

IN THE MATTER OF the Resource Management Act 1991

AND

IN THE MATTER OF applications by Central Plains Water Trust to:

Canterbury Regional Council for resource consents to take and use water from the Waimakariri and Rakaia Rivers and for all associated consents required for the construction and operation of the Central Plains Water Enhancement Scheme

Selwyn District Council for resource consents to construct and operate the Central Plains Water Enhancement Scheme

AND

IN THE MATTER OF a notice of requirement by Central Plains Water Limited to:

Selwyn District Council for the designation of land for works associated with the construction and operation of the Central Plains Water Enhancement Scheme

RIGHT OF REPLY EVIDENCE OF CRAIG DOUGLAS BISHOP

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Introduction

1. My name is Craig Bishop. I am a senior consultant ecologist. I work for Golder Associates (NZ) Ltd, based in Auckland. I have over twelve year's experience in terrestrial ecology and resource management issues. I hold the qualifications of Bachelor of Science and Master of Science (Honours) in Botany, and Doctor of Philosophy in Plant Ecology, from the University of Auckland. My particular areas of expertise include assessments of environmental effects, ecological significance assessment, plant ecology and restoration ecology.
2. In this right of reply evidence I will respond to some comments made by Dr Grove from Environment Canterbury (ECan) and Mark Davis (Selwyn District Council) in their respective supplementary evidence briefs.

Ongoing work on terrestrial ecological values within the CPW area

3. As directed by the Commissioners, there has been some recent consultation between the terrestrial ecologists representing the various interested parties, and me, in order to draft an agreed map of significant natural areas. To this end, Mark Davis (consultant ecologist for the Selwyn District Council) has prepared a map which identifies the location of all currently known areas of significant, or at least potentially significant, indigenous habitat within the CPW command area, the Waianiwaniwa valley and intake location surrounds.
4. This mapping exercise has been carried out in conjunction with Dr Grove (ECan), Dr Meurk (Forest and Bird), Mr Head (DOC) and me. Once the boundaries of these significant areas are delineated and digitised, it will be possible to identify locations where more detailed plans are needed to avoid or mitigate adverse effects on significant areas of indigenous vegetation and habitat. This would include significant sites which will not be directly displaced by CPW infrastructure, but where their close proximity to works means they may be adversely affected by construction activity, increased sedimentation, and/or alteration of drainage patterns.

Effects of works in river bed and river margins and terrace risers

5. To date, plans showing the location of infrastructure associated with the three CPW scheme intakes have been general arrangement plans and designation corridors, rather than detailed construction outlines. However, a reconnaissance survey of vegetation associations along the routes of the Rakaia and lower Waimakariri intake canals has shown that, with the exception of some key sites outlined below, vegetation is overwhelmingly dominated by exotic species such as broom, gorse and pines.
6. I agree with Dr Grove and Mr Davis that the current location of the intake structures and canals, as outlined in the general arrangement plans, could affect some habitats which have

already been identified as significant sites and/or which may have value as habitat for indigenous flora and fauna. To date these include the sites listed below, which are all associated with the intake and headrace canals to the tops of the main terrace risers.

- (A) Some dryland vegetation on steep slopes above the upper Waimakariri tunnel intake lies within the designation corridor. A careful approach to construction will be needed here to minimise damage to indigenous shrubs on the steep slopes above the existing canal intake. Following a more detailed assessment of the damage likely to be caused by different construction approaches, conditions for this site should include specific guidelines on which areas may be affected by construction and which are 'protected'. The limited extent of the site and native plants present means it may be possible to designate individual trees as 'able to be cleared', 'try to protect but may be affected' and 'protected'. The most appropriate mitigation for disturbed habitat would be establishing replacement habitat in the same area, although there are obvious technical difficulties associated with 'like for like' mitigation in this case. This site is labelled in Figure 2 in my evidence in chief;
- (B) An area of willow-dominated wetland vegetation (with scattered flax, cabbage tree and *Coprosma propinqua*) approximately 1km south-east of the lower Waimakariri intake. The current intake crosses the western 'arm' of this site and will disturb at least 2.5 ha of habitat on the margin of this site (i.e. it does not increase the fragmentation of the remaining area). The large size (c. 30 ha) and current level of weed infestations within this site means there is ample scope for mitigation through weed control and re-planting of native species in the remaining area. Care should also be taken to ensure that the current water supply is retained to this wetland site, through culverting of existing water supply or diversion of additional water sources if necessary;
- (C) Westwood Terrace wetland, which is crossed at its lower margin by the canal associated with the lower Waimakariri intake. Avoidance and mitigation measures will largely follow those outlined for (B) above. Disruption to water input is less likely in the case of this site, and it may be possible to increase the water levels in the wetland above the canal. This site is labelled in Figure 2 in my evidence in chief;
- (D) Keens Road Wetland, which is situated near the upper Waimakariri tunnel entrance. The designation corridor lies outside the boundary of this wetland, as mapped in the 'significant wetland database' for the Waimakariri River, and shown in Fig 33 of Mr Lewthwaite's evidence in chief. However, a reconnaissance survey and aerial photographs indicate that patchy areas of wetland vegetation, with a similar composition to the significant site, extend beyond its western boundary and into low lying areas which may be affected by CPW scheme. A more detailed survey of the exact distribution of

