IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of applications for resource consent by the Central Plains Water Trust and a notice of requirement for the designation of land by Central Plains Water Limited associated with the construction and operation of the Central Plains Water Scheme

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SUMMARY OF EVIDENCE OF JOHN HAYES ON BEHALF OF THE NORTH CANTERBURY FISH AND GAME COUNCIL AND THE DIRECTOR GENERAL OF CONSERVATION

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1. INTRODUCTION

Qualifications and Experience

1.1 My full name is John William Hayes.

1.2 I have the following qualifications: BSc Honours and PhD in zoology from the University of Canterbury. I am a member of the New Zealand Freshwater Sciences Society and the American Fisheries Society.

1.3 I have 27 years experience as a freshwater fisheries scientist. My expertise includes instream habitat modelling, general river and fish ecology, especially of trout and salmon, and recreational fisheries. After graduating with my PhD in 1984 I worked as a fisheries research scientist at the Freshwater Fisheries Centre of the Ministry of Agriculture and Fisheries until 1992. Between then and 1994 I held a similar position with the National Institute of Water and Atmospheric Research (NIWA). I have been employed as a senior fisheries scientist with the Cawthron Institute, Nelson since July 1994.

1.4 I have extensive experience with the science of environmental flow regime assessment. In 2007 I was included in a group of national experts in this field commissioned by the Ministry for the Environment to draft a National Environmental Standard on methods for establishing environmental flows.

1.5 I have experience with 1 dimensional and 2 dimensional hydraulic and instream habitat modelling as is routinely undertaken in the Instream Flow Incremental Methodology (IFIM) for assessing flow needs of instream values. I have developed habitat suitability criteria (HSC) for trout habitat and salmon angling habitat in New Zealand rivers for use in the IFIM and have reviewed trout and salmon HSC from overseas.

1.6 I also have experience with salmon fishability analysis, having investigated relationships between flow and/or water clarity and salmon angling conditions in the Rangitata (Davis et al. 1987, for Webb 2001) and Waitaki rivers (Hayes & Strickland 2002, Hayes 2006, 2007).

1.7 Examples of hearings in which I have given freshwater fisheries and instream habitat evidence include the:

- Buller River Water Conservation Order
- Motueka River Water Conservation Order
- Rangitata River Water Conservation Order
- Tongariro Power Development Resource Consents Hearing
- Otago Water Plan Appeal Environment Court Hearing
- Waitaki Water Allocation Board Hearing
- Trustpower's Wairau River Water Resource Consents Hearing
- Meridian Energy's lower Waitaki North Branch Tunnel Concept Water Resource Consents Hearing

1.8 I have over 42 years experience as a trout and salmon angler. I have fished all four of the major Canterbury salmon rivers, including the Rakaia and Waimakariri, and most of the minor salmon rivers. I also have some international salmon and trout fishing experience, mainly in North America.

Scope of evidence

1.9 I have been asked by the Department of Conservation (DOC) and North Canterbury Fish and Game Council ("Fish and Game") to present evidence on benthic invertebrates, native fish, trout and salmon, salmon angling, and bird habitat in the Rakaia and Waimakariri rivers

1.10 My evidence covers the following points:

a. Features to consider in setting environmental flow regimes for rivers, including;

   i. Instream values
   ii. Management objectives
   iii. Levels of habitat retention

b. Identifying instream values and their significance in the two rivers, including:

    i. Benthic invertebrates
    ii. Native fish
    iii. Trout and salmon
    iv. Birds
    v. Salmon angling

c. Habitat – flow relationships for instream values;

d. Relationships between flow and water clarity and temperature and their significance to salmon angling.

e. Individual and cumulative effects of the Central Plains Water ("CPW") Scheme flow regimes on the above values in the two rivers.

f. Options for mitigating adverse effects of abstraction.

g. Effects of the CPW Scheme river works, permanent structures, and discharges on the above values in the two rivers.

h. The adequacy of the CPW Scheme Assessment of Environmental Effects (AEE) and supporting reports for assessing effects on the above values.

