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

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BRIEF OF EVIDENCE OF CLIFFORD JOHN MAXWELL TIPLER

23 October 2009

BUDDLE FINDLAY
Barristers and Solicitors
Christchurch

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Qualifications and experience

1. My full name is Clifford John Maxwell Tipler.

2. My qualifications and experience have been presented to this Committee in my primary brief of evidence and have not been repeated here.

Scope of Evidence

3. I will provide in this section of my evidence, responses to questions from the Commissioners during the reconvened hearing of October 2009. This will include:

   - Low flow duration graphs,
   - Impact of Barrhill Chertsey Rakaia River water allocation on hydrology data presented,
   - Impact of Plan Change 1 on scheme reliability,
   - Flow and clarity for salmon angling,
   - Flow duration less than 55 m^3/s on Waimakariri and impact on braided river birds.

Low Flow Duration Graphs

4. The Commissioners asked why there was a difference in the Pre-CPW low flow duration graph in my Figure 3 (Section 6 evidence) to that in my Figure 26 in my first brief of evidence. The latest Figure 3 has fewer occasions in each low flow duration interval compared to the original graph. The reason for this is that there is a difference in the Pre-CPW assumptions for each graph, relating to the abstraction of winter water. For Figure 26, the assumption was that Waimakariri Irrigation Ltd and NTPL took 11.7 m^3/s of winter water and the remaining was available to CPWES. For Figure 3 the assumption was that only 5.6 m^3/s of winter water was taken by WIL and NTPL. There is also a difference in the Class A water available in September, with less water taken by WIL and NTPL for Figure 3 compared that for Figure 26. The reason for the changes was to align the before and after assumptions between Mr Duncan, Mr De Joux and myself. The effect of this is that less water is assumed to be taken by others in the Pre-CPW situation in Figure 3, therefore fewer days at the minimum flow are reported.

5. However the predicted increase caused by CPW remains the same. It is just the starting point that has altered, and in Figure 3, the consequential benefit of the 1:1 sharing is demonstrated by the very small change between the Pre-CPW and Post-CPW curves. The comparison in each case remains valid.

Barrhill-Chertsey Water

6. As outlined in by Section 6 brief of evidence, CPWES has negotiated access to 7 m^3/s of Barrhill-Chertsey (BHC) water. The result of this is to lower the demand from the Waimakariri River. The Commissioners have asked that my summary hydrological tables be updated to show the effect once CPWES no longer has access to this water. My Tables 4-7 in my Section 6 brief of evidence are presented below with the scenario of with-out BHC water (W/O BHC) included. These show that while the effect is greater than the "with BHC" case, the effect is still less than the "available" scenario.

Table 4: Frequency of flows within specified flow bands - updated October 2009

Scenario	Flow Band	Before CPW				After CPW			
		67-01	70/71	89/90	95/96	67-01	70/71	89/90	95/96
		Full Period	Dry Year	Typical Year	Wet Year	Full Period	Dry Year	Typical Year	Wet Year
Days total		12419	365	365	365	12419	365	365	365
1:1 Sharing 25 Max - Predicted	50 - 60m^3/s	1165	35	56	13	1244	34	56	14
1:1 Sharing 25 Max W/O BHC - Predicted		1165	35	56	13	1423	33	60	13
1:1 Sharing 25 Max - Available		1165	35	56	13	1568	39	72	20
30 Gap 25 Max - Available		1165	35	56	13	1165	35	56	13
1:1 Sharing 25 Max - Predicted	60 - 70m^3/s	1199	18	35	6	1100	16	37	9
1:1 Sharing 25 Max W/O BHC - Predicted		1199	18	35	6	1145	20	36	13
1:1 Sharing 25 Max - Available		1199	18	35	6	1226	26	34	14
30 Gap 25 Max - Available		1199	18	35	6	1199	18	35	6
1:1 Sharing 25 Max - Predicted	70 - 80m^3/s	1050	17	28	36	937	15	25	29
1:1 Sharing 25 Max W/O BHC – Predicted		1050	17	28	36	903	16	27	35
1:1 Sharing 25 Max - Available		1050	17	28	36	899	18	24	39
30 Gap 25 Max – Available		1050	17	28	36	1807	38	50	64

