

**IN THE MATTER OF the Resource Management  
Act 1991**

**AND**

**IN THE MATTER OF applications by Central  
Plains Water Trust and  
Central Plains Water Ltd to  
Take and Use Water for  
Irrigation in the Central  
Plains Area**

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**Supplementary Evidence of Philip Grove**

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**INTRODUCTION**

1. My name is Philip Grove. I am employed by Environment Canterbury as a Land Resources Scientist (terrestrial ecology). My qualifications and experience, and the basis on which I am preparing this supplementary evidence, are set out in my previous S42A report prepared in advance of this hearing.
2. This supplementary brief of evidence has been prepared primarily in response to the supplementary evidence of Dr Bishop presented to this hearing on behalf of the applicant, and to matters raised by submitters. This report will provide information and advice related to:
  - Effects of Works in the river bed and river margins on terrestrial ecology and wetlands, related to the construction and use of intakes and associated structures for the proposed Central Plains Water Enhancement Scheme.
  - Effects of water take on terrestrial ecology of riverbeds, river margin and riparian wetlands.
  - Effects of water use on the terrestrial ecology and wetland habitats of Te Waihora/Lake Ellesmere.
  - Ecological effects on Canterbury Regional Council reserve land within the CPW scheme area
  - Effects of bywash discharges on terrestrial ecology and wetlands.
  - Effects of water use on terrestrial ecology and wetlands.
3. In his supplementary presentation of evidence, Dr Bishop pointed out that many issues raised in the S42A reports of Mr Mark Davis, for Selwyn District Council, and myself were common to both. To avoid duplication at this stage of the hearing, Mr Mark Davis will respond to the evidence of Dr Bishop with information relating to effects of proposed of works outside the riverbed and riparian margins, including headrace canals on terrace risers, distribution canals, and reservoir construction. Mr Davis will also comment on Significant Natural Areas and assessment of ecological significance.

#### 4. Summary of conclusions

- Nationally threatened river bed nesting bird species are likely to be adversely affected by proposed CPW water abstractions from the Waimakariri River.
- Nationally and regionally significant indigenous species and habitats will be impacted by proposed CPW scheme infrastructure and associated works.
- Significant indigenous species and habitats within the proposed irrigation area will be threatened by effects of agricultural intensification associated with the scheme's water use.
- Insufficient information has been provided by the applicant to support their claim that effects of the scheme on the vegetation and wildlife of Te Waihora/Lake Ellesmere, an internationally significant wetland habitat, will be minor.

#### Effects of works in the river bed and river margins

5. The principal evidence of Dr Bishop on this issue stated that “known sites of higher ecological significance will be avoided” (para. 107), “there are no significant wetlands or riparian sites associated with the proposed intake locations on either river” (para 109), and “most of the adverse construction effects on terrestrial ecology will be minor” (para. 109). This has been amended in his supplementary evidence. It is now acknowledged that important indigenous habitats could be affected by the proposed intake structures and headrace canals, “which will be carefully surveyed prior to construction” (para 8 supplementary evidence).
6. Insufficient information on indigenous terrestrial and wetland ecosystems potentially affected by intake structures and headrace canals has been presented in this application. These works are a fundamental part of the overall CPW scheme, and many (though not all) areas of significant indigenous habitats in the vicinity of the proposed works are well described in reports and databases that have been available to the applicant.
7. This existing information should have formed the basis for further ecological survey and assessment, with a full description of the works' footprint area, assessment of effects, and details of how CPW proposes to avoid or mitigate these effects included in the application. This is required so that consenting authorities and submitters have opportunity for informed comment on the applicant's overall assessment and proposed mitigation, and in recommending consent conditions. I agree with the evidence of Dr Meurk (para 194) that there is nationally and regionally significant vegetation and wildlife habitat in the footprint of the CPW scheme which will be destroyed by proposed infrastructure and associated works.
8. I have looked at maps of the proposed intake and terrace headrace canal works footprint provided by the applicant. The upper Waimakariri intake is located, of course, in the riverbed – a wildlife habitat of outstanding significance. The first 1km of the headrace canal lies within the Waimakariri riverbed, it then crosses the Kowai River, and terminates on the main river terrace at Keens Road, adjoining

the Keens Road Wetland – one of the most diverse and mature freshwater wetlands in the Plains Ecological Region. The potential effects of canal construction and operation on the hydrology of this regionally significant wetland were identified in a S.92 letter of April 2007 from Mr Walter Lewthwaite to SDC as requiring investigation, but have not been addressed in Dr Bishop's subsequent evidence.

