In the matter Resource consent application-Central Plains Water Trust
Resource Management Act 1991

To Canterbury Regional Council and
Selwyn District Council

Evidence Tim Wardell

1. My full name is Timothy John Wardell. I am a layperson.

2. Having sat and listened to these proceedings since March of this year I would like to expand the detail of my original submission taking into consideration the detailed information (beyond that presented in the AEE) which I have heard in the interim.

3. In simplistic terms my concerns are around the loss and degradation of the Commons of water. As an individual it is my perception that I have a one in four millionth shareholding in the water that the applicant is applying for. If granted, the usage right of that water will go to 370 individuals and in so doing will become inaccessible to all. When returned (via groundwater) it will be in poorer condition than when permission was granted.

4. My more specific concerns are outlined below-

- Impact of the outtakes on both the Rakaia and Waimakariri with consideration of the impacts predicted by the Intergovernmental Panel on Climate Change (IPCC) and the influence of the Interdecedal Pacific Oscillation (IPO).
- Efficient use of water.
- Impacts of the scheme on groundwater (and hence surface water) quality (nitrates) and quantity (mounding and drainage) and the long term implications.
- The reduction of trees within the landscape from perspectives of evapotranspiration (E-T), animal welfare and biodiversity (albeit exotic).
- That the scale of the scheme, if granted as proposed, has irreversible impacts.

- Conflict of developing systems fully reliant on water without due consideration of best use of the resource and long term sustainability.
- Other societal costs of intensification such as future liabilities under proposed Emissions Trading Schemes.

5. **IPCC and IPO influences-**

"Some major eastern rivers whose catchments reach back into the main divide could maintain or even increase flows, because of projected rainfall increases in these areas. However, a change in phase of the IPO relative to 1978-1998 may mean this does not eventuate over the next 20-30 years. Regardless it is prudent to acknowledge that overall Canterbury will become drier in the foreseeable future." O'Donnell (page 28)

The use of historic river flow data used in the proposal is influenced by a positive IPO (wetter) cycle. To what extent this influences the mean flows is uncertain, yet it seems it would be important to take into account the potential of lower river flows in the future.

When the original Project Aqua was in discussion it was noted that the 30 year average flow was approximately 10% greater than the 70 year average flow. This could also be influenced by the melting of the permanent snowfields. On page 13 the above report says "a 23-32% loss of glaciation and an average recession of glacier length of 38% for South Island glaciers over the past century."

The concern I raise is that with both rivers it would appear that the asked for outtakes are close to the upper limits of impacts on both environmental flows and amenity values. Much evidence has been heard relating to those issues.

If lower seasonal flows are the norm for the next 20-30 years, is it the rivers and those values that suffer or will that mean a reduction in usage rights to CPW to maintain those wider societal values?

In my mind neither river plans take such change into consideration and nor does the PNRRP and the water allocation mechanisms used within.

Other effects predicted under the IPCC modeling are increased E-T, decreased recharge to aquifers, increased intensity and frequency of droughts and decreased water quality due to large precipitation events.

6. **Efficient use of water-**

Considering the pressures that the rivers are under from abstraction i.e. cumulative effects of consents granted and the potential of IPCC/IPO influences, **s7 (b)** efficient use and development, appears to be important.

CPW are applying for the usage of 370 million cubic meters (MCM). In the abstraction and distribution of the resource the modeling predicts 95MCM of this water will be lost to groundwater through leakage from races and discharge (if and when required). This is a loss of 25.6 % and for me it is hard to accept as efficient.

It has been portrayed as beneficial in enhancing/recharging the aquifers and mitigating the depleted flows in lowland spring fed streams. In fact it goes beyond that, creating groundwater mounding issues downstream and for some of those streams doubles their historical flows ie changes dramatically their historical natural form.

Piping the distribution races gives the benefit of being able to manage by wash/discharge and minimizes losses to the headrace only. The loss is reduced to 8.3% and logically it would appear much of the mounding/drainage issues would be mitigated down country. Another way to look at that is 62MCM of water could stay in the river for other values.

The other major benefit of piping is being able to use head pressure for actual irrigation reducing the schemes energy demands.