indigenous plants will be undertaken at this site to determine the disruption to indigenous vegetation associated with the final infrastructure layout, and the need for any mitigation. However, weed control and enhancement through restoration of indigenous wetland habitat is feasible in the immediate vicinity. It will be important to ensure that the current supply of water to the wetland areas downstream of the canal and tunnel intake is not disrupted;

- (E) Several willow dominated wetland 'fingers' and open ponds in low lying channels, situated just north of the broom covered fan of the Kowai River, are inside the designation corridor for the upper Waimakariri intake works. In the vicinity of the flow control gate, fish screen and fish return pipe as labelled in Figure 6 of Mr Lewthwaite's evidence in chief. Wetland vegetation appears to be confined to narrow bands, and some avoidance of this habitat may be possible through a relatively small (c. 50m) movement of infrastructure. However some disturbance of this habitat will almost certainly occur during construction. Once again, there is ample scope for mitigation in the immediate vicinity of the site through willow control in wetland areas, broom control on dry terraces, and/or the restoration of indigenous wetland habitat.
- (F) An area of vegetation containing patches of kowhai, cabbage tree, flax and other indigenous species on the Rakaia canal route which lies approximately 500m south-east of the lime quarry. This site is presently intersected by a part of the designation corridor. The exact distribution of indigenous plants within this area is unknown at present and requires more survey work to occur in conjunction with the drafting of infrastructure plans. Aerial photo analysis suggests that most of the indigenous plants are outside, or just on the edge of the designation envelope. This may allow the canal to be relocated to avoid the site altogether, or at least impact on only a small section of the site margin. Mitigation options are similar to those already outlined for the other sites.
- (G) An unidentified number of small (5-10m diameter) patches of open rock and river gravels, with scattered indigenous cushion and herbaceous plants, are found within the dense broom infestations on river terraces at the Rakaia and upper Waimakariri intake sites. It is likely that a small number of these patches will be affected by the infrastructure associated with canal intakes. Relocation of these plants through physical removal of their rocky substrates, creation of new areas of open habitat (through broom control) and establishment of new populations is recommended for avoidance and mitigation. The small areas that are likely to be affected mean this should not require the commitment of a large amount of resources.

7. As outlined above, the formulation of final construction plans in all these key areas will be informed by much more detailed field surveys which will be used to: adjust the location or

routes of canal infrastructure; inform the approach to construction in sensitive areas with the goal of minimising disturbance to surrounding vegetation and habitats (e.g. clearance and removal of vegetation in a manner that minimises mortality of any wildlife present, and allows them to move to nearby unaffected locations); and for calculation of suitable mitigation/biodiversity offsets, and detailed plans in relation to how this mitigation will be carried out, where avoidance is not possible.

