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

12 October 2009

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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, comments on the ECan officers reports and other submissions as they relate to my area of expertise. This will include:

    - The Bidwell/Norton Section 41C report
    - The Duncan report
    - Hayes evidence

4. I will not comment on evidence that in my opinion has not advanced the discussion of the relevant issues beyond that presented previously to the Commissioners.

Bidwell/Norton Report

5. There is very little difference between Dr Bidwellôs assessment and mine. At the larger scale we have similar quantities of nitrogen entering the groundwater and similar quantities of water. At the local scale, Dr Bidwell correctly identifies that the regional mixing model I have used does not purport to represent what will actually happen in practice. He raises the point (paragraph 43) that there is uncertainty in the relevance of the low nitrate water for dilution within the CPW scheme area.

6. This is an issue at a farm scale level, where the nitrate leaching is over the farm area, while the low nitrate water input may not be within that same area, or if up gradient at some distance, it will be out of sync with the land drainage losses. The consequence is that ñundilutedò land drainage concentrations may be found in immediately down gradient wells.

7. Dr Bidwell does not that the severity of such events should they occur, will be no greater than that already occurring across the plains down gradient of existing intensive agricultural practices.

8. In terms of expressing this as a risk, I would say that the risk to an individual who lives immediately down gradient from an intensive agricultural practice is no greater than the risk to those currently living in such a situation. Dr Bidwell acknowledges the existence of such a risk now.

9. On the flip side, if as Dr Bidwell points out, an individual does not get the benefit from the dilution effect at a local level, there will be someone else who will get extra benefit from the dilution water. Their wells would see a lowering of nitrate concentrations and consequently a lowering of risk. On average, the increases and the decreases will balance out, some individuals may be worse off, but faced with a risk no greater than exists now, and others may be better off, and face a risk that is lower than that faced now.

10. There are some points that I would not place the same importance on as has Dr Bidwell. I believe it would be unlikely that an individual will take water from a well that is made up only of land drainage from CPWES irrigated land, without there being any beneficial effect from the low nitrate dilution water. This is because most wells are screened over an interval of 1-3m and allowing for the drawdown effect, effectively sample water from a range of depths, not just the top metre which would be representative of just the land drainage water from the immediate vicinity. The abstraction method therefore acts to mix water from several depths and therefore several sources, some of which I would expect to be low in nitrate.

11. As stated previously, should a well become potentially unsafe as a consequence of the CPWES, then the simple solution would be to lower the screen level of that well. Dr Bidwell also acknowledges this as a solution, but notes that there will be increased economic costs (paragraph 76) due to drilling and pumping energy. I agree with the additional drilling costs, but not necessarily the additional pumping costs, as deeper aquifers do not generally require more energy to pump them compared to shallow aquifers, as the piezometric head in each are similar.

12. Dr Bidwell and Mr Norton have raised the issue of increased discharges of phosphorus from the CPW scheme area (paragraph 77 and others) and note that this has been insufficiently investigated.

13. I had previously considered the effects of increased phosphorus discharges, but for the following four main reasons, I did not believe that this needed the level of quantitative assessment suggested by Dr Bidwell and Mr Norton:

    (a) Phosphorus loss is predominantly associated with surface runoff and sediment transport

    (b) Phosphorus is retained within the soil profile and does not have the leaching potential of nitrate

    (c) Central Plains contributes only a minor amount of phosphorus to Te Waihora ï Lake Ellesmere in relation to other sources.

(d) There is little evidence that current and past land use practices are affecting the DRP concentrations in Central Plains groundwater

14. Phosphorus discharge from agricultural land is often associated with surface runoff and sediment transportation, which have a lesser relevance to the Central Plains than for other agricultural catchments. The Central Plains is not like the rolling country of the Waikato where surface flow contributes significantly to stream flow, nor is the irrigation system proposed border-dyke, which also increases overland flow and high contributions to stream flows.