9. The footprint of the lower Waimakariri (gorge bridge) intake structure and tunnel impacts on the braided riverbed again, and the significant 'Waimakariri Gorge Bridge dry shrubland' – the largest and least modified example of this vegetation type in the ecological district. Downstream of the tunnel, the headrace canal footprint re-enters the Waimakariri River bed and berms, crossing two riparian wetland sites. These wetlands, although dominated by exotic willows, also support a range of native wetland plants and are possible habitat for threatened crake and bittern.
10. The Rakaia River intake structure occurs within another area of outstanding value for wildlife.
11. The generic effects avoidance, remediation or mitigation measures very briefly outlined in Dr Bishop's principle evidence (para 116) have not been developed in his supplementary evidence. There is no detail as to which ecologically significant sites in the vicinity of the proposed works will be avoided, which will be impacted, and specifically how these impacts will be remedied or mitigated. I do not consider the applicant's approach on this issue – that is reliance on future surveys and development of mitigation measures after granting of consent – appropriate for a project of this scale, given the high ecological values at stake within parts of the affected area.

#### Suggested conditions and mitigation

12. A thorough ecological survey of the scheme footprint, assessment of potential ecological effects, and proposals to avoid, remedy or mitigate effects is required, prior to granting of consent.
13. Although Dr Bishop's evidence provides no detail on this, it is considered that mitigation for effects of intake structure works on braided river birds should be relatively straight forward. Conditions are recommended so that works do not occur within 100 metres of where nesting sites have been identified by a suitably qualified expert. It is also recommended that comprehensive management plans for ecological mitigation and habitat restoration of (actual or potential) river bird nesting areas in the vicinity of the proposed works be prepared, prior to granting of the consent. This should include monitoring and control of any new weed incursions resulting from the works.
14. Any native river bed vegetation present in the vicinity of the intake works footprint should be avoided wherever possible. Monitoring and control of any new weed incursions resulting from the works that may threaten any nearby native riverbed vegetation should also be carried out. If native vegetation is directly affected by works, compensation or offsets will be required. While planting and re-establishing of new habitat is worthwhile, it is not the equivalent of the original habitat. In the case of affected native river bed vegetation, it is suggested that

additional offset or compensation would be for CPW to fund a sustained programme of weed control at other sites of similar vegetation where they occur elsewhere in the riverbed.

15. Disturbance to Keens Road Wetland from the proposed works must be avoided. A detailed management plan should be developed for this site that ensures it will not be impacted by construction activities. An assessment of effects of canal construction and operation on the wetland's hydrology is also required, with measures put in place to remedy any adverse effects.
16. A detailed management plan should be developed for creation of riparian wetlands to offset those impacted by canal construction downstream of the lower Waimakariri intake. Again, however, establishment and planting of new wetlands can not fully replace the original habitat. In determining what is the appropriate ratio of compensated area for lost habitat, the approach suggested by Dr Meurk, calculating this in terms of the age or maturity of lost species/habitat, is supported (para 138 of his evidence). For example, the loss of 50 year old riparian wetland habitat might involve establishing an area 10 times the size of 5-year old riparian wetland habitat.

