

**IN THE ENVIRONMENT COURT  
AT CHRISTCHURCH**

**UNDER** The Resource Management Act 1991

**IN THE MATTER OF** appeals under clause 14(1) of the First Schedule to the Act

**BETWEEN**

**FEDERATED FARMERS OF NEW ZEALAND  
(INCORPORATED) MACKENZIE BRANCH**  
ENV-CHC-2009-000193

**HIGH COUNTY ROSEHIP ORCHARDS LIMITED AND  
MACKENZIE LIFESTYLE LIMITED**  
ENV-CHC-2009-000175

**MOUNT GERALD STATION LIMITED**  
ENV-CHC-2009-000181

**MACKENZIE PROPERTIES LIMITED**  
ENV-CHC-2009-000183

**MERIDIAN ENERGY LIMITED AND GENESIS ENERGY  
LIMITED**  
ENV-CHC-2009-000184

**THE WOLDS STATION LIMITED**  
ENV-CHC-2009-000187

**FOUNTAINBLUE LIMITED & OTHERS**  
ENV-CHC-2009-000190

**R, R AND S PRESTON AND RHOBOROUGH DOWNS  
LIMITED**  
ENV-CHC-2009-000191

**HALDON STATION**  
ENV-2009-CHC-000192  
**Appellants**

**AND** **MACKENZIE DISTRICT COUNCIL**

**Respondent**

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**STATEMENT OF EVIDENCE IN CHIEF OF MICHAEL ARTHUR COUPLAND  
HARDING ON BEHALF OF MACKENZIE DISTRICT COUNCIL**

**DATED: 15 JULY 2016**

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## STATEMENT OF EVIDENCE IN CHIEF OF MICHAEL HARDING

### INTRODUCTION

1. My full name is Michael Arthur Coupland Harding. I am an Environmental Consultant based at Geraldine, South Canterbury. I hold a Diploma in Parks and Recreation Management (with Distinction) from Lincoln University (1986) and Intermediate papers in Botany and Geology from Otago University (1980). I have seven years' experience in national park management and conservation advocacy, and a further twenty-two years' experience as an independent ecologist.
2. My work as an independent ecologist has predominantly involved field survey of indigenous vegetation and habitat, assessments of ecological significance, assessments of priorities for protection of indigenous ecosystems, and provision of advice on management of indigenous ecosystems.
3. Consultancy experience that is of particular relevance is:
  - 3.1 administration of riverbed vegetation survey (at 739 sites) throughout the Mackenzie Basin (Project River Recovery contract, 2002/2003);
  - 3.2 survey of vegetation and/or collation of specialists' survey reports on 75 high country pastoral leases, including six Mackenzie Basin properties, for Pastoral Lease Tenure Review Programme (DOC contracts, 1994 to 2015);
  - 3.3 survey and trial application of Canterbury Regional Policy Statement ecological significance criteria for identification of Sites of Natural Significance (SONS), Balmoral Station, Mackenzie Basin (Mackenzie District Council contract, 2013);
  - 3.4 survey of vegetation at 14 consent application sites or vegetation clearance sites in Mackenzie Basin (84 hours of field survey), assessment of that vegetation against Mackenzie District Plan Vegetation Clearance Rules, and assessment of ecological significance of those sites (Mackenzie District Council contracts, December 2014 to June 2016); and

- 3.5 survey and assessment of significant natural areas (s6(c) RMA) at more than 800 sites in Timaru and Waitaki districts (Timaru District Council and Waitaki District Council contracts, 2005 to 2016).
4. I have been engaged by the Mackenzie District Council (**Council**) to provide evidence in relation to its post-consultation version of Plan Change 13 to the Mackenzie District Plan (PC13 (**s 293V**)).
5. I have read the code of conduct for expert witnesses contained in the Environment Court Practice Note 2014. I have complied with it in preparing this evidence and I agree to comply with it in presenting evidence at this hearing. The evidence that I give is within my area of expertise except where I state that my evidence is given in reliance on another person's evidence. I have considered all material facts that are known to me that might alter or detract from the opinions that I express in this evidence.
6. With respect to the Code of Conduct, I advise the Court that I have been engaged over the past three and a half years (and continue to be engaged) by Mackenzie District Council to provide ecological advice on Sites of Natural Significance and on vegetation clearance in the Mackenzie District.
7. In preparing this evidence I have been made aware of and viewed the following material:
- PC13 Section 293 Package (November 2015);
  - Submissions received by Council on the proposed amendments to PC13;
  - Amended (post consultation) PC13 Section 293 Package (May 2016);
  - Canterbury Regional Policy Statement;
  - Mackenzie District Plan; and
  - Plan Change 5 to the Canterbury Land and Water Regional Plan.

8. I use the following abbreviations and acronyms in my evidence:

8.1	Council	Mackenzie District Council
8.1.	DOC	Department of Conservation
8.2.	ED	Ecological District
8.3.	FBA	Farm Base Area
8.4.	GA	Scenic Grassland Area
8.5.	LENZ	Land Environment of New Zealand
8.6.	LINZ	Land Information New Zealand
8.7.	PC13	Mackenzie District Plan Change 13
8.8.	PNAP	Protected Natural Areas Programme
8.9.	RAP	Recommended Area for Protection
8.10.	RMA	Resource Management Act 1991
8.11.	SH	State Highway
8.12.	SIV	Significant Inherent Values

#### **SCOPE OF EVIDENCE**

9. In this evidence I provide an ecological overview of the Mackenzie Basin, provide additional ecological analysis of the part of the Mackenzie Basin south and east of SH8, describe activities that adversely affect indigenous vegetation and habitat in the Mackenzie Basin; provide an opinion on whether the area south and east of SH8 is suitable for development, discuss Farm Base Areas, provide an ecological perspective on Scenic Grassland Areas, discuss the intensification of land use in the Mackenzie Basin and the effects of that intensification on ecological values, provide comments on submissions received by Council on the amended PC13 provisions, and provide an opinion on whether Council's proposed amendments to PC13 will provide for the protection of ecological components of natural landscape character.

#### **ECOLOGICAL OVERVIEW OF MACKENZIE BASIN**

10. The physical components that give the Mackenzie Basin its distinct ecological character are the recent glacially-derived landforms and the harsh inter-montane climate. Its location east of the highest part of the main divide of the Southern Alps ensured that it was severely affected by the most recent (Otiran) glaciation and that its contemporary

landforms are young in geological terms. The basin floor landforms have been formed by glaciers (moraine), rivers flowing from glaciers (outwash terraces) or more recent river deposits. They lie between landforms carved by glaciers (steep valley sides and roches moutonnées).