15. In the paper by Wilcock et al (2006)[1] it is reported that applying the OVERSEER nutrient model to an average dairy farm, pond emissions contributed almost two-thirds of the total farm P loss, with the remaining (34%) coming from overland flow and (2%) from soil drainage. In the CPW situation, it is this 2% which is relevant, and being a small component of the total farm loss, in my opinion ceases to be an issue of significance.

16. Similarly Wilcock et al (2007)[2] report on the P losses from the Waikakahi border-dyke irrigation scheme in South Canterbury. They identify the history of high sediment loads to the Waikakahi Stream due to poor riparian management, and the fact that overflows from border-dyke irrigation contribute to high P losses. This latter point is also made in Monaghan et al (2009)[3] where they report that border dyke irrigation runoff has a potentially large effect on a range of water quality parameters due to excessive stream flows and the entrainment of P, N and faecal bacteria in this flow as it passes from land to stream.

17. Best Management Practice recommended by Wilcock et al (2007) for P control include:

(a) deferred irrigation of dairy shed effluent

(b) Reducing soil P fertility (nutrient budgeting)

(c) Avoiding soil compaction (because it contributes to run-off)

(d) Open-drain vegetation for trapping particulate P.

18. CPWL has proposed a sustainability protocol that would provide protection to riparian margins (best practice for sediment control into streams) and Nutrient budgeting that also will manage the excessive application of NPK fertilisers. Soil compaction is less of an issue on the free draining Canterbury soils, compared to the heavier soils considered

[1] Wilcock RJ, Monaghan RM, Quinn JM, Campbell AM, Thorrold BS, Duncan MJ, McGowan AW, Betteridge K, (2006) *Land-use impacts and water quality targets in the intensive dairying catchment of the Toenepi Stream, New Zealand.* New Zealand Journal of Marine and Freshwater Research, 2006, Vol 40: 123-140

[2] Wilcock RJ, Monaghan RM, Thorrold BS, Meredith AS,Betteridge K, Duncan MJ. (2007) *Land-water interactions in five constrasting dairying catchmetns: issues and solutions.* Land Use and Water Resources Research 7 (2007) 2.1 ï 2.10.

[3] Monaghan RM, Carey PL, Wilcock RJ, Drewry JJ, Houlbrooke DJ, Quinn JM, Thorrold BS. (2009) *Linkages between land management activities and stream water quality in a border dyke-irrigated pastoral catchment.* Agriculture, Ecosystems and Environment 129 (2009) 201-211.

in the above papers. Dairy shed effluent irrigation practice is also different in Canterbury to other regions such as the Waikato, where there is a predominance of effluent ponds, some of which discharge directly to streams, others have irrigation disposal systems. Direct discharges and irrigation to wet, rolling and poorly drained land will result in high P discharges to surface waters. These are not typical features of dairy farming on the upper Central Plains

19. Phosphorous is retained within the soil profile, depending upon the cation exchange capacity (CEC) of the soil and the extent to which the exchange sites are occupied. The alluvial soils of the Central Plains do not have high CECs compared to some soils, however intensification of agriculture such as dairy farming, is also accompanied by an increase in organic matter in the soil, which in turn increases the phosphorus carrying capacity of the soil, therefore the potential to lose phosphorus becomes reduced. Nevertheless, phosphorus can leach through soils, particularly the dissolved fraction through mechanisms such as macropore flow. The significance of this issue therefore relates to how much of the phosphorus that is lost from agricultural systems comes via land drainage.

20. Heathwaite AL and Dils RM (2000)[4] specifically consider the mechanism of P leaching. They record that a high proportion of TP in the drainage portion was in the dissolved form. The pastoral system they studied included the application of cattle slurry in mid-March (UK practice of discharging stored slurry from wintering barns) and this contributed to elevated P concentrations in macropore flow. They note that P concentrations in groundwater were low relative to losses in surface runoff and macropore flow. Field tile drains also contributed to high P losses to surface waterways. As cattle slurry application and field tile drainage are not practices expected within the CPWES, I conclude that the mechanisms by which P will leach to groundwater and thereby to the lowland streams and Te Waihora will be minor and do not warrant further consideration.