1.11 All of the issues covered by this scope of evidence are within my area of expertise.

1.12 In preparing my evidence I have reviewed:

a. The Code of Conduct for Expert Witnesses (Rule 330A, High Court Rules and Environment Court Practice Note) and have complied with it in the preparation of this statement of evidence;
b. The CPW Scheme resource consent application and AEE;
c. Relevant parts of the Canterbury Natural Resources Regional Plan (NRRP) and Waimakariri River Regional Plan (WRRP);
d. Evidence presented on behalf of CPW by: Mr Tipler, and Lewthwaite, Dr Kennedy, Burrell, Allibone, Glova, Mabin, and Bishop.

e. Evidence presented on behalf of DOC and Fish and Game by: Mr. de Joux and Dr Olsen and Hughey, Mr Bejakovich and expert anglers.

f. The Section 42A officer reports

2. SUMMARY

Instream values

Aquatic invertebrates

2.1 No invertebrate species of conservation interest are known from the mainstems of the Rakaia and Waimakariri Rivers within the footprint of the CPW Scheme, although little sampling has been undertaken, especially in the Waimakariri River. Invertebrate densities vary greatly, depending on flow history, with floods generally suppressing densities.

2.2 Despite their variable and overall low abundance benthic invertebrates (particularly *Deleatidium* and Chironomids) provide the main food resource for native fish, trout and juvenile salmon, and birds in the Rakaia and Waimakariri rivers. Therefore they are critical to the life supporting, and productive, capacity of the rivers.

Native fish

2.3 Fifteen native fish species occur in the mainstems of both the Rakaia and Waimakariri rivers within the footprint of the CPW Scheme and they occur at relatively low densities probably owing to frequent floods. Two species of some conservation concern are longfin eel (gradual decline) and lamprey (sparse). Of those fish species that occur upstream of tidal influence to the intakes only two have fisheries significance – longfin and shortfin eels.

Trout and salmon

2.4 The Rakaia and Waimakariri rivers support regionally important trout and nationally important salmon fisheries and these occur with in the footprint of the CPW Scheme. The mainstem Rakaia trout fishery is based on brown trout and that of the Waimakariri is based on both brown and rainbow trout.

Birds

2.5 The Waimakariri and Rakaia rivers are of national and international significance, for the composition and diversity of bird communities, and abundance of some species, they support. The braided sections of the rivers host 18 - 19 native ‘wetland’ bird species, nine of which are of conservation concern. The rivers are particularly important for the large number and high proportion of the ‘threatened’ and ‘endangered’ black-fronted tern and wrybill populations they support.

Critical instream values

2.6 Salmon angling is the critical value for determining instream flows levels in the Rakaia and Waimakariri rivers during November to April because it is both highly valued and is the most sensitive to flow change. If flow decisions are based on salmon angling the flow requirements of all other instream values will be met by default.

2.7 Consideration also should be given to maintenance of benthic invertebrate habitat, especially over spring - summer, since this fundamental to the life supporting capacity of the rivers and is flow sensitive.

2.8 Bird habitat, particularly of black-fronted terns and wrybills, also needs attention over the breeding season (August – January and especially the peak in September – December).

Ecologically relevant flow statistics

2.9 Food and space (in which to feed or breed) are two key seasonal requirements of fish and bird populations. The effects of flow change on space requirements of fish are assessed relative to habitat sustained at the mean annual low flow (MALF) and effects on feeding opportunities (and related production potential) are assessed relative to fish and invertebrate habitat sustained at the median or monthly summer (December – March) median flows. Similarly effects on bird feeding are assessed relative to bird and invertebrate habitat sustained at the monthly spring peak breeding season (September – December) median flows.

Effects of CPW Scheme abstraction on instream habitat

Waimakariri River

Figures 3, 5, 7, 12

Sensitivity of habitat to flow

Critical values and habitats - Slide

2.10 Because the CPW flow scenarios will not change the MALF appreciably the cumulative effect on annual habitat carrying capacity of native and salmonid fishes is small – no more than about 3 – 10% depending on the species/life stage.