There is a downside. The modeling relies heavily on these losses to dilute nitrogen (N) leached from the scheme area raising the concentration by 0.9mg/L. The cynic in me would suggest that dilution is not the long term solution to pollution and at the wider receiving environment perspective (in this case Te Waihora) peak load remains the issue.

On page 11 of the Aqualinc report L05248/2 it is noted "URS has advised Aqualinc that dam leakage is zero. The consequence of this is that if there is

any dam leakage, the analysis is not conservative with respect to groundwater table increases."

Ultimately we come face to face with whether first in first served (FIFS) is the best allocation method for the efficient use of the public resource of water. Pastoral farming requires approximately twice the water than arable.

Unfortunately this is happening at a time when we are considering the allocation of the last waters in this catchment.

There is a strong reliance on market forces for determination of this efficient use yet the market appears to be retrospective or lagging in reference to most efficient use and maintaining quality values. Will it take market price collapse to force change and who pays the cost of clean up?

Rodgers (WRT) noted CSIRO figures of 1470 litres of water required for a $ output of milk versus 300 litres of water for a $ output with grain. This is a 5:1 benefit in resource usage i.e. efficiency. These figures are indicative the need of a wider thinking required in allocation.

Is allocation to confined areas for intensification prudent considering results to groundwater quality indicated by the IRAP program (section 13, p.12) versus wider distribution of the resource within the landscape giving future resilience to a wider group of farmers and diminishing risk of water quality degradation under the plains?

7. **Groundwater quality-**

It is agreed that groundwater quality will degrade. Generally it is accepted concentrations that are currently being measured are not reflective of most recent land use practices.

"However one would expect effects increase with progressing distance downstream from the upper end of the scheme. This is because the dilution effect becomes increasingly reduced by the infiltrating nitrates. However, the depth to groundwater at the upper end of the scheme is so large that it will take many years, maybe even decades, for the nitrates to reach the groundwater table." Aqualinc (page 61)

In calculating N concentrations and loads the Aqualinc report uses a ratio of 60% pastoral: 40% arable (p59) with resulting N concentration increases of 2.5mg/L (p2) and "approximately a doubling in the amount of nitrates that are leached to the groundwater systems-1400-1900 tonnes nitrate-N per year prior to CPW versus 3700-3900 tonnes nitrate-N per year with CPW" (p59). On averages this would move the observed mean concentration from 4.3 mg/L to 6.8 mg/L and increase the peak load by 130%.

White (TRONT) predicts land drainage concentrations from the current land use of 4 mg/L-5.6 mg/L (average=4.8mg/L) moving to 7.4mg/L-8.1mg/L (average 7.7mg/L) i.e. on average a 2.9mg/L increase (Para 14.1-2). He predicts a change from 1700-2300 tonnes (average 2000 tonnes) to 4000-4400 tonnes (average 4200 tonnes), an increase of 110%.

He also expresses concern on the applicants reliance on clean water input (Para 14.9). I confer with these concerns.

Tipler (CPW) in his second brief uses a 75% pastoral: 25% arable scenario indicates peak load increases from 2000 tonnes to 3600 tonnes of N (80% increase) and median N concentration increases from 3.7 mg/L to 4.9 mg/L.

I have already highlighted the impact of piping on concentrations and Tipler (para 86, page 25) also mentions that water from headrace could potentially move deeper and therefore limit its dilution ability.

In table 5, page 21, Callinder (Christchurch City Council) looked at the change pre and post CPW of N concentration after mixing showing a move from 5.9 to 6.2 mg/L, a 5% change. Using the same methodology the piping of the distribution network shows a further increase of 0.9 mg/L to 7.1 mg/L, a 20% increase in N concentration. A further reduction of dilution by losing half of the headraces clean water to either sealing overtime of the race or loss to deeper waters or both gave a further increase of 0.3 mg/L to 7.4 mg/L, a 25% increase in concentration, seemingly rather significant.

Using the higher peak loads indicated by White and Aqualinc, a higher percentage of arable systems would have a further influence on the N concentration after mixing under all scenarios and breach Rule WQL19 of the PNRRP (Murray-CPW-para65, p15).

In section 8.5.2. of the AEE, figure 8-10 shows the relationship between N concentration and % arable. Macfarlane (oral submission) made comment that pastoral use of water could decline within the front end of the scheme as global population demands impact. In his para 62 he makes reference to protein demand, in which case an increase of arable practices seems logical.