11. Its location between the main divide and the foothill ranges (Two Thumb, Rollesby and Dalgety ranges and Grampian Mountains) gives the Mackenzie Basin an inter-montane climate with temperatures that are hot in summer and very cold in winter. The predominant westerly air flow causes frequent strong warm foehn winds and a marked rainfall gradient with high precipitation in the west and relatively low precipitation in the east. These conditions result in high soil moisture deficits (drought) on the eastern basin floor in summer, and hard frosts and frequent snow in winter.
12. The indigenous vegetation of the Mackenzie Basin owes its distinct character to its short period of colonisation (following glacial retreat), glacial and fluvio-glacial landforms and harsh climate. A defining character is the lack of forest. The forest that was present prior to human settlement was most likely restricted to wetter western parts of the basin (silver beech/*Lophozonia menziesii*) or lower valley sides at eastern parts of the basin (mountain totara/*Podocarpus laetus*). Early European settlers observed totara logs though not on the basin floor, which was dominated by “scrub and tussock” (Vance, 1980). Analysis of buried pollen and radiocarbon dates from soil charcoal and subfossil wood indicate that, prior to human settlement, semi-arid basins of the southeast South Island supported low-growing woody species but that the dry terraces of the inter-montane basins were dominated by tussock grasslands (McGlone, 2001).
13. Fires following early human settlement, then more frequent burning associated with European settlement, have hindered the establishment of woody vegetation. Instead, tussock grassland and other non-woody vegetation (herbfield/cushionfield/stonefield) persisted and may have since increased in extent. Years of pastoral use, the effects of introduced species (notably rabbits, hawkweed and conifers) and pastoral intensification (notably cultivation and irrigation) have altered and reduced the extent of indigenous vegetation in the Mackenzie

Basin. Despite these influences, large parts of the Mackenzie Basin still support indigenous vegetation, although much of that vegetation is modified or degraded.

14. Habitats of indigenous fauna have been similarly modified and depleted. Early European settlers observed moa bones exposed on the ground and large populations of other native birds (Vance, 1980). Quaternary fossil records indicate the presence of 62 species of birds in inland Otago basins (Worthy, 1998) and more than 60 species in the South Canterbury downlands (Worthy, 1997). Introduced predators, firstly kiore/Polynesian rat (*Rattus exulans*) and kuri/dog (*Canis familiaris*) (King, 1990), and then the numerous mammals introduced by European settlers, have dramatically depleted the diversity and abundance of indigenous fauna. Fifty-nine native breeding bird species are believed to have become recently extinct in New Zealand (Tennyson, 2010).
15. Construction of the Waitaki Hydro Scheme altered freshwater habitats in the Mackenzie Basin, raising the levels of lakes Tekapo and Pukaki, creating Lake Benmore and dewatering the Tekapo and Pukaki rivers. Removal of vegetative cover and modification of wetlands have further depleted habitats of indigenous fauna. Despite these influences, the Mackenzie Basin still provides important habitats for indigenous birds, lizards, fish and invertebrates.
16. Characteristic present-day indigenous terrestrial plant communities of lower-altitude parts of the Mackenzie Basin are:
  - 16.1. tussockland/shrubland/herbfield on moraine;
  - 16.2. short tussockland/herbfield/mossfield/lichenfield/stonefield on outwash terraces;
  - 16.3. shrubland/short tussockland/herbfield/cushionfield/stonefield on riverbeds;
  - 16.4. sedgeland/rushland on poorly drained moraine and terraces (wetlands);
  - 16.5. herbfield/mossfield/loamfield on beds and margins of lakes and tarns; and
  - 16.6. tussockland/shrubland on lower hill slopes.

Some of these plants communities are illustrated in the **appendix** to my evidence. Within these plant communities are a number of common naturalised (exotic) grasses and herbs, such as mouse-ear hawkweed (*Pilosella officinarum*), which in places form the dominant ground cover, especially at degraded sites. Also present are naturalised shrubs, notably sweet brier (*Rosa rubiginosa*), and infestations of wilding conifers.

17. These plant communities are part of the characteristic ecosystems of the Mackenzie Basin. Several of these terrestrial ecosystems are significant, as they were historically rare, i.e. with a total extent of less than 0.5% of New Zealand's total land area (Williams *et al*, 2007). The threatened status of these historically rare ecosystems has been assessed (Holdaway *et al*, 2012) as follows:

- inland sand dunes (critically endangered)
- outwash gravels (critically endangered)
- ephemeral wetlands (critically endangered)
- braided riverbeds (endangered)
- seepages and flushes (endangered)
- moraine (vulnerable)
- lake margins (vulnerable)

18. These ecosystems provide habitats for a distinctive suite of indigenous plant species. Earlier disturbance, the effects of plant and animal pests, and recent land-use change, mean that a substantial number of these species are 'at risk' of, or 'threatened' with, extinction. Notable threatened species, with their existing threat status (de Lange *et al*, 2012), are:

- |                                |                       |
|--------------------------------|-----------------------|
| • <i>Amphibromus fluitans</i>  | nationally vulnerable |
| • <i>Cardamine</i> "tarn"      | nationally critical   |
| • <i>Carmichaelia curta</i>    | nationally critical   |
| • <i>Ceratocephala pungens</i> | nationally critical   |
| • <i>Chenopodium detestans</i> | nationally critical   |

- *Crassula peduncularis* nationally critical
- *Isolepis basilaris* nationally vulnerable
- *Leonohebe cupressoides* nationally endangered
- *Lepidium sisymbrioides* nationally endangered
- *Lepidium solandri* nationally endangered
- *Leptinella conjuncta* nationally critical
- *Myosotis brevis* nationally vulnerable
- *Myosurus minimus* subsp. *novae-zelandiae* nationally endangered
- *Olearia fimbriata* nationally vulnerable
- *Pachycladon cheesemanii* nationally vulnerable
- *Pseudognaphalium ephemerum* nationally critical
- *Rytidosperma merum* nationally vulnerable
- *Sonchus novae-zelandiae* nationally vulnerable
- *Wurmbea novae-zelandiae* nationally endangered

19. Similarly, the ecosystems of the Mackenzie Basin provide habitat for a distinctive suite of indigenous animal species. Notable examples of bird species, with their existing threat status (Robertson *et al*, 2012), recorded in this area (Robertson *et al*, 2007) and lizard species, with their existing threat status (Hitchmough *et al*, 2012), are:

- Australasian bittern (*Botaurus poiciloptilus*) nationally endangered
- banded dotterel (*Charadrius bicinctus*) nationally vulnerable
- black-billed gull (*Larus bulleri*) nationally critical
- black-fronted tern (*Chlidonias albostrigata*) nationally endangered
- black stilt (*Himantopus novaezelandiae*) nationally critical
- grey duck (*Anas superciliosa*) nationally critical
- long-toed skink (*Oligosoma longipes*) nationally vulnerable



- Mackenzie Basin spotted skink nationally vulnerable (*Oligosoma* aff.)
  - scree skink (*Oligosoma waimatense*) nationally vulnerable
  - southern crested grebe (*Podiceps cristatus australis*) nationally vulnerable
  - wrybill (*Anarhynchus frontalis*) nationally vulnerable
20. In summary, the Mackenzie Basin is a recognisably different part of New Zealand, with its own distinct array of landforms, ecosystems, plant communities and habitats. These all contribute to the natural landscape character of the Mackenzie Basin.
21. Many areas of indigenous vegetation and habitats of indigenous fauna in the Mackenzie Basin are significant under section 6(c) RMA. Existing Sites of Natural Significance (SONS) are listed in Appendix 1 of the Mackenzie District Plan. Sixty-six lie in the Mackenzie Basin. These SONS were principally collated (in the mid-1990s) from other information sources, including: Recommended Areas for Protection (RAP) from the Protected Natural Areas Programme (PNAP); Special Sites of Wildlife Interest (SSWI); Wetlands of Ecological and Representative Importance (WERI); invertebrate habitat sites; and threatened plant sites. One site (SONS16) was recently re-surveyed (April 2016). Otherwise, these sites do not appear to have been formally surveyed or field-checked for more than twenty years.
22. I am familiar with a number of these Mackenzie Basin SONS. I am also familiar with the information sources from which they were selected, especially the PNAP. In my opinion, the existing Mackenzie Basin SONS are most likely inaccurate and inadequate for three main reasons. First, the criteria under which the sites were originally selected were not designed for assessing significance under Section 6(c) RMA. Second, the ecological values at some sites are likely to have been lost through the effects of plant and animal pests and land use over the past twenty years. And, third, many additional plant and animal species in the Mackenzie Basin have become threatened or at risk (or our understanding of rarity and threat has improved) over the past twenty years.

23. Some areas of former Crown Pastoral Lease land in the Mackenzie Basin have been retained by the Crown for protection over recent years through a tenure review programme. This programme has not protected all likely SONS on the reviewed land for four main reasons. First, the tenure review programme assesses the Significant Inherent Value (SIV) of sites under the Crown Pastoral Lands Act 1998, rather than significance of vegetation and habitats under the RMA. The Department of Conservation's SIV Guidelines differ from the RPS ecological criteria. Second, DOC can only provide recommendations for protection to the Crown agent, Land Information New Zealand (LINZ). LINZ, not DOC, determines the extent to which the Crown will negotiate to protect those recommended areas. Third, tenure review outcomes are negotiated settlements in which the outcomes sought by DOC may not be achieved. And, fourth, some early tenure review surveys did not adequately identify all values, or are now so dated that their recommendations are no longer adequate.
24. I have been involved in DOC's tenure review programme as an independent ecologist in a number of ways since the programme's inception in the 1990s. I have surveyed vegetation on pastoral lease properties, collated and edited specialists' reports on properties into Conservation Resources Reports, drafted recommendations for protection of SIVs, collated ecologists' views on DOC's SIV Guidelines and submitted those collated views to DOC, and re-surveyed values on existing and former pastoral leases. My conclusion is that the Crown's tenure review programme is not a substitute for Council's section 6(c) RMA assessments.
25. Accurate identification of SONS in the Mackenzie Basin is an urgent issue. I am aware of several areas of significant indigenous vegetation outside of the existing SONS that have been lost through land-use change during the past two years. Council has instructed me to review SONS throughout Mackenzie District. Survey of SONS in the Mackenzie Basin has been hindered by constraints on access to properties for field surveys.
26. Despite the lack of field survey information, it is possible to provide an overview of the nature and extent of likely SONS in the Mackenzie Basin. Criteria for determining SONS are set out in Mackenzie District

Plan Rural Policy 1B and in Appendix 3, Canterbury Regional Policy Statement, 2013 (RPS). The ten RPS criteria fall under four headings: representativeness; rarity/distinctiveness; diversity/pattern; and ecological context. A summary of the extent to which indigenous vegetation in the Mackenzie Basin would be significant under these criteria is provided below. Effective assessment of significant habitats of indigenous fauna usually requires field survey and is not attempted here.

27. Representativeness: The two representativeness criteria place value on the extent to which vegetation/habitat is representative, typical or characteristic of the ecological district (ED) (including degraded examples), and on relatively large examples of such vegetation/habitat. Most indigenous shrubland, tussockland, herbfield, mossfield, lichenfield, cushionfield and stonefield plant communities are representative or typical of the ED. There are large examples of these plant communities on moraines, outwash terraces and alluvial sites in the Mackenzie Basin.
28. Rarity/Distinctiveness: The four rarity/distinctiveness criteria place value on vegetation/habitat that has been reduced to less than 20% of its former extent in the ED or Land Environment of New Zealand (LENZ), threatened or at risk indigenous species, species at distribution limits, and indigenous vegetation within an originally (historically) rare ecosystem. Land environments (Leathwick *et al*, 2003) in the Mackenzie Basin in which indigenous vegetation is reduced to less than 20% (Ceiraad *et al*, 2015) cover substantial areas around the southern part of Lake Tekapo and at the eastern edge of the basin floor. Threatened and at risk indigenous species are present in most Mackenzie Basin habitats, though confirmation by field survey is required. And, substantial parts of the Mackenzie Basin comprise originally rare ecosystems (notably moraines and outwash terraces).
29. Diversity/Pattern: The single diversity/pattern criterion places value on vegetation/habitat that contains a high diversity of indigenous ecosystem types, habitat types or taxa. Most intact (i.e. uncultivated) sites in the Mackenzie Basin have moderate indigenous species diversity for the habitat type (at least 20 plant taxa), though plants are

often sparsely distributed. Field survey is required to determine species diversity.