7. The above data have been broken down by month and are presented in Tables 4A – 4C following:

Table 4A Average year flow data

Month	Average Year (1989/90)															
	Days flow 50 - 60m^3/s before CPW	Days flow 50 - 60m3/s after CPW			Days flow 60 - 70m^3/s before CPW	Days flow 60 - 70m^3/s after CPW			Days flow 70 - 80m^3/s before CPW	Days flow 70 - 80m^3/s after CPW			Days flow 80 - 90m^3/s	Days flow 80 - 90m^3/s after CPW		
		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC
January	4	11	6	6	5	3	5	6	5	2	1	4	3	2	3	2
February	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
March	1	2	1	1	0	0	0	0	2	1	2	2	0	1	0	0
April	1	1	1	1	2	2	2	2	3	3	3	3	2	2	2	2
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
June	7	7	7	7	6	6	6	6	2	2	2	2	3	3	3	3
July	6	6	6	6	5	5	5	5	4	4	4	4	4	4	4	4
August	14	14	14	14	5	5	5	5	2	2	2	2	1	1	1	1
September	16	16	16	16	3	3	3	3	4	4	4	4	1	1	1	1
October	0	7	4	2	5	6	2	4	2	3	3	3	4	2	2	2
November	3	6	6	4	2	1	1	3	4	2	1	2	0	1	2	1
December	2	2	1	1	2	3	4	2	0	1	1	1	1	1	0	3
Total Days	56	72	62	60	35	34	33	36	28	24	23	27	19	18	18	19

Table 4B Dry year flow data

Month	Dry Year (1970/71)															
	Days flow 50 - 60m^3/s before CPW	Days flow 50 - 60m3/s after CPW			Days flow 60 - 70m^3/s before CPW	Days flow 60 - 70m^3/s after CPW			Days flow 70 - 80m^3/s before CPW	Days flow 70 - 80m^3/s after CPW			Days flow 80 - 90m^3/s	Days flow 80 - 90m^3/s after CPW		
		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC
January	1	3	3	1	1	1	1	2	2	0	0	1	1	0	0	0
February	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0
June	4	4	4	4	3	3	3	3	3	3	3	3	1	1	1	1
July	7	7	7	7	4	4	4	4	5	5	5	5	3	3	3	3
August	13	13	13	13	6	6	6	6	2	2	2	2	2	2	2	2
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	5	2	0	0	5	0	1	3	2	4	4
November	2	4	3	2	2	5	2	2	2	2	4	5	4	3	0	3
December	5	5	5	3	2	2	0	3	3	1	3	2	2	0	0	2
Total Days	35	39	37	33	18	26	18	20	17	18	17	19	16	11	10	15

Table 4C Wet year flow data

Month	Wet Year (1995/96)															
	Days flow 50 - 60m^3/s before CPW	Days flow 50 - 60m3/s after CPW			Days flow 60 - 70m^3/s before CPW	Days flow 60 - 70m^3/s after CPW			Days flow 70 - 80m^3/s before CPW	Days flow 70 - 80m^3/s after CPW			Days flow 80 - 90m^3/s	Days flow 80 - 90m^3/s after CPW		
		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC
January	4	8	6	3	1	2	3	7	6	2	2	2	2	3	2	2
February	5	4	4	5	2	3	2	2	2	3	2	3	3	2	1	1
March	3	3	3	3	1	2	1	1	1	2	1	2	1	1	1	0
April	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1
May	0	0	0	0	0	0	0	0	1	1	1	1	3	3	3	3
June	0	0	0	0	0	0	0	0	7	7	7	7	5	5	5	5
July	0	0	0	0	0	0	0	0	4	4	4	4	4	4	4	4
August	0	0	0	0	0	0	0	0	12	12	12	12	4	4	4	4
September	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	3	0	0	0	2	1	1	1	1	2	2
November	0	3	4	1	2	4	3	2	2	4	3	3	2	4	1	4
December	0	1	1	0	0	0	0	1	1	2	1	0	0	5	0	1
Total Days	13	20	19	13	6	14	9	13	36	39	34	35	26	33	24	27

8. Tables 5-7 of my Section 6 brief of evidence have been updated to include the "without BHC" scenario and are presented below.