This could also be further driven by constraints on water resources under IPCC conditions with arable being more water efficient but requiring higher reliability than pastoral systems as noted by Jansen (NTPL).

Within the groundwater systems there is aquatic life that we know very little about mainly in the form of microscopic shrimp. It is believed they play an important role in keeping the aquifers healthy and are considered an ancient life form. How they react to changing N concentrations and whether their thresholds are the same as for surface water aquatic life is an unknown (Fenwick, NIWA, per comm.).

When looking at N concentration in wells and the % that breach of MAV I believe we need to be cautious. It seems to me that there are 2 sets of data. Many of the wells at the lower end (< 2) have these values due to influence of either, highly connected river recharge (along the banks of the Rakaia, Waimakariri and Waikirikiri), or up swellings from deeper unconfined aquifers. The other wells show more sensitivity due to the lack of diluting influences. It would be worthwhile putting this more sensitive data set onto a cumulative frequency curve and note any changes in the % breach of MAV.

8. **Groundwater quantity (mounding)-**

Weirs modeling suggests groundwater rises of up to 20m above the 1967-2005 average in some areas and in average seasons an increase in area of water table to within 1m of the surface by ~11 000 ha.

Accepting that N takes time to move through the vadose zone, the inundation of this zone by raised groundwater has the inevitability of bringing the future forward. Potentially there is a risk of a jump in N concentration dependant on the dilution effect and at least an increase of total load of N to groundwater. As noted this is only bringing the future forward as given time current land use practices will equilibriate with ground water quality.

The other major concern is the impact on other already consented activities. In the case of SDC this includes the potential diminishment of the separation zone for sewage disposal to land (Rolleston & Leeston) and inundation of community piping infrastructure leading to a requirement of early replacement, both issues having large potential rate impacts (noted by Blake-Manson, SDC).

At a more individual basis, consented septic tank systems could well be impacted along with a potential need to lower well depth for potable water for households outside of Community schemes.

Chapman (for Gravel extractors) raised the Aoraki precedent and if that holds it has implications in these situations. I.e. derogation of consented rights.

Callander (CCC) suggested a change of onus to the applicant with which I concur. In the case of increased well depth for potable water, I suggest that this should also include the additional incremental power costs into the future.

If compensation is the only available mitigation, the total bill is starting to add up.

9. **Surface water quality-**

The water quality of the spring fed streams is strongly connected to the groundwater systems. 3.4 mg/L N is the mean of median concentrations in eight streams draining to Te Waihora (White, para 15.23) currently with an increase of 0.5 mg/L during winter due to raised groundwater's (White, para 3.6 & 6.25).

With the predicted groundwater mounding as a result of CPW the soils in the area east of SH1 will be saturated more often. This potentially means a smaller rainfall event will create run off, increasing the likelihood of nutrient (both N & P) and microbial contaminants being transferred to surface water. More P in the system which is generally P limited is hardly desirable.

It also implies that what is currently a winter increase could become more frequent even though there may be a dilution effect from increased stream inflows.

It is worth noting that New Zealand has the highest incidence of Campylobacter in the western world.

10. **Surface water quantity-**

The decrease of the volumes in the spring fed streams is a concern for many. To hear both Chamberlain (Harts creek) and Lay (Irwell river) speak of the decline in these waterways in the last 3-5 years was poignant to say the least.

White (para 3.8) notes the contention around whether this decline is due to climatic conditions or due to climatic conditions and groundwater abstraction.

I can't see how the two can be separated and for me this reinforces the concept of over-allocation, albeit unwittingly. It has become apparent with changing conditions that using a 50% land surface recharge is no longer a conservative approach. This has been exasperated by the courts over ruling the Council when concerns have been raised.

In the Proposed National Standards on Ecological Flows and Water Levels (NES), which is currently out for consultation, the suggested standard for aquifer allocation (if starting afresh) is 35% of the average annual recharge.

The modeled flow changes to the streams and rivers feeding into Te Waihora (Allibone, p46, fig 10) show increases in general, with over a doubling from historical for the Waikirikiri and Irwell. The question is when does a river become a drain?

11. **Te Waihora-**

The existence of Te Waihora as a receiving body within the larger catchment makes this application even more interesting. Within the Canterbury plains the impacts of land intensification generally filters directly to the coastal environment without accumulating to the same degree as in this case. In this instance it becomes difficult for society to deny the cumulative effects of land use intensity and its impacts on the receiving waters.