30. Ecological Context: The three ecological context criteria place value on vegetation/habitat that provides or contributes to an important ecological linkage or network or buffering, on wetlands which play an important hydrological role, and vegetation/habitat which is important for indigenous species. Intact areas of indigenous vegetation in the Mackenzie Basin do provide linkages and buffering; some wetlands are hydrologically important; and open habitats (including severely degraded sites) provide habitat for threatened species such as banded dotterel (*Charadrius bicinctus*).
31. In summary, most undeveloped (i.e. uncultivated and un-irrigated) areas on glacially-derived landforms (moraines and outwash terraces) in the Mackenzie Basin are likely to meet the RPS criteria for SONS, except where vegetation is substantially modified by over-sowing, top-dressing, grazing, or wilding conifer spread. Severely degraded sites will, in many cases, meet the RPS criteria for SONS as these sites provide habitat for threatened plant and animal species.
32. I note that Plan Change 5 to the Canterbury Land and Water Regional Plan includes a policy (15B.4.23) which requires, as part of any application for resource consent for a farming activity to exceed the nitrogen baseline, an assessment of environmental effects which identifies the indigenous biodiversity values present in the application area and identifies any sites of significant indigenous biodiversity. Rule 15B.5.18B of Plan Change 5 requires this assessment to be undertaken, by a suitably qualified ecologist, except where areas of significant indigenous biodiversity have been identified and maintained in accordance with the relevant provisions of any district plan notified after 13 February 2016.

### **ECOLOGICAL OVERVIEW OF THE AREA SOUTH AND EAST OF SH8**

33. A part of the Mackenzie Basin, that is of particular interest with respect to PC13, is the area identified by the Environment Court in its Interim Decision as potentially suitable for higher density irrigated farming: "...the flats of the lower Mackenzie Basin, much of the Eastern Plain,

the Pukaki River Plain as well as the lower Twizel River Plain and part of Benmore...”<sup>1</sup>. A brief desktop analysis of the likely significance of this area was undertaken in July 2015 (appended to Council’s PC13 Section 293 Report). An overview of the character and significance of this area is provided below.

34. Lower-altitude basin-floor parts of the area south and east of SH8 comprise material deposited by the glaciers that occupied lakes Pukaki and Tekapo (moraine), fluvio-glacial material deposited by rivers flowing from those glaciers (outwash terraces), or alluvial material more recently deposited by the Twizel, Pukaki and Tekapo rivers, and smaller streams (Irishman Creek, Edward and Sawdon streams) (Cox and Barrell, 2007). The likely significance of vegetation on these separate landforms is assessed below.
35. The Twizel River plain is an outwash gravel terrace. It lies in a Level IV LENZ (N6.1a) in which more than 30% indigenous cover remains (Cieraad *et al*, 2015). Areas around Twizel and the lower (southeast) part of the terrace are developed or cultivated. Other, uncultivated parts support depleted short tussock grassland. A recent (June 2016) field survey of part of this terrace recorded 26 indigenous plant species, including good populations of indigenous grass species. Uncultivated parts of the Twizel River outwash terrace most likely meet the RPS criteria for a SONS.
36. The Pukaki River plain west of the river is an outwash gravel terrace. It lies in a Level IV LENZ (N6.1a) in which more than 30% indigenous cover remains (Cieraad *et al*, 2015). Lower (southern) parts of the terrace appear cultivated or highly degraded. Northern parts of this terrace lie within SONS16. A recent field survey (April 2016) extended SONS16 north to include uncultivated land between SH8 and Pukaki River. SONS16 has a high diversity of indigenous plant species (at least 48), including nine indigenous grass species. Five at risk plant species were recorded in the April survey. Other, uncultivated parts of this outwash terrace most likely meet the RPS criteria for a SONS.

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<sup>1</sup> *High Country Rosehip Orchards Limited v Mackenzie District Council* [2011] NZEnvC 387 at [208].

37. The Pukaki River plain east of the river is also an outwash terrace within the N6.1a LENZ. I am less familiar with this terrace but aware that substantial parts of it have been recently cultivated. A recent field survey (June 2016) of a small uncultivated part of this terrace recorded 25 indigenous plant species, including three at risk species. An earlier survey of this site by Norton (2016) recorded two threatened plant species: *Lepidium solandri* (nationally endangered) and *Sonchus novae-zelandiae* (nationally vulnerable). Other, uncultivated parts of this outwash terrace most likely meet the RPS criteria for a SONS.
38. Hill country south of SH8 at Lake Pukaki is moraine. It lies in a Level IV LENZ (E4.1b) in which 20-30% indigenous cover remains (Cieraad *et al*, 2015). Most parts of this moraine are uncultivated and appear to support short tussock grassland with scattered shrubs. A recent field survey (March 2016) of a small part of this moraine recorded 13 indigenous plant species and fescue tussock (*Festuca novae-zelandiae*) cover of up to 30%. An earlier survey (November 2015) of a nearby site recorded 18 indigenous plant species. Parts of the moraine where pastoral intensification has not occurred most likely meet the RPS criteria for a SONS.
39. The Tekapo River plain is a large area at the southeast part of Mackenzie Basin. It is the driest part of the basin and appears the most degraded. Areas alongside Tekapo River, Irishman Creek, Edward Stream and Sawdon Stream are alluvial gravels recently deposited by those waterways. Other areas are outwash gravels. The area between SH8 and the Tekapo River lies in a Level IV LENZ (E4.1b) in which 20-30% indigenous cover remains. An area at the eastern edge of the basin lies in a Level IV LENZ (N7.1a) in which 10-20% indigenous cover remains. Other parts lie in Level IV LENZ (N6.1a and N6.1b) in which more than 30% indigenous cover remains (Cieraad *et al*, 2015). I am less familiar with this part of the Mackenzie Basin. A recent field survey (June 2016) of a substantially degraded area adjacent to SH8 recorded 29 indigenous plant species, including two at risk (declining) species. Uncultivated parts of this area that lie on outwash gravels, and less-degraded areas of alluvium, most likely meet the RPS criteria for a SONS.