Table 5 Average year flow data - Updated October 2009								
	Average Year (1989/90)							
	Days flow above 70 before CPW	Days flow above 70 after CPW	Days flow above 70 after CPW	Days flow above 70 after CPW	Days flow above 60 before CPW	Days flow above 60 after CPW	Days flow above 60 after CPW	Days flow above 60 after CPW
		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC
January	18	8	13	11	23	12	18	16
February	0	0	0	0	0	0	0	0
March	6	4	4	4	6	4	5	5
April	13	13	13	13	15	15	15	15
May	31	31	31	31	31	31	31	31
June	16	16	16	16	22	22	22	22
July	20	20	20	20	25	25	25	25
August	6	6	6	6	11	11	11	11
September	5	5	5	5	8	8	8	8
October	19	11	18	18	24	16	22	21
November	14	9	13	11	16	10	15	15
December	16	13	13	13	18	16	17	17
Total Days	164	136	152	148	199	170	189	186

Table 6 Dry year flow data - Updated October 2009								
	Dry Year (1970/71)							
	Days flow above 70 before CPW	Days flow above 70 after CPW	Days flow above 70 after CPW	Days flow above 70 after CPW	Days flow above 60 before CPW	Days flow above 60 after CPW	Days flow above 60 after CPW	Days flow above 60 after CPW
		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC
January	4	1	1	1	5	2	2	2
February	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0
April	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0
June	18	18	18	18	21	21	21	21
July	19	19	19	19	23	23	23	23
August	12	12	12	12	18	18	18	18
September	30	30	30	30	30	30	30	30
October	31	26	31	31	31	31	31	31
November	23	15	23	23	25	21	24	24
December	10	5	8	6	12	7	9	8
Total Days	147	126	142	140	165	153	158	157

Table 7 Wet year flow data - Updated October 2009								
	Wet year (1995/96)							
	Days flow above 70 before CPW	Days flow above 70 after CPW	Days flow above 70 after CPW	Days flow above 70 after CPW	Days flow above 60 before CPW	Days flow above 60 after CPW	Days flow above 60 after CPW	Days flow above 60 after CPW
		Available	Predicted With BHC	Predicted Without BHC		Available	Predicted With BHC	Predicted Without BHC
January	19	10	11	11	20	13	15	13
February	15	9	12	12	17	12	13	12
March	11	8	10	10	12	10	11	11
April	27	27	27	27	27	27	27	27
May	31	31	31	31	31	31	31	31
June	30	30	30	30	30	30	30	30
July	31	31	31	31	31	31	31	31
August	31	31	31	31	31	31	31	31
September	30	30	30	30	30	30	30	30
October	31	28	31	31	31	31	31	31
November	28	22	28	27	30	26	30	30
December	31	30	30	30	31	30	31	31
Total Days	315	287	302	301	321	302	311	308

Plan Change 1 impact on CPWES

9. Figure 1 below replicates Figure 2 below (from my Section 6 brief of evidence). It depicts the reliability of the CPWES if the Plan Change 1 (PC1) gap of 30 was implemented. The significant effects are a lowering of the reliability of the groundwater augmented half of the scheme from a minimum 95% in May to approximately 89% in March. The second major effect is the lowering of the run-of-river half of the scheme from 45% in February to 38%.