8. There are also scattered examples of indigenous plant species such as cabbage tree, *Coprosma propinqua*, bracken and *Muehlenbeckia australis* which grow within the canal designation corridor along the main terrace risers. In some locations these species may be found together, forming small (10 – 30m wide) patches of vegetation with a much higher percentage of indigenous biomass. More precise field surveys to pin-point the locations of these scattered ‘patches’ will be conducted in conjunction with the preparation of a detailed construction outline plan. As the current designation envelope leaves some room for adjusting the exact line of the canal route along the terrace riser, this will be optimised to avoid as much indigenous vegetation as possible. Where indigenous plants cannot be avoided, some form of mitigation (using weed control and planting of the same sorts of indigenous species that are being displaced) will be carried out.
9. The scattered, low density distribution of indigenous plants along most of the canal corridor means that very high mitigation ‘multipliers’ (in terms of numbers of indigenous species replanted vs. number disturbed) are achievable with only a moderate commitment of resources. It is essential that these mitigation plantings are sourced from local genetic material and are monitored and managed to ensure that they are able to establish on these harsh sites.
10. The potential for construction works to have a negative influence on nearby indigenous vegetation that is not directly affected by clearance (e.g. through fragmentation of larger sites, increased erosion and/or alteration of hydrological regime) will also be assessed as part of the detailed planning process.
11. The total area of the intake works comprises a very small proportion of the total riverbed of the Waimakariri and Rakaia Rivers (c.0.4% of the Waimakariri riverbed and low terrace formations below the upper intake and c.0.1% of the Rakaia below Rakaia Gorge). Therefore, provided these structures avoid highly significant indigenous vegetation and habitats, their construction is unlikely to have serious adverse effects on the overall values in these river beds.
12. I agree with the comments of Mr Davis and Dr. Muerck surrounding the likely difficulties associated with restoration of new indigenous habitat in these locations, given the harsh nature of soil conditions associated with many parts of the terrace and terrace risers. For

these reasons any restoration carried out by CPW should be focused on outcomes (e.g. “X” area of habitat created with “Y” density of indigenous species or the restoration of specific ecosystem processes). Restoration may need ongoing monitoring and active management for a much longer time period than would be usual during other restoration projects.

13. As pointed out by Mr Davis, restoration works will need to be tailored to specific site values and circumstances, and should aim to extend, enhance (through weed control) and link areas of existing indigenous habitat surrounding the canals.
14. I agree with the suggested conditions and mitigation in relation to the construction of intake structures outlined by Dr Grove in points 12 – 15 of his supplementary evidence. However, the calculation of the correct ‘multipliers’ for biodiversity offsets should be in accordance with international best practice approaches for these sorts of offsets, or appropriate national guidelines if these are adopted by statutory conservation authorities in New Zealand. Such calculations would include a consideration of the relative age of the disturbed vs. restored areas of habitat (as pointed out by Dr Muerk and Dr Grove), but would not be based solely on this criteria. Other biodiversity indicators such as the level of weed infestation, species diversity, range of structural classes, and value as wildlife habitat, in both the ‘disturbed’ and ‘restoration’ sites, are also important considerations.

Effects of water use on terrestrial ecology in the CPW command area

15. Dr Grove and other submitters have expressed concerns about the possible impact of agricultural intensification on indigenous ecosystems within the CPW command area, the lack of information surrounding the location of small remnants indigenous flora and fauna, and the current voluntary nature of many aspects of the sustainability protocol.
16. I believe the key point here is the extremely modified nature of most of the CPW command area. While there are likely to be as yet unidentified areas of indigenous habitat, according to the NZ Landcover Database, less than 1% of the CPW command area is characterised by indigenous ecosystems. This gives ample scope both for concentrating development in areas with no indigenous habitat, and proving real benefits through the planting of new areas of indigenous vegetation. However, it also reinforces the ecological significance of the remaining remnants of indigenous vegetation, and the need to provide for their protection, enhancement and long term management within the auspices of the CPW biodiversity protocols.
17. As pointed out in my evidence in chief, the implementation of sustainable land management practices should be a compulsory component of subscribing to the CPW scheme, and must be monitored and enforced if any biodiversity gains are to be realised. Therefore I agree

with Dr Grove's recommendations that the following 'biodiversity management actions' should be a requirement of participation in the CPW scheme:

- (a) farm development should include a detailed survey of existing indigenous habitats and values associated with specific locations, which would be peer reviewed by Council or DOC officers;
 - (b) indigenous values associated with all areas (rather than just wetlands and stream corridors) should be protected;
 - (c) use of appropriate indigenous species should be a compulsory requirement of any re-planting programme where planting is to adjoin or link existing indigenous remnants;
 - (d) guidelines on adequate buffers for areas of important indigenous habitat should be established, and the adequacy of these buffers should be confirmed through long-term ecological monitoring (against baseline values) of the most ecologically significant indigenous sites (i.e. Plains PNAP survey category A, B and C sites).
18. The 'ecologically significant sites database' prepared by Mark Davis can be used to identify the most significant habitats within the CPW command area. Restriction on development within, and in agreed buffer zones surrounding, these areas should be an obligation of participation in the CPW scheme. The database can also be used to target baseline monitoring and restoration/ rehabilitation efforts, although I believe these activities should be concentrated in the more significant sites (i.e. Plains PNAP A, B and C rank sites, rather than D rank areas).
19. The 'ecologically significant site map' prepared by Mr Davis includes all known areas of indigenous habitat. This includes Plains PNAP rank D sites which, given their relatively modified nature and/or limited extent, would not be considered as significant sites in many other Ecological Districts.