40. The part of Benmore referred to by the Environment Court in its Interim Decision is presumably the lower eastern part of the Tekapo River plain and the Stony River plain, adjacent to Lake Benmore. Areas alongside these rivers are alluvial gravels. Other parts are outwash gravel. It lies in a Level IV LENZ (N6.1b) in which more than 30% indigenous cover remains (Cieraad *et al*, 2015). There are several large centre-pivot irrigators in this area. Other, uncultivated parts of this area may meet the RPS criteria for a SONS.
41. Herbaceous plant species, listed by de Lange *et al* (2012) as threatened or at risk, recorded from the Tekapo River plain by myself, Department of Conservation (DOC) (Nick Head, *pers.comm.*) and Landcare Research (Susan Walker, *pers.comm.*) are:
- *Anthosachne falcis* at risk; naturally uncommon
  - *Botrychium australe* at risk; naturally uncommon
  - *Cardamine* "tarn" threatened; nationally critical
  - *Carmichaelia nana* at risk; declining
  - *Carmichaelia vexillata* at risk; declining
  - *Ceratocephala pungens* threatened; nationally critical
  - *Colobanthus brevisepalus* at risk; naturally uncommon
  - *Convolvulus verecundus* at risk; declining
  - *Dysphania pusilla* extinct (2012); since rediscovered
  - *Lepidium sisymbrioides* threatened; nationally endangered
  - *Lepidium solandri* threatened; nationally endangered
  - *Leptinella conjuncta* threatened; nationally critical
  - *Leptinella serrulata* at risk; naturally uncommon
  - *Leucopogon nanum* at risk; naturally uncommon
  - *Luzula celata* at risk; declining
  - *Muehlenbeckia ephedroides* at risk; declining
  - *Myosotis brevis* threatened; nationally vulnerable

- *Myosurus minimus* subsp. *novae-zelandiae* threatened; nationally endangered
- *Parahebe canescens* at risk; declining
- *Pimelea sericeovillosa* subsp. *pulvinaris* at risk; declining
- *Raoulia beauverdii* at risk; naturally uncommon
- *Raoulia monroi* at risk; declining
- *Sonchus novae-zelandiae* threatened; nationally vulnerable
- *Trisetum antarcticum* at risk; declining
- *Wurmbea novae-zelandiae* threatened; nationally endangered

Some of these nine threatened and 15 at risk species are relatively common on depleted terraces in this area. Several species (including *Lepidium sisymbrioides* and *Myosurus minimus* subsp. *novae-zelandiae*) are restricted to the Mackenzie Basin and Central Otago. A number of these species have been recorded at other sites south and east of SH8, including SONS16.

42. The open grassland, herbfield and stonefield habitats on terraces and riverbeds south and east of SH8 provide important habitat for indigenous fauna. Bird species, listed as threatened by Robertson *et al* (2012), recorded in this area (Robertson *et al*, 2007) are:

- banded dotterel (*Charadrius bicinctus*) nationally vulnerable
- black-billed gull (*Larus bulleri*) nationally critical
- black-fronted tern (*Chlidonias albostrigata*) nationally endangered
- black stilt (*Himantopus novaezelandiae*) nationally critical
- grey duck (*Anas superciliosa*) nationally critical
- wrybill (*Anarhynchus frontalis*) nationally vulnerable

These areas also provide habitat for invertebrates, such as robust grasshopper (*Brachaspis robustus*) (threatened; nationally endangered).

43. In summary, parts of the area south and east of SH8 which lie on naturally uncommon ecosystems (moraines, outwash gravels and



ephemeral wetlands) and are uncultivated are most likely to meet the RPS criteria for SONS. Other uncultivated parts of the area (on river gravels) are also likely to meet the RPS criteria as they provide habitat for threatened plant and bird species. Field survey would be required to determine these values. Field survey should be undertaken at an appropriate time of the year (spring/summer), as some threatened species are not obvious (plants) or present (birds) during winter. Areas with severe degradation and/or high rabbit numbers should not be excluded from survey, as such areas may still provide habitat for threatened plant and bird species.

#### **ACTIVITIES HARMFUL TO INDIGENOUS VEGETATION AND HABITAT**

44. Activities harmful to terrestrial indigenous vegetation and habitat in the Mackenzie Basin are those which cause direct loss and those which cause degradation. Direct loss is caused by clearance, excavation, cultivation, afforestation, drainage, inundation and, in some conditions, irrigation, burning or application of herbicides. Degradation is more complex. Activities that may cause degradation are grazing, burning, browsing/predation by introduced animals, invasion by exotic plant species, over-sowing and top-dressing. Of these activities, grazing and browsing have been the most pervasive causes of degradation in the Mackenzie Basin, especially in drier eastern parts of the basin. Overall, fire, pastoral farming and exotic species have been the major causes of vegetation change in the eastern South Island high country (Young *et al*, 2016).
45. Grazing animals selectively remove palatable plant species, reduce the stature of taller vegetation, expose shade-adapted low-growing plants to direct sunlight, trample ground-cover species, remove nutrients from the plant community and redeposit nutrients elsewhere at the site (e.g. at stock camps). Heavier animals, such as cattle, break woody vegetation and damage the ground. The effect of grazing, especially when accompanied by burning, is the conversion of shrubland and tall tussockland plant communities to short tussockland, herbfield and bare ground. This degraded vegetation provides favourable habitat for rabbits and invasive naturalised plants such as mouse-ear hawkweed (*Pilosella officinarum*), sheep's sorrel (*Rumex acetosella*) and exotic

grasses. The extent and rate of degradation at any site will depend on a range of factors.

46. I am familiar with two Mackenzie Basin examples of the response of indigenous vegetation following the removal of grazing at basin-floor plant communities: Tekapo Scientific Reserve and SONS16. At Tekapo Scientific Reserve indigenous vegetation recovered in the 18 years following removal of grazing and with effective rabbit control, despite high levels of initial modification and exotic cover dominance (Walker *et al*, 2016). These authors concluded that the pattern of vegetation change across the reserve was consistent with grazing having exerted a powerful constraint on growth and biomass of both indigenous and exotic species prior to reservation.
47. At SONS16 (Ben Ohau Conservation Area) grazing is excluded and the area receives regular rabbit and wilding conifer control (DOC, *pers.comm.*). I surveyed grassland/herbfield plant communities at SONS16 in April 2016 and have surveyed similar plant communities at two other sites on other parts of this outwash terrace during the past year. I observed 48 indigenous plant species at SONS16, including nine indigenous grass species. In places, indigenous grasses form the dominant cover. The number of indigenous plant species at any one site at SONS16 is typically greater than 20. At other sites surveyed on this outwash terrace, where grazing occurs, the number of indigenous species recorded was eight at one site and ten at the other.
48. I am aware of a commonly-held view that degradation at many eastern high country sites is caused by the invasive introduced mouse-ear hawkweed (*Pilosella officinarum*). Hawkweed is frequently the most dominant low-growing plant species at degraded sites in the Mackenzie Basin. One study found that mouse-ear hawkweed increased in fescue tussock grassland with a low (<5%) initial cover of hawkweed regardless of grazing treatment (Meurk *et al*, 2002). The same study found that there was little change in species composition at sites already dominated by mouse-ear hawkweed (>50% cover) regardless of grassland type and grazing treatment. Another study found that the rate of invasion of mouse-ear hawkweed in short tussock grassland did not increase following grazing or following removal of dominant grass species by herbicide (Walker *et al*, 2005).