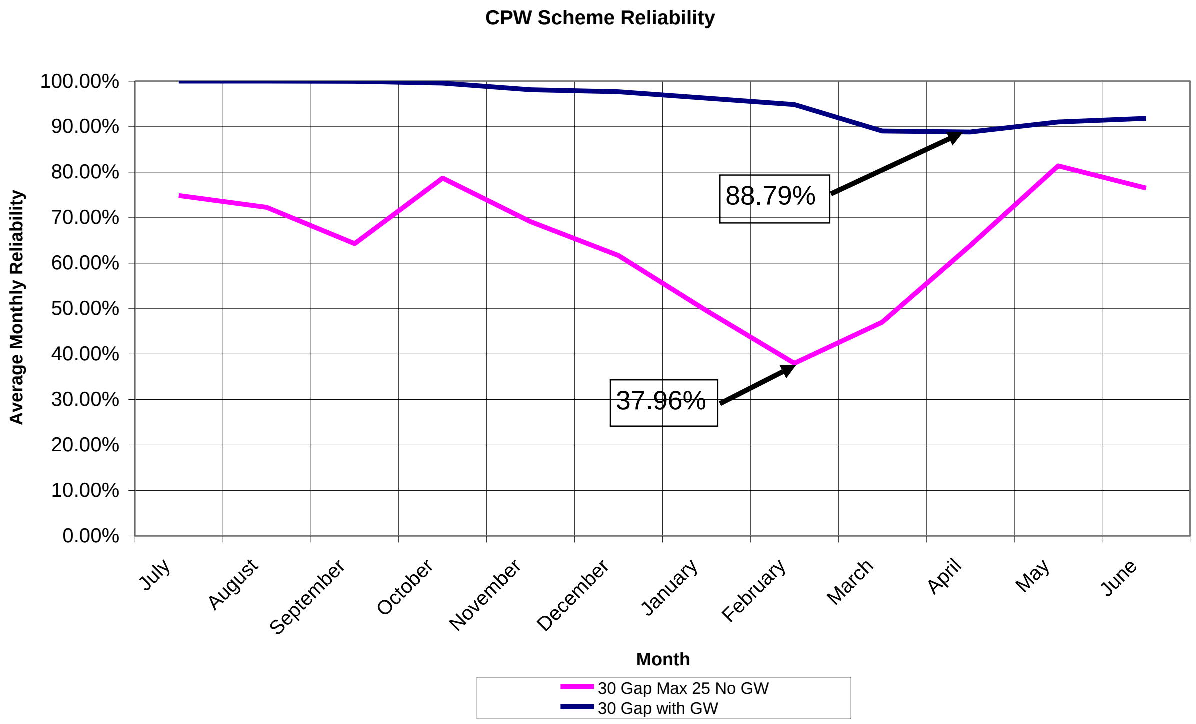

Figure 1: CPW Scheme Reliability for 30 Gap Max 25 Scenario

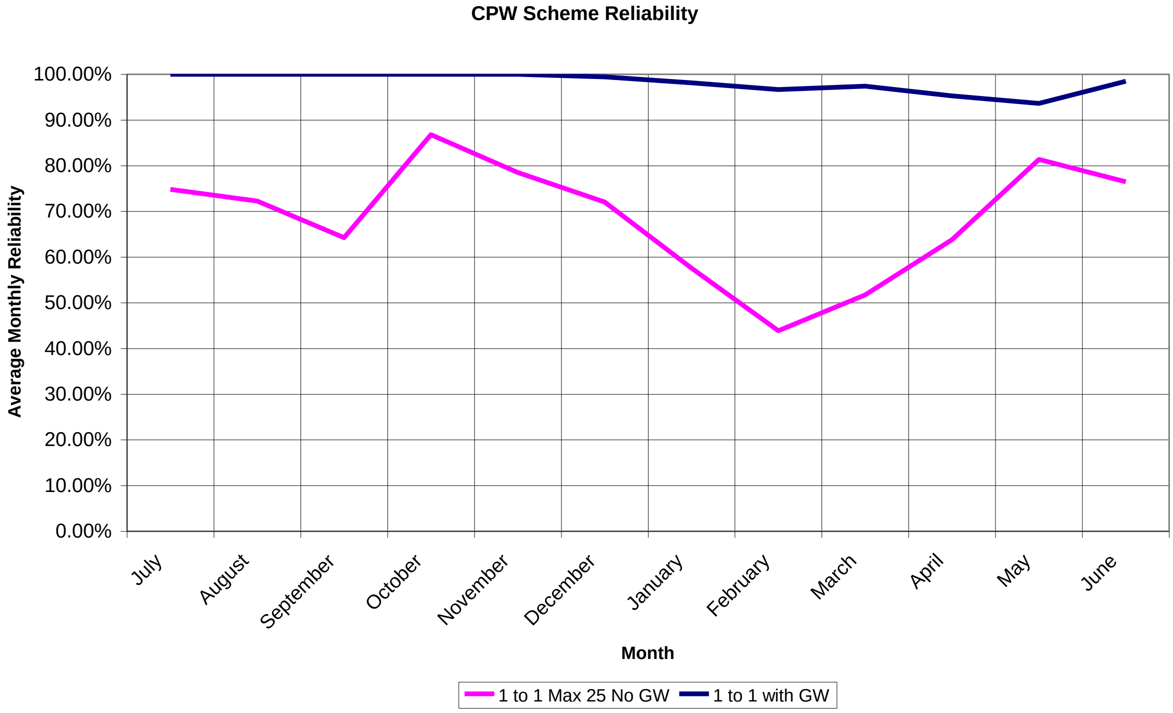

Figure 2: Revised Scheme Reliability – from Section 6 Brief of Evidence

10. Mr Macfarlane in his evidence at the reconvened hearing, explained how farmers would be likely to offset the low reliability for the run-of-river half in the months of Jan – Mar by installing on-farm storage equivalent to approximately 1500 m^3/ha. While the storage provided would not support intensive pastoral systems such as dairy farming, it would be sufficient to support mixed or arable farming options in his opinion.