2.11 However, there are also potential effects on seasonal feeding opportunities and related production of fishes, and breeding success of birds, through reducing their median monthly habitat and that of their invertebrate food supply. Cumulative effects on habitat availability for native and salmonid fishes over critical summer months range from small to moderate. Predicted cumulative habitat losses at median monthly flows over summer (December – March) for native fishes range between 8% and 28% and for juvenile salmon and adult brown trout habitat 4 – 16% and 10 – 18%, respectively. Predicted cumulative habitat losses over the critical peak spring breeding period (September – December) for black-fronted terns and wrybills range between 2% and 18%.

2.12 The cumulative effects of the CPW Scheme on the flow regime of the Waimakariri River are greatest during typical years rather than in dry years because the river often naturally falls below the minimum flow during dry years restricting abstraction for long periods. This means that the CPW Scheme will effectively reduce the average productive and life supporting capacity of the river.

2.13 Median losses of invertebrate habitat will be as high as 19 – 26% during some critical months (December – March) for feeding by fish and nesting birds. These are more than minor effects on the potential life supporting capacity of the river given the high fisheries and bird conservation values at stake. However, whether these invertebrate habitat losses will translate to effects on fish and bird populations depends on whether food is limiting but there is insufficient information to determine this with confidence.

2.14 Given their relatively low densities, space may not be limiting native fish and salmonid fish populations but I am concerned about the effect of the cumulative invertebrate habitat losses (19 – 26%) on maintenance of food supplies for fishes – particularly trout and juvenile salmon.

Rakaia River

2.15 Because the proposed CPW Scheme abstraction from the Rakaia River will have only a small influence on the river's flow regime the isolated effects of the CPW Scheme abstraction on instream habitat for fishes, birds and their benthic invertebrate food supply will probably be minor and the cumulative effects may be minor. However, insufficient information has been provided by the applicants to reliably determine this. In particular they have not conducted any instream habitat modelling on the Rakaia River. Historical empirical habitat – flow relationships on which CPW has based much of its assessment of effects are subject to a high degree of uncertainty and may underestimate the sensitivity of habitat to flow change for some instream values.

Effects of CPW Scheme abstraction on salmon passage

Waimakariri River

2.16 Instream habitat modelling at Crossbank indicates that a minimum flow of 41 m^3/s will provide continuous fish passage depths > 0.3 m in the deeper channels. While this exceeds the 0.25 m minimum depth requirement for salmon passage, radio tagging research has indicated salmon experience difficulty migrating upriver at this flow during dry years.

2.17 Although the CPW Scheme abstraction will not draw flows lower than this, the cumulative effect will cause the river to become shallower overall for longer by truncating flood recessions which are important for salmon migration. These changes in flow and depth are likely to delay upstream migration by salmon and increase abrasion on their bodies which has adverse consequences for migration energetics, mortality, and ultimately reproductive success.

2.18 The CPW Scheme will add to existing abstraction extending the adverse effects on salmon passage from dry to typical flow years. The result will be that salmon will encounter difficult conditions for upstream migration in most years during the critical February – March period, largely as a result of cumulative effects of water abstraction.

Rakaia River

2.19 The CPW Scheme abstraction will not adversely affect adult salmon migration in the Rakaia River because the monthly minimum flows during the salmon migration period applying under the Rakaia Water Conservation Order (129 - 95 m^3/s – November to June) substantially exceed the flow (68 m^3/s) that provides minimum passage depths (0.25 m) at the Gorge.

Effects of CPW Scheme abstraction on salmon angling

Waimakariri River

2.20 Of all the instream values in the Waimakariri River, salmon angling will be the most severely affected by the CPW Scheme. Suitable salmon angling habitat losses of 27% (WUA) to 54% (angling lies) due to the CPW 20/40/220 flow regime will add to habitat losses due to the existing flow regime to produce cumulative losses relative to the naturalised flow regime of 51 – 74%.