21. The relevance of the Central Plains command area to the other catchments contributing phosphorus to Te Waihora (Lake Ellsemere) is small. Only 5-10% of the total phosphorus entering the lake comes from the Central Plains. Moore and Borrie (1998)[5], found that approximately 55% of the TP entering the lake came from the Upper Catchment, defined as the hill catchments of the upper Selwyn and associated rivers. ~17% comes from the lower catchment of heavier soils around the lake edge, below SH1. ~21% comes from the Banks Peninsula hill areas and the remaining ~7% comes from the Central Plains. They also showed that the influx of TP was predominantly due

[4] Heathwaite AL, Dils RM. (2000) *Characterising phosphorus loss in surface and subsurface hydrological pathways.* The Science of the Total Environment 251/252 (2000) 523-538.
[5] Moore JA, Borrie DN. *What Feeds the Weeds in Lake Ellesmere.* (1988). Soil and Water, DSIR (1988).

to storm flow events. If P leaching was significant, then it would contribute to base flow in the lowland streams, and this is not the major input source of P to the lake.

22. I conclude from these papers that any increase in the discharge of P to groundwater as a consequence of CPWES will be small (~2% of total farm losses) and that this will be accompanied by a ~30% increase in drainage volume from the command area, such that concentrations in groundwater are unlikely to increase due to the scheme, and further that the proportionate increase in TP from the scheme to the lake will be negligible.

23. The existing concentrations of dissolved reactive phosphorus (DRP) in groundwater are presented in an ECan report by Hanson and Abraham[6] where they show that the concentrations of DRP in groundwater showed a pattern that was the inverse of that for most other determinants. The lowest concentrations of DRP were found in the water that was land surface recharge, with the highest concentrations found in the deeper groundwater and closer to the coastal margins. It is suggested that the DRP may be sourced from the dissolution of phosphatic minerals from the local geology[7] and influenced by reducing conditions close to the coastal margins. These data therefore do not support land use practices as being a source of DRP in groundwater and therefore do not support that the intensification of land use by the CPWES will have a potential effect that is more than minor.

24. Therefore while Dr Bidwell and Mr Norton identify this as an issue that has not be quantified, I do not believe there is a need to quantify it in this instance, as the impact will be less than minor. I believe that the conventional practice for the assessment of effects of irrigation schemes on the plains, to ignore the effects of phosphorus, is justifiable.

Duncan Report

25. Mr Duncan has reached conclusions very similar to mine and I am not aware of any issues I have with his analysis. The only comment I would make is that we have looked at the analysis in slightly different ways, with Mr Duncan focussing on a comparison with the Proposed Plan Change No. 1 30 Gap scenario. I agree with his statement in paragraph 40 that the differences in time in the preferred flow ranges between the proposed (by CPW) 1:1 scenarios and the current A Block takes are relatively small in terms of days per year for most cases. This is supportive of the basic premise I have presented in my supplementary brief of evidence.

[6] Hanson C, Abraham P. (2009) *Depth and spatial variation in groundwater chemistry – Central Canterbury Plains.* ECan Report R09/39 ISBN 978-1-86937-969-8, February 2009.
[7] Abraham P, Hanson C. (2008) *Annual groundwater quality survey, spring 2008.* ECan Report No. R09/46 ISBN 978-1-86937-978-0. June 2009.

Evidence of Dr Hayes

26. Dr Hayes has stated in para 2.2 that I have inflated the number of days in the preferred salmon angling range after abstraction. This relates to an issue discussed by the Commissioners earlier, where changes to time within flow bands need to be considered carefully, as in itself, it is not definitive. Dr Hayes point that a too-high, too-dirty flow, will still be too-dirty even if the flow is dropped into the preferred band is correct. He fails to mention the corresponding point that a flow that is just right in terms of flow and clarity, is likely to still be a good fishing day, even if the flow drops below the ideal flow band range. These are almost quid pro quo events, of which the Commissioners are aware and I will not comment on any further.