#### Effects of works on Environment Canterbury reserve land within the scheme area

17. In addition to significant natural areas on the Waimakariri river bed and berms described above, significant natural dryland habitats occur on Environment Canterbury reserve land in the north-east corner of the CPW command area, between Courtney and Halkett. These areas, shown in a map appended to Dr Bishop's principal evidence, support regionally-significant examples of dry plains kowhai and kanuka woodland as well as native shrubland, grassland and moss-herbfield habitats. Nationally rare/threatened plant species present here include the shrub daisy *Olearia adenocarpa*, leafless muehlenbeckia (*Muehlenbeckia ephedroides*) and flat-leaved mat daisy (*Raoulia monroi*).
18. I do not accept Dr Bishop's rationale for omitting to carry out detailed ecological survey and assessment of effects of the scheme on these (and other) significant areas prior to granting of consent. Dr Bishop's belief that the risk of CPW scheme infrastructure disrupting indigenous habitat is "low by virtue of the fact that it is very uncommon" (para 6 of his supplementary evidence) is contradicted by the applicant's own information, as well as that of expert witnesses for submitters. For example, nine significant natural areas on Environment Canterbury reserve land between Courtney and Halkett lie within or alongside the footprint of proposed distribution canals/water races and bywash discharge canals, as shown on maps provided by the applicant.

#### Suggested conditions

19. CPW scheme distribution and bywash discharge canals avoid significant natural areas on Environment Canterbury reserve land.

## Effects of water takes on terrestrial ecology of the Waimakariri and Rakaia Rivers

20. Expert witnesses for CRC and submitters are in general agreement with the applicant that the proposed CPW water take will have only minor effects on the hydrology, aquatic ecology and terrestrial ecology of the Rakaia River, due to the provisions of the WCO and relatively small size of the take. However, the witnesses also note that insufficient information has been provided by the applicant to reliably determine this. My evidence on this issue will therefore concentrate on effects of the proposed water take from the Waimakariri River.

## Combined effects of Waimakariri water take on river birds

21. Three principal factors, all directly or indirectly related to river flows, influence the well-being of threatened ground-nesting braided river birds: suitable nesting habitat, largely free of exotic vegetation; protection of nests and nesting birds from predation; and food supply. These factors can also operate interactively or cumulatively. For example, reduced flows may increase predation risk at the same time as reducing food availability for nesting birds.
22. The applicant has assessed the effects of the CPW take on these three factors in isolation, and considered them to be minor in each case, but has not assessed whether cumulative “minor effects” could have major effects. Lack of consideration of these more complex interrelationships in both the habitat modelling and overall ecological assessment of effects remains a fundamental gap in the applicant’s evidence on this issue.

## Exotic vegetation encroachment

23. In para. 29 of his supplementary evidence for the applicant, Doctor Bishop stated “the limited impact of CPW water extraction on large flood events, which are the key disturbance driver with regard to braided river vegetation (Rogers et al. 2005), means that the scheme is unlikely to result in the invasion of introduced shrubs.”
24. The applicants have not presented any evidence to demonstrate that it is only the big floods that move sediment, change channels and cause the sort of erosion that clears weeds. I consider that small-to-moderate freshes, of the size and duration that would be affected by CPW, could well perform this function. Not only introduced shrubs are of concern. Fast-growing exotic herbaceous plant species also exclude native vegetation, smother bird nesting sites and provide cover for predators on braided river beds. The reference quoted by Dr Bishop (Rogers et al. 2005) is a useful overview of the past and present role of disturbance in New Zealand dryland ecosystems, but does not look in detail at the issue of exotic vegetation encroachment into braided river beds.
25. At present, the Waimakariri River has a relatively high proportion of bare river gravel habitat (e.g. Wilson 2001). The lower Waimakariri appears to be coming

more important for threatened species such as wrybill, black fronted tern and banded dotterel, as amount of suitable habitat declines elsewhere. Many key weed species are present on this river as they are on others, suggesting that the hydrology and geomorphology of the Waimakariri River have limited their spread to date. However there is no guarantee this will remain the situation post CPW.

26. In his evidence on river geomorphology presented to this hearing, Dr Tim Davies concluded that the proposed intake structures and water abstraction regime would cause changes to the character of the Waimakariri River, including alterations in the river channel pattern (para. 6.1). The potential effects of such changes on river bed vegetation patterns and bird habitat have not been addressed by the applicant. The lack of quantitative research into the cumulative role of small freshes on vegetation clearance, erosional and depositional processes was also highlighted in the evidence of Dr Ken Hughey (paras. 2.107-2.108).