49. At Tekapo Scientific Reserve, hawkweed invasion did not retard recovery; instead, indigenous vegetation recovery was higher on more productive landforms with higher initial hawkweed cover (Walker *et al*, 2016). Monitoring of permanent vegetation transects in eastern South Island grasslands over 25 years showed that broad-scale fluctuations in species richness and community composition were not driven by hawkweed invasion (Day and Buckley, 2013). So, it appears unlikely that degradation is simply caused by mouse-ear hawkweed. The causes of degradation are likely to be more complex.
50. Grazing can help maintain plant communities and can be used to manage components of those communities. Grazing can prevent recovery or re-establishment of taller species and thereby prevent a short tussock grassland, for example, regenerating to a tall tussock grassland or shrubland plant community. Grazing can hinder the establishment of undesirable woody species, such as wilding conifers. However, my experience with grazing and vegetation monitoring at a lowland grassland site in the Timaru District (Oliver Dryland Reserve) indicates that it can be difficult to manage grazing to achieve specific changes to a plant community.

#### **SUITABILITY OF AREAS SOUTH AND EAST OF SH8 FOR DEVELOPMENT**

51. Analysis of the suitability of areas in the Mackenzie Basin south and east of SH8 for pastoral development is constrained by a lack of readily available survey data. Data are available for some areas, including recent field survey data that I have gathered at sites subject to consent applications and data from DOC and Landcare Research surveys. Analysis of aerial photographs shows a uniformity of landform and vegetation over most parts of this area. More difficult is determining which areas have been developed since those aerial photographs, as there has been considerable recent cultivation.
52. Extrapolation of survey data indicates that many parts of the area south and east of SH8 are likely to be significant in terms of section 6(c) RMA because of the extent of the originally rare ecosystems (moraines, outwash terraces and ephemeral wetlands), the large number of threatened and at risk plant species (at a range of

habitats), and the importance of open habitats in the area for nesting by native birds.

53. So, while areas south and east of SH8 have potential for pastoral intensification, development of any uncultivated parts of that area should be subject to assessment of ecological values. That assessment should include thorough field survey at an appropriate time (spring/summer).

#### **FARM BASE AREAS**

54. In February 2016 I was asked to assess the accuracy of the Farm Base Areas (FBA) mapped in Attachment C of Council's PC13 Section 293 Report. The purpose of that assessment was to determine whether it is appropriate for pastoral intensification to be a permitted activity within those FBAs. The results of that assessment are appended to Council's updated (May 2016) Section 293 Report. I summarise this assessment below, while acknowledging that the precise boundaries of the FBAs are yet to be finalised.
55. For this assessment I viewed (in QGIS) aerial images photographed in 2014 and the proposed FBA boundaries as mapped on Council's electronic (GIS) maps. Also mapped on the aerial images I viewed are land parcel boundaries, streams and SONS. The objective of the assessment was to determine whether areas with significant ecological values (potential SONS) are contained within the proposed FBA boundaries. The assessment was limited in some areas by the difficulty distinguishing between natural seepage wetlands and tall pasture, trees (especially crack willow) obscuring views of streams and wetlands, and the difficulty determining species composition of some shrublands and grasslands.
56. Of the 35 FBAs assessed, boundaries appear to include wetlands or streams at 22 locations, indigenous shrubland or forest at six locations, and existing SONS at two locations. Most areas of wetland and stream appear modified or constructed (e.g. water supply ponds). At some locations, it appears that the FBA boundary has been drawn inaccurately, such as where it includes parts of a waterbody or SONS. The conclusion of my assessment was that the boundaries of six FBAs

should be redrawn to exclude waterbodies and SONS, and that vegetation/habitat at parts of eight other FBAs should be field checked. Since this assessment, I have been advised of one other FBA which is not mapped on Council's GIS.

57. The proposed amendments to PC13 require subdivision and development within FBAs to maintain or enhance the outstanding natural landscape and other natural values by (among other things) "avoiding adverse effects on the natural character and environmental values of waterbodies, groundwater and sites of natural significance" (Policy 3B3). The amendments also require pastoral intensification to be set back 20m from the bank of a river and 50m from a wetland. This provides protection for ecologically significant areas that lie within FBAs. However, I believe it would be useful and prudent to field check those few (eight) locations where the nature of the vegetation/habitat is unclear on aerial images, and to redraw FBA boundaries where they obviously (and presumably inadvertently) include waterbodies or SONS. I understand it is Council's intention to refine the FBA boundaries.

### **SCENIC GRASSLAND AREAS**

58. In June 2016 I assessed the ecological values of the proposed Scenic Grassland Areas (GA), mapped in Attachment C of Council's PC13 Section 293 Report. For this assessment I viewed the 13 GAs from the roadside, taking note of the type and extent of the plant communities present. This method permitted only a general overview of the vegetation, and was insufficient to identify species-level ecological values. Assessments of the GAs are presented below. Some of the GAs are illustrated in the **appendix** to my evidence.
59. GA1 lies on the north side of SH8 between Burkes Pass and the junction of Haldon Road (Dog Kennel Corner), with a narrow strip on the south side of SH8. Vegetation on both sides of the road is predominantly narrow-leaved snow-tussock (*Chionochloa rigida*) grassland in good condition. Shrubs of matagouri (*Discaria toumatou*) are common in the tussockland, especially on the north side of SH8. The tussockland extends up-slope on the north side of SH8 beyond the upper boundary of the GA.

60. GA2 lies on both sides of SH8 west of the junction of Haldon Road (Dog Kennel Corner). The area on the north side of SH8 is grassland dominated by exotic species, of which browntop (*Agrostis capillaris*) is the most obvious, with scattered fescue tussock. Fescue tussock is more common at the east part of the area and low-growing matagouri is present at the west (Sawdon Stream) part. The area on the south side of SH8, and west of Haldon Road, is browntop-dominated grassland with scattered fescue tussock. At both areas similar plant communities extent beyond the GA onto lower slopes and Sterickers Mound respectively.
61. GA3 lies in two parts on the west side of Haldon Road between Sterickers Mound and the Mackenzie River fan. There is also a small strip on the east side of Haldon Road, though this is a mapping error (Graham Densem, *pers.comm.*) so was not assessed. The north parcel of GA3 is browntop-dominated grassland with scattered fescue tussock and low-growing matagouri. The south parcel of GA3 is dominated by low-growing matagouri scrub at the north part, grading to browntop-dominated grassland and open herbfield at the southern part. A stand of exotic trees is present mid-way along the GA at a road bend.
62. GA4 lies on the broad alluvial fan of the Mackenzie River, on both sides of Mackenzie Pass Road. It extends east beyond the fan to the roadside Mackenzie Memorial in the incised valley of the Mackenzie River. The west part of the area on the broad fan is browntop-dominated grassland with areas of herbfield and bare ground. Scattered fescue tussock is present at some locations. The west part of the area is browntop-dominated grassland with scattered fescue tussock and extensive patches of low-growing matagouri scrub. Taller denser matagouri scrub is present on the north side of the Mackenzie River.
63. GA5 lies on the north side of SH8, covering the alluvial plain of Dead Man Creek (between Sawdon and Edward streams). It is sparse fescue tussock grassland within which the inter-tussock spaces appear to be dominated by exotic grassland/herbfield. Low-growing matagouri is present, and fescue tussock less dominant, at the east part of the area. This vegetation extends north onto the lower hill slopes beyond the upper boundary of the GA.