11. To assess whether the reliability would be adversely affected by PC1, I have considered the reliability of the "no groundwater" half of the scheme if 1500 m^3/ha of on-farm storage was provided. Figure 3 below shows the reliability of the run-of-river half with and without the on-farm storage. The critical issue is the reliability through the early summer period, where Mr Macfarlane was of the opinion that for the 1:1 25 Max scheme, some on-farm storage was required. Without storage Mr Macfarlane thought that it was less likely that the scheme would be a "bankable" option for those farmers. The PC1 impact over that critical period has the effect of cancelling out the advantages that on-farm storage would provide. The loss of reliability would be in the order of 10% over the critical periods of Jan – Mar, which given the limited reliability in the first place is a significant loss.

12. The financial implication of this can be assessed by considering the amount of storage required to offset the impact. As stated by Mr Macfarlane, a cost of $2/$m^3$ for on-farm storage, excluding land cost could be used. Given that 45 MCM does not bring the reliability of the PC1 scenario back to level with the 1:1 25 Max scenario, I would assess this impact of the PC1 change as in excess of $100M.

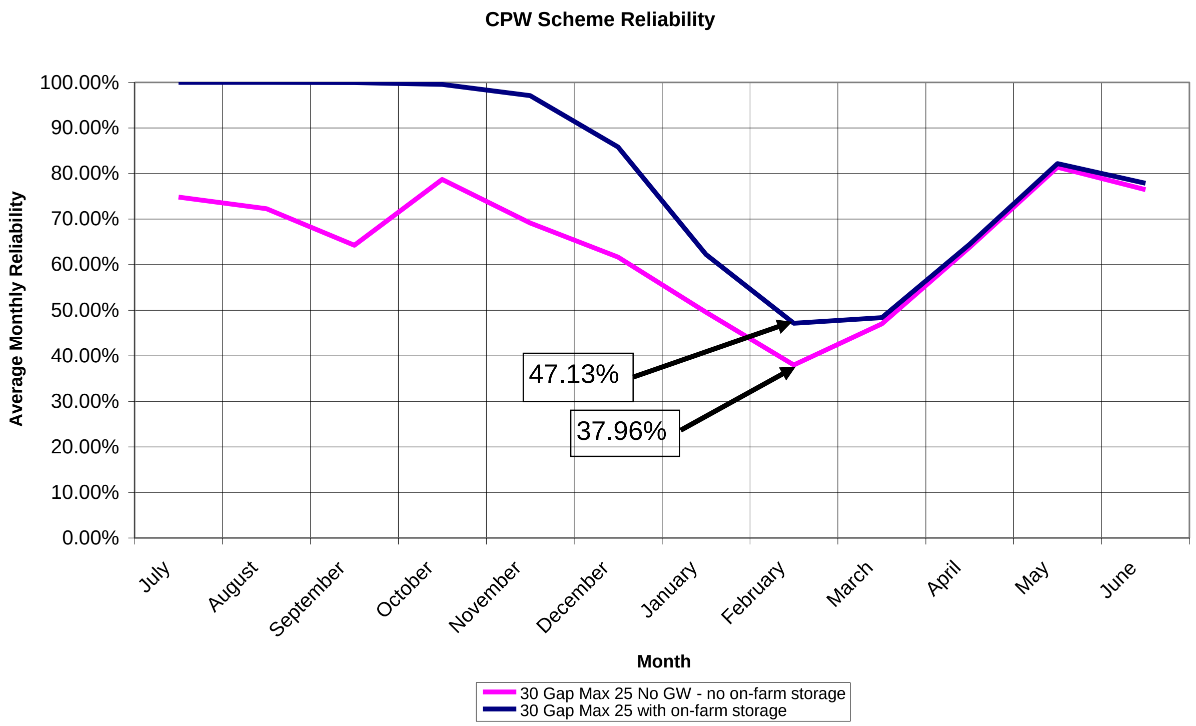

Figure 3: CPW Scheme Reliability with limited on-farm storage

13. If the run-of-river half of the scheme was to be uneconomic, it would fail to attract investment or commitment from the farmers, and therefore the total cost of the scheme would fall on the other half of the scheme area, jeopardising the overall feasibility. I believe this would lead to a situation similar to the Barrhill-Chertsey irrigation proposals that presently are having difficulty attracting commitment from farming investors. I believe this to be a critical issue to the viability of the scheme.

Flow and clarity for salmon angling,

14. The Commissioners requested that Mr Duncan, Mr De Joux and I reach a common position if possible on the relationship between turbidity and flow and duration within the preferred turbidity range for salmon angling. Mr Duncan will report separately on this issue. He has my support in terms of the advice he will provide on this matter.

