has enabled large infestations to be controlled cost-effectively. In most instances dead willows are left to break down. At important sites such as high use recreation areas willows can be cut and removed or windrowed and burnt. All fragments of crack willow must be removed or new infestations will occur via fragments that have taken root. Both grey willow and crack willow are unwanted organisms

Wilding conifers

The main methods for wilding conifer control are felling, application of herbicide to the stem (basal bark application) and aerial herbicide application. Occasionally, larger stems are removed for timber production. This can cause site disturbance and thick reinfestation of wilding conifers. Research in the Marlborough Sounds on *Pinus Radiata*. shows that when mature wildings are felled light wells result in further wilding conifer seedlings. When trees are killed standing, by drilling stems and applying herbicide, low light and shelter results in native plant regeneration (provided deer and goats are also controlled) and no germination of wilding conifers. There is increasing recognition of the advantages of killing wilding conifers standing without disturbance associated with felling.

Spartina control

Manual control of spartina is limited to small patches less than 2 square metres. After this it becomes impractical and there is high risk of fragments being carried by tidal movements. Haloxyfop is an effective herbicide which can kill 99% of plants and has recently been approved for use by the Environmental Protection Agency. Spartina has been controlled at a number of sites with success in killing the infestations and the restoration of habitats. This was achieved when weeds broke down in situ. Spartina forms deep roots which can become active after disturbance. A recent Christchurch example is an increased abundance of spartina at McCormack's Bay following the Christchurch's earthquakes and liquefaction events. Physical or mechanical removal of spartina from fragile estuarine ecosystems is also likely to cause considerable environmental damage.

Other riparian weeds

A number of riparian weeds are controlled along fragile river and lake margins. Herbicide application results in minimal disturbance and effective kills. Removal of weed material would result in environmental damage to sensitive sites.

Aquatic weeds

Herbicide application is an effective way of controlling aquatic weeds. Weed beds are left to breakdown. Controls can be carried out if too much dead material would cause unacceptable adverse effects. The recent EPA decision on the use of a number of herbicides into or onto water places conditions places a number of conditions on herbicide applications. (see report on EPA website Application for the modified reassessment of aquatic herbicides APP201365).