#### Effect of water take on bird feeding habitat

27. Earlier studies (e.g. Robertson et al. 1983) have shown that reduction in flows reduces feeding habitat by decreasing the size and number of small channels as well as the overall useable area of aquatic habitat. Dr Bishop's conclusion that the effect of CPW on river bird feeding habitat is "relatively minor" (para. 29 supplementary evidence) does not accord with the opinions of other expert witnesses. Dr John Hayes calculated that loss of invertebrate habitat will be as high as 19-26% during some months (para 2.13 of his evidence). Dr Neil Olsen concluded that the CPW scheme alone (i.e. not accounting for cumulative effects) is expected to reduce the available habitat for the important invertebrate *Deleatidium* by up to 20% in several months of the year.
28. Whether these invertebrate habitat losses will translate to effects on bird populations depends on whether food is limiting. The applicant has provided no information to help determine this. In the absence of such information I support the conclusions of Drs Olsen, Hayes and Hughey regarding the likely overall negative effect of reduced food production on braided river birds.

#### Effects of water take on predation of nesting birds

29. I remain particularly concerned about increased vulnerability to predation of threatened braided river bird species as a result of reduced river flows during the breeding season. I do not agree with Dr Bishop's conclusion that the risk of the CPW water take resulting in such significant adverse effects is "low" (para. 38). Dr Hughey highlighted the general lack of research in this area, and considered that virtually none of the evidence from the applicant addressed this issue in a quantitative manner (para 2.109).
30. Hydrological modelling information presented by both the applicant and submitters for the same section of the Waimakariri River show the relationship between river flow changes and numbers of braids and islands in the river bed.

31. Dr Hughey stated that on the basis of his own recent research (Duncan et al., 2008 in prep.), the optimal flow range for bird nesting habitat on the Waimakariri River appears to be 60-90 m<sup>3</sup>/s, and that at flows less than 60 m<sup>3</sup>/s there is a substantial reduction in both the number and total area of secure nesting sites (para. 2.110). He also presented hydrological data demonstrating that these flows, which occur naturally in the peak spring-early summer breeding season and are already affected by existing water takes, would be substantially compromised under the proposed additional CPW takes (Fig 9).
32. Research undertaken for the Waitaki River (Boffa Miskell Ltd and Urtica Consulting 2007) demonstrates the importance of the ‘moat effect’ of braided river hydrology in reducing predation of ground nesting birds. The Waitaki study indicated braid flows of as little as 0.059 m<sup>3</sup>/s appeared to provide a measure of protection against predation, so maintaining flows of almost any size in braids is of some benefit. However the moat effect is relative, not absolute: its efficacy will vary depending on predator species, predator abundance and other site conditions.
33. Earlier studies (Pierce 1987, Pascoe 1995) in Mackenzie Basin rivers showed that water barriers do not simply limit all predators. Rather, this research showed that channels of different sizes limit different species (e.g. virtually any water stopped hedgehogs, but moderate flows were required to stop ferrets and cats). Pierce (1987) indicated that braid flows of > 3 m<sup>3</sup>/s were required to reduce risk of predation at his study sites. However, both these studies were limited in that they did not examine a wide range of flows or channel configurations.
34. Given that all the main predator species can swim to some extent, and that some are strong swimmers (Duncan et al. 2008 in prep.), it would follow that reduced flows offer a diminished level of protection for birds nesting on islands. More quantitative experimental research is required to assess the relationship between mammalian predation and flows on the Waimakariri River.
35. In looking at modelled flows of 60-40 m<sup>3</sup>/s, Dr Hughey’s analysis of effects conflicts directly with that of Dr Bishop for the applicant. Dr Hughey’s analysis indicated major reductions in secure bird habitat across the range of modelled flows that would “almost certainly” increase predation pressure on key species (Table 7 of his evidence); while Dr Bishop’s analysis was that changes in braid patterns due to the CPW scheme water take and consequent impact on bird predation would be “relatively minor” (para. 34 supplementary evidence).
36. While both Dr Bishop for the applicant and Dr Hughey presented comparative braid flow-depth modelling for the same section of the Waimakariri River, the applicant’s information appears considerably less sensitive, for example braid depths of 0.05 – 0.5m are aggregated into a single category (Attachment 1 of Dr Bishop’s supplementary evidence). This may explain, at least in part, the different interpretation of effects. Another explanation may be that in his analysis, Dr Bishop regarded any island as offering effective protection from predation. Dr Hughey was more precautionary and considered that even birds nesting on islands would still face increased risk of predation at reduced flows, while if flow reduction led to drying out of channels, then there would likely be even greater access by predators to nesting colonies.