Effects of scheme on values within the Waianiwaniwa Valley

20. I agree with Mr Davis that the establishment of natural wetland vegetation around the reservoir margin is not a practical proposition, given the extreme fluctuations in water levels. However this does not preclude the establishment of an (albeit narrow) buffer of indigenous shrubs around the margin which are resistant to occasional inundation. Such plantings would dramatically increase the presence of indigenous shrubs and trees within the Waianiwaniwa Valley. Indigenous vegetation could also be established around the mudfish canals, which will be permanently watered.

21. I agree with Mr Davis's comments that any newly created wetlands are likely to be (at least in the short term) a poor substitute for the areas they are replacing, but in my opinion establishment of replacement wetlands with similar species compositions is technically feasible.
22. I accept that the peat bog described by Dr. Meurk and Mr Davis in their evidence is highly significant, will be destroyed by inundation and is impossible to recreate; given the slow accumulation of peat over very long time spans in these systems. Some type of biodiversity offset mitigation will therefore be needed to account for this negative environmental effect. If the mitigation is to be as close to 'like for like' as possible it will need to be associated with an existing, nearby peat wetland which will remain unaffected by the CPW scheme. Restoration of peat wetlands by physical removal and re-siting of large 'turfs' of the affected wetland habitat is a possibility, but is technically difficult and would still destroy or degrade many of the values associated with the current site.

Effects of scheme on braided river birds

23. Dr Grove and other submitters are in general agreement that the proposed CPW water take will have only minor effects on birds in the Rakaia River.
24. A number of submitters, including Dr Grove and Dr Hughey, have identified a range of possible negative effects on braided birds in the Waimakariri River resulting from the CPW water take. These include changes in rates of predation (due to a reduction/ change in the 'moat effect' of individual braids), changes to food supply, weed invasion of breeding or feeding habitat, and the possibility of complex interactions between these factors leading to an increase in predation and/or loss of habitat through other sources.
25. Dr Grove, Dr Hughey and others rightly point out a lack of quantitative data surrounding how changes in these three factors, and interactions between them, combine to determine the breeding success and survival of braided river birds. The CPW water take will certainly change both the pattern and flow levels in the river braids. However, separating out the effects of these changes in water levels on braided river birds from other natural factors (e.g. the population dynamics of predator species and extreme weather events) or artificial disturbances (e.g. nest disturbance by 4WD vehicles or disturbance of birds by recreational users leading to nest abandonment) is problematic.
26. The key point here is the high level of uncertainty surrounding the potential effects of the CPW scheme on braided river birds, and the severity of these effects. I therefore recommend there should be some requirement for CPW to monitor the population and survivorship of key braided river bird species and weed invasion of their habitats. Should the CPW water take be shown to be having adverse effects on these birds, then management

actions to reduce or eliminate these effects, and/or mitigation such as weed and predator control, will be necessary. The amount of mitigation should be designed to achieve a 'no net loss' for braided river birds in the Waimakariri.

27. While this type of monitoring is inherently difficult (given the scale over which effects could occur and the multiple, interacting drivers which may affect breeding success) it is not impossible if there is the will (and statutory requirement) to commit the necessary resources. A potential benefit of this work is the greater understanding of the ecology of braided river systems which would stem from this type of research and monitoring.
28. Dr's Hughey and Grove agreed that weed control is an appropriate, albeit expensive, form of mitigation if the CPW water take is shown to be increasing the rate of weed establishment within the braided river bed.. The benefits of active mammalian predator control (e.g. using poison or traps) are less proven at this time. However, research into the most appropriate methods for predator control could be carried out in conjunction with the weed and bird monitoring programme.
29. Project River Recovery, situated in braided river beds of the upper Waitaki Basin, provides an example of a programme which, due to the commitment of resources over a long period of time, has had some measure of success in maintaining relatively weed free areas, restoring critical habitat and maintaining and increasing bird populations in key locations. Adoption of a similar approach to the active management of braided river birds in the Waimakariri could be adopted if monitoring detects any negative effects.