2.21 The effects of the CPW Scheme on salmon angling habitat will be compounded by effects on water clarity. When water clarity is 1 – 2 m at the Gorge clarity reduces (i.e., water gets dirtier) downstream at flows greater than about 40 m^3/s and the difference in clarity increases with increasing flow. The decrease in clarity with distance downstream would benefit salmon angling when clarity at Gorge is in the 1 – 2 m range, because clarity at some flows will fall into the optimal range (0.4 – 1 m) by the time the water reaches SH1 Bridge, and this benefit increases with increasing flow. Cumulative abstraction will substantially reduce this water clarity benefit to salmon angling (by 110%) and the CPW abstraction alone will reduce the benefit by 27%. This will adversely affect fishability.

Figure 16

Relationship between flow and water clarity: Waimak

Excerpt from Supplementary Evidence

Table 1 from Supplementary Evidence

However, the effect of abstraction on days when clarity at SH1 Bridge falls in the optimal range for salmon angling (0.4 – 1 m) is small – only 2 days difference between the naturalised and other flow regimes. Moreover, the adverse effect is confined to "A" permit abstraction (cf. naturalised versus pre-CPW in Table 1) because the 1 – 2 m clarity range is associated with flows < 63 m3/s (i.e., the minimum flow for "B" permit abstraction). The effect of "A" permit abstraction will not be confined to optimal days for salmon angling though. The natural reduction in clarity downstream with increasing flow within the 1 – 2 m clarity range will not be as great with abstraction and this will be adversely affecting salmon angling in these clearer water, lower flow conditions.

Figure 9
Preferred flows for salmon angling: Waimak

2.22 Waimakariri salmon anglers preferred fishing flows in the range 50 – 80 m^3/s. The number of days that the flow is in the optimal range for salmon angling will decline by 49% post CPW compared with pre-CPW, and by 59% as a result of cumulative abstraction. These are underestimates owing to water clarity not being taken into account in the analysis of preferred angling days.

Excerpt from Supplementary Evidence

In my supplementary evidence I present salmon catch versus flow data recorded by Mr Dirk Barr, upstream of the Waimakariri SH1 Bridge, that shows he caught most of his salmon over the flow range 50 – 89 m^3/s and his highest catch rate was at 80 – 89 m^3/s.

Figure 2 and 3 from Supplementary Evidence
Dirk Barr's catch and catch rate figures

2.23 These major adverse effects on salmon angling habitat and lesser effects on water clarity which I have described will compound to significantly reduce salmon angling opportunities in the Waimakariri River. Anglers will have much fewer lies to fish and suitable days for fishing.

Rakaia River

2.24 The effects on salmon angling in the Rakaia River will be smaller owing to the CPW Scheme and cumulative abstractions being smaller proportions of the natural flow. A salmon angling salmon days analysis undertaken by Dr Glova suggests that the CPW Scheme abstraction will have beneficial effects on salmon angling by slightly increasing the number of salmon angling days over existing levels but this analysis underestimates adverse effects because it also did not account for water clarity – flow relationships.

2.25 CPW have not provided sufficient information, by way of water clarity, flow and angling suitability data, to adequately assess effects on salmon angling in the Rakaia River.

Options for mitigating adverse effects of abstraction

Waimakariri River

2.26 1:1 flow sharing between "B" permits and the river at flows above the present "B" permit 63 m^3/s minimum flow will provide no mitigation benefit for fish habitat at the MALF because the CPW flow scenarios have little effect on the MALF. Flow sharing would mitigate cumulative effects on invertebrate habitat to a small degree (reducing habitat loss by about 7%). It would be of little to no overall benefit for adult trout and juvenile salmon habitat retention at monthly median flows, reducing summer (December – March) habitat loss for trout by up to 5%, but increasing habitat loss for juvenile salmon by the same amount. However, it would benefit native fish habitat a little, reducing summer habitat loss by up to 4 - 7%, depending on the species. There are no benefits for bird habitat in the peak breeding season (September – December) though because cumulative habitat losses are predicted to increase by up to 3%.