37. Notwithstanding the contrasting interpretation of effects over the modelled 60-40 m<sup>3</sup>/s flows, it would have been useful for the applicant to also have modelled higher flows more typical of the Waimakariri during bird breeding season (e.g. 90-60 m<sup>3</sup>/s), and assessed effects of the CPW take at these levels.
38. I note that modelled higher flows have now been presented as part of the recent (July 2008) additional information received from the applicant. However no discussion or analysis of these modelled higher flow levels regarding effects of the CPW take on braided river birds was included with this new information.
39. The applicant presented no quantitative information about potential movements across channels by predators, or assessments of predation probability associated with different flow conditions. I concur with Dr Hughey in his opinion (para 2.111) that the applicant has underestimated the potential adverse effects of this issue on riverbed nesting birds.

#### Monitoring and mitigating effects of water take on braided river ecology

40. No monitoring for effects of the CPW water take on braided river ecology was proposed in the original application, so Dr Bishop's recommendation that monitoring should take place within a context of quantitative targets or thresholds (paras 22, 35 and 38, supplementary evidence) is supported. However the applicant has provided no details of monitoring procedure, thresholds or response in the event of thresholds being exceeded.
41. Monitoring exotic vegetation within the braided river bed should be relatively straightforward using a combination of aerial photography and/or satellite imagery, and ground survey at selected sites. I agree with Dr Bishop's suggestion that this monitoring should include assessment of any new weed encroachment into formerly open bird breeding habitat.
42. I support the submission of Dr Hughey that a condition of any consent granted should include a requirement to undertake monitoring that meets key decision criteria, and that the monitoring data should be publicly available (para 2.73). However, Dr Hughey provided statistical evidence (paras 2.69-2.72) to show that it is very difficult to reliably determine trends in numbers of key bird species on large braided rivers without major and ongoing investment in repeat surveys. Therefore any effect predicted to detrimentally impact on birds, and required mitigation measures, will be very difficult to monitor (para 1.17). This difficulty was also recognised by Dr Bishop (para 35 of his supplementary evidence).
43. Mitigation options proposed by the applicant include control of braided river weeds and predators (para 35-36). Dr Hughey agreed that weed control as a responsibility of CPW was a possibility, but noted it as an expensive commitment for which the funding source had not been clearly identified. However he considered mammalian predator control (by traps or poison) for protection of braided river birds to be costly, ongoing and of unproven benefit (para 1.23). I agree with Dr Hughey's opinion that the best known form of mammalian predator control is maintaining the natural river flows.

44. The difficulties in monitoring effects of the scheme in relation to population trends of threatened braided river bird species, and the limitations of current pest control methods are acknowledged by the applicant. Therefore if consent is granted and the scheme proceeds, as mitigation I recommend conditions on the water take that will maintain Waimakariri River flows as close as possible to natural levels during the critical bird breeding season (spring – early summer). This will help ensure sufficient food supply and provide a measure of protection against mammalian predators.
45. If consent is granted and the scheme proceeds, I recommend as a condition that the applicant also be required to develop a comprehensive monitoring and mitigation programme for weeds (both woody and herbaceous species) on the lower Waimakariri River. This programme should seek to identify and protect native plant habitats on the river bed and margins, and enhance the total area of suitable bird breeding habitat, with particular focus on river bed ‘islands’.