Effects of scheme on vegetation and wildlife in Te Waihora/Lake Ellesmere

30. In the large catchment area of Te Waihora (much of which is outside the CPW irrigation area), there is potential for both positive and negative effects on indigenous habitat and wildlife from altered freshwater and/or saltwater inundation regimes. Interactions with weed (particularly willow) invasion means that assessing the likely positive and/or negative impacts of the CPW scheme on the ecology of the lake is a complex and inherently uncertain undertaking.
31. However, in my evidence in chief I outlined several different lines of reasoning which suggested that these effects may be relatively minor, including:
 - (a) Dr Grove and other submitters suggest that the increase in nutrient concentrations will be detrimental to the lake and its birdlife. In order to assess this effect, I have relied on the evidence of Mr Tipler, whose modelling suggests that the CPW scheme will have only a negligible impact on nutrient concentrations in Te Waihora;

- (b) The increased freshwater flows which will result from the CPW scheme are likely to have a positive impact on indigenous wetland vegetation; reduction in freshwater flows having been identified as one of the main threats to the lake.
32. I agree with Dr Grove's statement that there needs to be some more certainty surrounding the details and level of monitoring which CPW would carry out within Te Waihora, and the type of mitigation that would be carried out if any adverse effects were detected.
33. Willow control seems to offer the best potential for mitigation. The negative impacts of willow invasion on bird habitat, native fisheries, sea-run brown trout fisheries and indigenous wetland vegetation in Te Waihora have been noted by a number of different experts, and willow control mitigation would therefore provide real benefits for a wide range of indigenous species within the lake.

Effects of bywash discharge structures

34. I accept that there is currently a lack of detail surrounding the relative extent and values of indigenous ecosystems at the various bywash discharge locations. However, I believe the risk of adverse environmental effects associated with their construction is relatively minor, for the following reasons:
- (a) The 'footprint' of these structures are relatively small in relation to the CPW works as a whole, which limits their potential impact on indigenous vegetation;
 - (b) The highly modified nature of the Central Plains environment means bywash discharge locations are likely to be dominated by introduced species;
 - (c) Detailed surveys of individual sites will be carried out prior to construction in order to identify and avoid indigenous vegetation;
 - (d) The wetlands created as part of the discharge works will use indigenous species, increasing the extent of this type of habitat.
35. I agree with Dr Grove's requirement for more detailed surveys of the locations where bywash discharge structure and wetlands will be constructed, to avoid existing areas of indigenous vegetation. It is highly likely that significant areas can be avoided. If this is impossible then indigenous communities with a similar composition to those disturbed would be restored at a nearby location, using the principles of 'no net loss' of indigenous biodiversity.

Value of ephemeral quarry ponds as bird habitat

36. Mr McAnergney has raised the issue of increased bird strike, due to birds utilising ephemeral ponds in the bases of quarries located close to the Christchurch Airport. Groundwater modelling suggests the water table could potentially form ponds in the base of these quarry pits once every four years on average.
37. Use of these quarries by birds will depend on the length of time that water is present in their bases, the season in which this occurs, the depth and vegetation cover within individual pits, and the level of bird disturbance due to activity in the surrounding quarry area. In my opinion the likelihood of increased bird strike risk is very low, provided the pits remain un-vegetated.

General comments and conclusions

38. The scale over which the CPW scheme will operate, and the complex interactions between many different components within this area, mean there is a relatively high degree of uncertainty surrounding both the benefits and negative environmental effects of this scheme.
39. The operation of such an inherently large and complex scheme means that not all potential effects of the scheme can be predicted in advance. However, as outlined in the Sustainability Protocol, CPWL and CPWT are committed to the implementation of a management and monitoring scheme to avoid and detect negative effects in significant ecological sites, and to the continued improvement in policies and practices.
40. The implementation of sustainable land management practices must be a compulsory component of subscribing to the CPW, and must be regularly monitored and enforced if the adverse effects of the CPW scheme are to be mitigated and the enhancement of natural biodiversity values realised.

Craig Bishop.

September, 2008.