15. In Para 9.70 of Minute 9, the Commissioners have noted that from a turbidity perspective, suitable conditions existed for salmon angling within the unmodified flow range of 70 – 140 m^3/s. If I take this interpretation a bit further and surmise that if the unmodified flow is above 140 m^3/s, the river it too turbid, I could then calculate how frequently these flows would be lowered into the ideal fishing flow band of 70 – 100 m^3/s during Dec-April. While I do not believe that these days would necessarily be too turbid for fishing, I understand this is a calculation sought by the Commissioners.

16. If the unmodified flow was 140m^3/s, after Class A takes, NTPL's take and CPW's take, the modified flow would be 140 – 22 – 1.24 – 24= 92.76 and therefore within the ideal

flow range. However if the CPW take was less than or equal to 16 m^3/s, (including 1 m^3/s of Class A water) then the resultant flow would not have dropped below 100 m^3/s if the unmodified flow as over 140 m^3/s, and therefore would not be within the desired flow band for salmon angling.

17. I have calculated the average number of days during the period 1 Dec – 30 April that CPW would be taking water at a rate greater than 16 m^3/s and the resultant flow was less than 100 m^3/s. This would be for 7.6% of the time, or some 11.5 days/yr. This represents the average number of days CPW would drop unmodified flows (before all takes) of above 140 m^3/s to less than 100 m^3/s (after all takes). I draw the attention of the Commissioners to my analysis reported in para 45 of my Section 6 brief, where I showed that the CPW take increased the percentage time within this flow band from 6.5% before CPW to 17% after CPW. Of this increase, 7.6% of the days would fall into the category analysed above.

Flow duration less than 55 m^3/s.

18. The Commissioners have asked for data on the frequency with which the CWPES abstraction would lower flows within the Waimakariri River to less than 55 m^3/s during the critical period for braided river birds of September – December. This is in response to the concerns raised by Dr Hughey that the change between the un-modified state (no takes) and the post-CPW state was highly significant.

19. My table following contains the data for the number of days by month, for Pre-CPW and Post-CPW, when the flows are below 55 m^3/s. I have also included in this table, the number of days before and after CPW that the flows are within the ideal flow range of 55 – 95 m^3/s and above 95 m^3/s. The reason that I have provided these data, is that to consider only those days when the flow falls out of the ideal flow range and to ignore the days when flows fall into the ideal flow range, only tells part of the story in relation to bird habitat. On the evidence of others, Mr Duncan and I have accepted that the analysis for preferred conditions for braided river birds, being a combination of many factors including predation and access to food, is better defined by considering flows within the above flow range. As can be seen from this table, the duration within the ideal flow range increases as a consequence of the CPW take.

Period 1 Jun 67 - 31 May 01 1:1 Sharing 25 max							
	Before CPW Flow			After CPW Flow			
	< 55 m^3/s	55 - 95 m^3/s	> 95 m^3/s	< 55 m^3/s	55 - 95 m^3/s	> 95 m^3/s	Total
September	52	345	623	52	345	623	1020
October	95	272	687	201	314	539	1054
November	95	330	595	217	368	435	1020
December	202	363	489	361	330	363	1054
Total	444	1310	2394	831	1357	1960	4148

20. I do acknowledge that the number of days less than 55 m^3/s will not increase if a 30 gap was to apply to the take. Nevertheless there is a degree of “betterment” for braided river birds with the proposed 1:1 Max 25 take.

21. Dr Hughey states in paragraph 4 of his Second Supplementary Evidence on Behalf of the Director General of Conservation that at flows below 55 m^3/s “the number of riverbed islands reduces substantially and thus average breeding success of birds is likely to decline”. However, Dr Hughey provides no data to support this assertion regarding reduced riverbed islands.

22. Dr Mabin, in his Supplementary Evidence in Response to Commissioners’ Minute #4, provided data on the proportion of wetted fairway in the Waimakariri River at Crossbank for various discharges, and showed that for every 10 m^3/s reduction in flow, there would be a 1.1 % reduction in the proportion of wetted fairway. Thus, at 60 m^3/s flow (ie in the preferred wildlife habitat flow range), 21 % of the fairway would be wet. At 40 m^3/s flow (ie well into the non-preferred wildlife habitat flow range), 19 % of the fairway would be wet. This shows only a small reduction in fairway wetted area. These data do not support Dr Hughey’s assertion that there would be a "substantial reduction" in riverbed islands at flows below 55 m^3/s.

Clifford John Maxwell Tipler