64. GA6 lies on the south side of SH8 opposite the west part of the GA5. The east part, on the upper terrace, is sparse fescue tussock grassland within which the inter-tussock spaces appear to be dominated by exotic grassland. The west part, on the lower (Edward Stream) terrace, is degraded herbfield with bare ground and small patches of grassland with scattered fescue tussock, typical of undeveloped terraces of the eastern Mackenzie Basin.
65. GA7 is an extensive area on the east side of Lilybank Road, between Richmond homestead in the south and Coal River in the north. The area south of Richmond homestead has been excluded (Graham Densem, *pers.comm.*), so was not assessed. The area just north of Richmond homestead to the Coal River alluvial fan is mostly fescue tussockland, with areas of degraded grassland/herbfield and bare ground, and areas of matagouri and sweet brier shrubland. A rectangular area alongside the road is excluded from the GA. The southern part of this excluded area (south of the Round Hill Skifield road) is fescue tussock grassland. The northern part of GA7, on the alluvial fan of Coal River, is degraded grassland/herbfield. Along the central part of GA7 similar vegetation extends onto the hill slopes beyond the upper boundary of the GA.
66. GA8 lies between Mt John and Lake Alexandrina, west of Lake Tekapo. This area is predominantly fescue tussockland interspersed with areas of herbfield in old stream channels and on stony moraine ridges. Part of the area, alongside Godley Peaks Road, has a grid-like group of fenced trial plots with vegetation that is difficult to determine from a distance. The fescue tussockland typical of most parts of this GA extends to near the shores of Lake Alexandrina, beyond the northwest boundary of the GA.
67. GA9 lies on the west side of SH8 just south of the Tekapo Military Camp at Balmoral. It has healthy fescue tussockland with patches of red tussock (*Chionochloa rubra*) at its west part. Also present are occasional wilding conifers, scattered matagouri shrubs and golden speargrass (*Aciphylla aurea*).
68. GA10 lies on both sides of SH8, north of Tekapo Canal. The west part of this area is fescue tussockland, possibly with areas of taller tussock

at its western edge. Similar vegetation extends north beyond the boundary of the GA. The part west of and alongside SH8 has a wide patch of Russell lupin (*Lupinus polyphyllus*), presumably planted, and at the north part areas of red tussock, matagouri and golden speargrass. The part east of SH8 is fescue tussockland with matagouri, golden speargrass and scattered tall tussock.

69. GA11 lies on the west side of SH8, between Irishman Creek and Maryburn, beyond the Scenic Viewing Area strip. It is fescue tussockland with scattered low-growing matagouri and small areas of exotic grassland.
70. GA12 lies in two parts on the east side of SH8, between The Wolds and Maryburn homesteads, and beyond the Scenic Viewing Area strip. The northern area is a mosaic of fescue tussockland and degraded grassland/herbfield. A small central part of this area appears to be developed (cultivated) pasture. The southern area is degraded herbfield, with small areas of fescue tussockland, typical of the undeveloped terraces of the eastern Mackenzie Basin.
71. GA13 is on both sides of SH8 on moraine between Simons Pass and Lake Pukaki. Western and central parts are fescue tussockland with scattered shrubs of matagouri and sweet brier. The eastern part, in a broad outwash valley, is degraded grassland/herbfield/stonefield with strips of exotic grassland and patches of sweet brier scrub.
72. In summary, the 13 Scenic Grassland Areas support vegetation that is typical of uncultivated parts of the Mackenzie Basin. Ecologically, this vegetation is not all "grassland", as normally defined (e.g. Atkinson, 1985). It includes areas of shrubland, tussockland, herbfield, stonefield and loamfield (bare ground).
73. Vegetation at some of the GAs extends beyond the mapped boundaries, notably at GA1, GA2, GA5, GA7 and GA8. At these locations the boundaries are not logical from an ecological perspective. There are also locations within the GAs where vegetation appears not to be indigenous, notably an area of Russell lupin at GA10 and possibly at the vegetation trial plots at GA8.



## **PASTORAL INTENSIFICATION AND EFFECTS ON ECOLOGICAL VALUES**

74. Pastoral intensification is defined in PC13 as cultivation, irrigation, top-dressing, over-sowing and/or direct drilling. Pastoral intensification has occurred over many years in the Mackenzie Basin, though mostly on a relatively small scale. In recent years, irrigation has prompted pastoral intensification on a larger scale. Consented and proposed irrigation sites are illustrated on the Areas of Landscape Management map (PC13, Map 1).
75. The effects of pastoral intensification at a site can be profound, especially when it involves conversion to irrigated pasture. In this situation, existing vegetation is removed, and threatened or at risk plant species are completely displaced. Habitats such as herbfield, cushionfield and stonefield are replaced with grassland (pasture), and cover provided by tussocks or shrubs is removed. Habitats of indigenous species such as banded dotterel are altered or destroyed.
76. The wider ecological effect of pastoral intensification is a reduction in the extent of the vegetation/habitat for indigenous plant and animal species typical of the Mackenzie Basin, including a number of threatened and at risk species. As well as a reduction in the overall area of vegetation/habitat, remaining areas become more fragmented. These fragmented areas have a higher boundary to area ratio and are more vulnerable to the adverse effects of activities on adjoining land. Cumulatively, these effects increase the vulnerability of threatened and at risk species.
77. I note that that Plan Change 5 to the Canterbury Land and Water Regional Plan includes a rule (15B.5.18B) that requires that resource consent applications for pastoral intensification that will exceed the nitrogen baseline be subject to methods to avoid or mitigate any adverse effects on significant indigenous biodiversity. Some of the activities defined as pastoral intensification in PC13 will be captured by this rule.