#### Effect of water take on riparian wetlands

46. I agree with Dr Bishop that wetland habitats alongside the Rakaia River are not likely to be affected by the proposed CPW abstraction, due to the provisions of the WCO and the relatively small size of the water take (para. 44).
47. Dr Bishop considered the impact of the CPW water take on Waimakariri River riparian wetlands as “likely to be relatively minor” (para 45), based on the groundwater modelling evidence of Mr Julian Weir presented on behalf of the applicant. Mr David Scott and Mr Peter Callendar presented evidence to this hearing as expert witnesses on groundwater modelling, for Canterbury Regional Council and Christchurch City Council respectively. They agreed that the effects of the abstraction on shallow groundwater levels in the vicinity of the Waimakariri River would probably be minor, although cautioning that inherent uncertainties in the modelling of Mr Weir make it difficult to judge the scale of the effect. They also noted that there will be a period of 3-5 years during which loss of Waimakariri River recharge would occur without the compensation of extra land surface recharge that CPW relies on to mitigate this effect.

#### Suggested conditions

48. If consent is granted and the scheme as proposed by CPW proceeds, I would recommend conditions requiring monitoring water levels and vegetation at key Waimakariri riparian wetland habitats because of the uncertainty surrounding this issue, and mitigation of any adverse effects detected. However, if the scheme proceeds but with a modified abstraction regime designed to better protect other ecological values by leaving more water in the river, such conditions will not be required.

#### Effects of bywash discharges on terrestrial ecology and wetlands

49. The applicant has provided no new information to address an acknowledged lack of detail concerning ecological values that may be present at the bywash discharge locations (para 61 of Dr Bishop's supplementary evidence).

#### Suggested conditions

50. A plan containing detailed information on the location, existing values, design and ongoing management of both the operational and emergency bywash discharge points is developed prior to granting of consent. This should contain measures (e.g. avoidance of significant natural areas, monitoring of effects and specified mitigation measures for adverse effects detected) to ensure that effects of discharges on terrestrial ecology and existing wetlands will be minor.

#### Effects of water use of terrestrial ecology and wetlands of Te Waihora/Lake Ellesmere

51. Effects of the CPW scheme on shoreline wetland habitats and birdlife of Lake Ellesmere were not specifically addressed in Dr Bishop's supplementary evidence, but effects on lake shore vegetation and water quality were examined in his principal evidence. The CPW scheme is predicted to affect lake water levels, as a result of increased flows to tributary streams and drains, and inflowing water quality. However the applicants have still not provided sufficient information to evaluate the impact of these changes on indigenous wetland habitats and the wildlife they support.
52. Dr Bishop states that there is a high amount of uncertainty in predicting effects of changing water levels and sources on the lake ecosystems (para 201, principal evidence). I agree that there is a high level of uncertainty regarding lake ecology in relation to changes in water levels and water quality (including salinity). The applicants have offered no new information to help resolve this uncertainty, yet Dr Bishop then claims that "vegetation changes due to salinity fluctuations and increased freshwater input are expected to be relatively small and localised, and vegetation responses to any increased nutrients negligible" (para 205, principal evidence).
53. No field measurements or modelling results are cited to support this assertion. There is also no analysis by the applicant of the effects of increased freshwater and nutrient inputs on the birdlife of the lake. The conclusion of Dr Bishop that the "overall effects of the CPW scheme on indigenous ecosystems of Lake Ellesmere are considered to be less than minor" (para 205) can not be supported on the basis of the information presented. More thorough investigation of these effects on the lake's nationally-significant vegetation and bird populations is required.
54. Evidence from expert witnesses for Canterbury Regional Council and submitters indicates that water quality downstream of the irrigation command area, including Lake Ellesmere and tributaries, will deteriorate as a result of CPW. Ms Hayward, Dr Larnad and Dr Hamilton all challenge the evidence of the applicant that changes in nutrient concentrations and loadings will be ecologically inconsequential. I concur with the opinion of Dr Hughey that this increase in nutrients will be detrimental for the lake and its birdlife (para 2.143 of his evidence).