27. In my main brief of evidence, I have supplied the data requested of CPW, expecting that the Commissioners are now aware of how these data should be interpreted.

28. The issue of clarity vs flow remains a difference of opinion between myself and Dr Hayes. I believe Dr Hayes has not given sufficient consideration to the causative relationship between clarity and flow.

29. Flow increases due to rainfall. Rainfall causes sediment to enter the river. Sediment in the river decreases clarity. This does not mean that an increase in flow causes a decrease in clarity, nor does it mean that a decrease in flow causes an increase in clarity.

Evidence of Mr P Callander

30. Mr Callander presents evidence on behalf of a number of parties. My comments above address the issues such as Phosphorus and I will not repeat those. Mr Callander has offered a number of suggested conditions that would meet the concerns of his clients. I have not advanced to any detail CPWôs views on proposed conditions, as I anticipate these will be discussed at a later date. Nevertheless it is important to record CPWôs opposition to some of what Mr Callander has proposed.

31. Mr Callander has requested conditions that link the Class B take to the actual measured flow at the Old Highway Bridge (OHB). The conditions and flow regimes I have proposed are in terms of the unmodified flow at the OHB and any difficulties created by the grant of CPWôs consents on existing consent holders, should be fixed by ECan through a review or variation process, rather than further complicate the allocation situation by linking consent conditions to measured flow at the OHB.

32. Mr Callander has requested a condition that requires CPW to only abstract water from the Waimakariri River when the water required cannot be met by abstraction from the Rakaia. While it is CPWôs intention to take Rakaia water as a priority to Waimakariri

water, the condition proposed is too restrictive. A ñbest endeavoursò or ñas far as practicableòtype condition would be supported by CPW.

Evidence of Mr P White

33. Mr White identifies a number of effects that ñmayò occur, including contamination of Christchurch Cityôs groundwater supply. In the absence of an assessment of the likelihood of this, nor the degree of the effect, I am unable to provide any further comment. These matters are addressed either in my previous evidence or by others.

Evidence of the Medical Officer of Health

34. Dr Humphrey reiterates his previous concerns, but also notes his support of the Draft Canterbury Water Management Strategy (CWMS) in paragraphs 45 ï 49. It is my opinion that the proposal by CPW is not in conflict with the draft CWMS. In particular it enables present and future generations to gain the greatest social, economic, recreational and cultural benefits from our water resources within an environmentally sustainable framework, while:

    (a) Providing infrastructure that is compatible with any of the proposed solutions within the draft CWMS

    (b) Providing an integrated management mechanism within the Waihora/Ellesmere water management zone

    (c) Reconfiguring allocations between surface and groundwater

    (d) Providing for land use intensification

    (e) Reducing the losses of nitrate from existing intensively farmed land, and the potentially intensively farmed land

    (f) Providing levies to fund environmental restoration

    (g) Driving efficiency into the use of water on farm

    (h) Keeping options open as to locations for future storage

    (i) Providing mechanisms for improved and self monitoring of performance

35. These demonstrate in my opinion, how the CPWES fits within the concepts being developed for the CWMS.

Conclusions

36. It is my opinion that the differences between other experts and me are now minor. From my considerations above, I conclude that:

(a) The risk to individuals and the community from nitrate contamination will be no greater than that existing at present.

(b) There is no need to quantify the impacts from phosphorus from the scheme area, as the incremental increase in phosphorus discharges to Te Waihora and the lowland streams is small.

(c) The 1:1 25 max flow regime proposed for the Waimakariri River take will have effects similar to that from the existing A block allocations.

(d) The CPWES proposals are not in conflict with the draft CWMS.

Clifford John Maxwell Tipler