## **RESPONSE TO SUBMISSIONS ON AMENDED PC13 PROVISIONS**

78. Council's amendments to PC13 were publicly notified in November 2015. Written submissions were received and Council consultation over these submissions resulted in further amendments to PC13. Ecological issues raised in these submissions, which do not appear to be already addressed by the subsequent amendments to PC13, are discussed below.
79. Tenure review: Several submitters request that PC13 should not restrict land uses such as pastoral intensification in areas for which freehold title was granted though the pastoral lease tenure review programme. I do not support this request. As outlined earlier (paragraphs 23 and 24) the Crown's tenure review programme is not a substitute for Council's section 6(c) RMA assessments. Reliance on tenure review outcomes would not ensure that Council is adequately meeting its section 6(c) RMA obligation to provide for the protection of indigenous biodiversity.
80. Pastoral intensification definition: Several submitters state that the PC13 definition of pastoral intensification is too strict. I do not support that view. The pastoral activities it includes are those which are most likely to have adverse effects on ecological values. I believe that a further activity (subdivision fencing) could legitimately be included in the pastoral intensification definition (see paragraph 87).
81. Pastoral intensification: Several submitters state that consent for pastoral intensification should be required only when a change to existing uses or management practices is proposed. I understand the logic of that argument. However, if this approach was adopted, it would be difficult for Council to be sure it was meeting its section 6(c) RMA obligations to provide for the protection of indigenous biodiversity. Existing land uses/management practices would need to be assessed by an independent party. That assessment would likely be constrained by the difficulty determining land uses/management practices through field inspection and/or reliance on information that, in many situations, could be provided only by the landowner. And, even then, continuation of existing land uses/management practices does not necessarily mean that there will be no loss or degradation of indigenous biodiversity values.

82. Areas of landscape management (Map 1): A large number of submitters object to inclusion of parts of their properties in High Visual Vulnerability, Lakeside Protection, Scenic Grassland and/or Farm Base areas. I acknowledge that this issue is primarily related to protection of landscape values. However, if those areas are to be reviewed, and the ecological components of natural landscape character are to be considered, field survey would be required to determine the presence and nature of those ecological components.
83. Natural science values: Several submitters express concern that PC13 Map 1 (Areas of Landscape Management) does not take into account ecological or natural science values. The submitters request that Council engages ecological and geomorphological expertise to supplement Map 1. I support that view, though note the following points. First, existing SONS are identified on planning maps, though these are no longer accurate or adequate. Second, PC13 proposes to control activities at sites of natural significance, though field survey is only required as part of a resource consent application. Third, robust identification of ecological values requires thorough field survey, which would be a considerable undertaking in an area the size of the Mackenzie Basin. Fourth, effective field survey is dependent on permission for access to properties. Despite these constraints, robust and comprehensive field survey of ecological values of the Mackenzie Basin, and identification of the location and extent of those values on planning maps, would be the ideal way to help ensure Council is meeting its obligation to provide for the protection of indigenous biodiversity.

#### **THE ABILITY OF PC13 TO PROTECT ECOLOGICAL COMPONENTS OF NATURAL LANDSCAPE CHARACTER**

84. While acknowledging that the primary purpose of PC13 is protection of landscape values, PC13 will also help achieve the objectives of sections 6(c) and 7(d) RMA (i.e. ecological components of natural landscape character). In particular, restrictions on buildings, subdivision, tree planting and pastoral intensification will help provide for protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna, and help maintain the intrinsic

values of ecosystems. However, there are in my view some areas where further clarification or caution may help achieve these obligations. These are:

- tree planting
- encouragement of traditional farming
- fencing
- changes in grazing type
- existing irrigation consents

These issues are discussed in turn below.

85. Tree planting (Rural Policy 3A4) is a non-complying activity in wetlands and SONS. Elsewhere in the Mackenzie Basin it is restricted discretionary (riparian areas) or permitted (in the vicinity of homesteads and farm buildings). "Other planting" in the Mackenzie Basin is a restricted discretionary activity. This should be clarified to ensure that tree planting is non-complying in areas with ecological values that meet the RPS criteria for SONS but that have not yet been identified as SONS.
86. Traditional pastoral farming (Policy 3B12) is encouraged so as to maintain tussock grasslands. As noted earlier, traditional pastoral farming may not maintain tussock grasslands. While I understand that existing uses are generally permitted, it may be more instructive if the policy statement was re-worded to state that those traditional farming methods which maintain tussock grassland will be encouraged.
87. The PC13 definition of pastoral intensification is cultivation, irrigation, top-dressing, over-sowing and/or direct drilling. It excludes fencing. Fencing for the protection of ecological values, such as at riparian areas and SONS, is important and should be a permitted activity. However, subdivision fencing of large grazing blocks into small paddocks, accompanied by intensive grazing of those paddocks, can have significant adverse effects on indigenous vegetation. It is perhaps unlikely that such subdivision fencing would be undertaken without one or more of the other activities that are included in the pastoral intensification definition. However, protection of ecological values may

be more secure if PC13 clarified the type of fencing that is and is not permitted.

88. Another activity that can have significant adverse effects on indigenous vegetation is a change in grazing from, for example, sheep to cattle, or sheep to deer. Cattle generally cause greater damage to vegetation and soils than sheep. Deer also have adverse effects on vegetation that are different to the effects of sheep. During field survey work in the South Canterbury foothills (Timaru District) in recent years, I have observed significant adverse effects on indigenous vegetation caused by subdivision fencing and intensive grazing of deer. If grazing (of any form) is regarded as an existing use, then opportunities to restrict a change in this activity may be limited.
89. Pastoral intensification is a permitted activity in areas “for which irrigation consent was granted prior to November 2015 and the effects on the outstanding natural landscape have been addressed through the regional consenting process” (Policy 3B13). This policy does not specifically include effects on the ecological components of this outstanding natural landscape. I am not directly familiar with the regional consenting processes for water takes. However, I am familiar with some of the areas for which water takes for irrigation have been granted through this process. Within those areas there are ecological values that meet the RPS criteria for SONS. I accept that a consent holder would have an expectation of being able to undertake that consented activity. However, I note that permitting pastoral intensification of consented irrigation sites will lead to the loss of significant indigenous vegetation and significant habitats of indigenous fauna (SONS) at some locations.
90. In conclusion, I believe that PC13 will substantially provide for the protection of the ecological components of the natural landscape character of the Mackenzie Basin. Consideration and integration of the matters raised in the paragraphs above will further assist Council in meeting this objective.

**Mike Harding**  
**15 July 2016**

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