2.27 Similarly the CPW 20/40/220 with 100 m^3/s "B" permit minimum flow scenario would provide no mitigation benefit for fish habitat at the MALF. The higher minimum flow would mitigate cumulative effects of the post CPW 20/40/220 regime on invertebrate habitat to a moderate degree in summer (reducing habitat loss by up to 14), but it would increase habitat loss in spring (during the peak bird breeding season) by up to 6%. It would mitigate loss of adult trout and juvenile salmon habitat by a small degree, reducing summer (December – March) habitat loss for trout and juvenile salmon by up to 10% and 8%, respectively. The benefits are slightly greater for native fish, with habitat loss over the summer months reducing by up to 2 – 14%, depending on the species. The benefits to birds during the peak breeding season (September – December) are mixed, with 1 – 4% reduction in habitat loss in December but 3 – 4% increase in habitat loss in September, depending on species and habitat suitability criteria.

2.28 1:1 flow sharing would reduce cumulative loss of salmon angling habitat by only 5% and a 100 m^3/s "B" permit minimum flow would reduce it by 12%.

2.29 1:1 flow sharing would reduce the cumulative adverse effect on water clarity for salmon angling by 11% and a 100 m^3/s "B" permit minimum flow would reduce it by 25%.

2.30 Flow sharing or increasing the "B" permit minimum flow to 100 m^3/s could substantially mitigate the adverse cumulative effect of abstraction on the number of preferred salmon angling days. 1:1 flow sharing by "B" permits would increase the number of preferred salmon angling days from 24 days post-CPW (20/40/220 scenario) to 51 days (a 113% increase). Imposing a 100 m^3/s minimum flow on "B" permits would increase preferred salmon days to 70 (by 192%).

2.31 Alternative measures for mitigating effects of cumulative abstraction could include varying the WRRP to increase both the "A" and "B" permit minimum flows and placing an abstraction cap on "B" permits.

2.32 CPW has proposed a condition to mitigate effects of flat lining, such that if flows are at or below the minimum for more than 21 consecutive days abstraction will be delayed following a flow increase by 2 days or until the modified flow exceeds 100 m^3/s. This will do little to mitigate effects on salmon angling because the best flows for salmon angling occur in the early part of flow recessions, not on the increasing limb of the hydrograph.

Rakaia River

2.33 Adverse effects of existing and cumulative abstraction on salmon angling in the Rakaia River could be mitigated by increasing minimum flows between December and March to more closely match optimal salmon angling flows (160 to 180).

Effects of river works and permanent structures

Fish screen by-pass flow

2.34 An adverse effect of diverting 2 or 5 m^3/s for fish screen by-pass flows is that this may occasionally breach the minimum flow condition in the mainstem. It will result in habitat loss for invertebrates, fish and birds, and may adversely affect salmon passage, in the mainstem. The length of the affected reaches may be 3 – 5 km and appears to have been underestimated by CPW (2 – 3 km).

Adequacy of the CPW SCHEME AEE, supporting reports and evidence, for assessing effects

2.35 The AEE fails to address and quantify effects of the operation of the CPW Scheme on instream habitat and angling in the Waimakariri and Rakaia rivers.

2.36 The AEE and supporting reports and evidence are deficient in focusing on the effects of the CPW Scheme in isolation and not also addressing cumulative effects.

2.37 They are also deficient in overlooking or downplaying effects on habitat area – particularly the area of invertebrate habitat which is relevant to life supporting capacity.

2.38 The AEE completely overlooks the major adverse isolated and cumulative effects on salmon angling habitat in the Waimakariri River and the supporting evidence underestimates effects in both rivers by not accounting for effects of flow on water clarity.

2.39 No rationale has been presented for interpreting the magnitude of habitat effects in relation to the conservation and fisheries significance of instream values, and management objectives. This calls into question the basis for conclusions on whether effects are more than minor.