55. Some generic options for effects management and mitigation around Lake Ellesmere are identified by Dr Bishop. However these management responses appear to be the responsibility of others, it is not clear specifically what mitigation CPW is offering for effects of the scheme on lake ecology, or what monitoring of effects would be carried out. In fact, Dr Bishop is reluctant to ascribe any future changes in the health of the lake to the operation of the CPW scheme (para 206-210, principal evidence).
56. This diffidence, although understandable given the complexity of lake ecology and the uncertainty surrounding prediction of effects, is not helpful for decision makers and submitters. Until more information is available, it is not possible to confidently assess effects of the scheme on lake shore vegetation and birdlife, and certainly not possible to assert that these effects will be “less than minor”.

#### Effects of water use on terrestrial ecology and wetlands within the scheme area

57. The consequences for terrestrial ecology of the main purpose of the CPW scheme, that is irrigation of the plains and agricultural intensification, although acknowledged (e.g. para 156 of Dr Bishop’s principal evidence), have still not been fully addressed by the applicant. Threats such as further clearance of remaining patches of indigenous vegetation and impact of shelterbelt removal on indigenous wildlife habitat (birds, lizards, invertebrates), are described in the evidence of Dr Meurk (para 36-42) and recognised in Section 4.2.2 of the CPW Ltd Sustainability Protocol (Mulcock 2008). I consider that Dr Bishop understates the seriousness of these threats in paragraphs 8-9 of his supplementary evidence.
58. I agree with Dr Bishop that protecting any as yet unrecognised areas of indigenous habitat in the Central Plains scheme area is important, and that the highly modified nature of the wider environment means these areas are likely to be ecologically significant. However, Dr Bishop also acknowledges that there is no specific compulsion in the Sustainability Protocol to carry out surveys for areas of unrecognised indigenous habitat (para 49 supplementary evidence).
59. I have seen the most recent draft of the CPWL Sustainability Protocol (Mulcock 2008) and farm management plan template. While “biodiversity and ecosystems” are discussed in these documents, specific *requirements* to avoid disturbance to or mitigate effects on terrestrial native vegetation and wildlife habitats are not included. For example, there are no requirements to protect remnant native vegetation/habitats that are not associated with waterways from clearance, cultivation or irrigation under CPW farm management plans. The use of indigenous species to replace shelterbelts for CPW water users will be “voluntary and will be encouraged” (para 16, Dr Bishop’s supplementary evidence), but is not a requirement.
60. Dr Bishop believes that indigenous dryland ecosystems will be resilient to adverse effects from irrigation and farm intensification “provided that adequate buffers are retained around any significant areas” (para 21 supplementary evidence). The Sustainability Protocol contains no requirements to protect such areas from irrigation, or any guidelines as to what constitutes an adequate buffer.

61. I support the requirements in the Sustainability Protocol to exclude cattle, deer and pigs from waterways and their margins (including wetlands), and that waterways are provided with appropriate riparian buffers to avoid or minimise adverse effects of water use and associated agricultural intensification.
62. I still consider that CPW's Sustainability Protocol/farm plan approach in its current form does little to ensure the avoidance, remediation or mitigation of potential adverse effects on terrestrial ecological values in the wider scheme area, and disagree with Dr Bishop on this issue (para 15 supplementary evidence).

#### Suggested conditions and mitigation

63. Protection of known areas of significant indigenous terrestrial and wetland habitats on CPW scheme properties should be secured prior to granting of consent to use water.
64. A thorough ecological survey of CPW properties should be carried out as a requirement of joining the scheme. Important sites for indigenous biodiversity and ecosystem protection throughout the scheme area need to be identified, risks assessed, and appropriate protection and/or mitigation measures specified in the relevant farm management plans.
65. Monitoring against baseline ecological values will need to be carried out, and response identified if monitoring shows management plan objectives are not being met. Ecological monitoring requirements and response to adverse affects should also be specified in farm management plans.

## References

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