As is, Te Waihora is in a severely impaired state, receiving around 1300 tonnes of N currently (White and Hamilton). White (Para 3.37) predicts this will increase to 2900 tonnes N per year (126% increase) as surface water quality equilibriates with current land use. CPW will compound this.

TRONT and others have a long term vision of restoration of natural values in the lake, an onerous task at the best. **S7 (a)** Kaitiatianga & **(aa)** the ethic of stewardship, appear to be relevant in this instance, as it is with water in general.

Brown (TRONT) spoke of pre-Wahine conditions and clarity of water. He also spoke strongly of the shame and burden for Ngai Tahu with the lake in its present condition; I say it is a societal shame, inadvertent though it may have been, and a burden to be carried by all.

Hamilton touched briefly on the requirements and difficulties of restoration. It would appear the only chance of this happening would be through wider societal input. With continued nutrient inflows some form of filtration process would be required using plants such as flax and raupo with purchase of land to make this achievable. It is worth noting that historically Te Waihora and its associated wetlands extended as far inland as Lincoln. Purchase of set back does not necessarily mean displacement of people as managers / overseers would always be needed in such a development. No doubt this is a multiple generation process – extending our ability to vision into the future.

O'Connell (TRONT) makes two references, one to the treatment of Te Waihora (mahinga kai) as a toilet bowl, the other being "what man has done, man must make an effort to undo". Both are apt comments.

In observation, figure 21, page 61 of Burrells (CPW) evidence is an intrigue. The consistent cycle of macrophyte beds until the 1940s and the changed cycle until the Wahine event coincide with the advent of super phosphate and its usage. This would be potentially contributive to further P and N enrichment and destabilization of the ecosystem, making it more vulnerable to an event such as the Wahine storm.

Also worthy of consideration is the increased inflows into Te Waihora requiring more regular controlled openings. This could potentially have

impact in the salinity of the lake, further altering it from its natural state and making restoration more difficult.

12. **Trees in the landscape-**

The historic shelter planting initiatives in the Canterbury region were driven by soil conservation measures on dry land landscapes under the auspice of the Catchment Boards. Public money was involved and from 1962 till 1982 approximately 1600 km were planted across Canterbury. This was reflective of societal thinking.

Irrigated land does not bear the same risk of soil loss to wind as long as there is continued water availability. Irrigation is capital intensive (Macfarlane, oral) and there are efficiency gains in the replacement of labour, hence the use of centre pivots.

Simply that means the loss of trees for capital efficiency.

There are a number of reasons why maintaining and developing shelter is beneficial on the plains, or anywhere for that matter. These include-

- Reduction of wind speed reducing evapotranspiration
- Animal welfare
- Biodiversity and landscape character
- Carbon sequestration

As pressure comes on available water, the drive for efficiency becomes more relative. Tall shelter across a landscape reduces wind speed and in doing so reduces the impact of evapotranspiration, incrementally, more water remains in the soil, reducing demand on the resource. Bright (oral submission) commented that peak water demand is driven more by E-T than soil type.

Irrigation is about remedying the deficit between rainfall and E-T to enhance reliability of productive values.

Good shelter and its benefits are a relationship of tree height and permeability of the shelter. The permeability (40-60%) is required to carry the benefit (reduced wind speed) across the landscape. With dense shelter the wind simply goes up, over and down providing little relief. Given good shelter the benefits are of the magnitude of 10-12 times the height of the trees.

Under the Catchment Board plantings, shelter was run north/south to minimize shading impact and cooling of soils. This can conflict with shade value for animals.

Most research has focused on dry land production yet logic dictates similar benefits accrue on irrigated pasture. Smail notes 20% net increase in pasture production from 6% of farm area set back for farm shelter. Radcliffe notes significant increase in pasture production.

Research in Alberta (Agriculture & Rural development) shows increase in wheat yields of 3.5% on fields sheltered by mature shelter including land taken out of production for shelterbelt planting and competition of the shelterbelt with crops.

Potentially a 10% reduction in water usage reduces scheme requirements by 28.5MCM. I.e. 370MCM less 95MCM(drainage loss) =285MCM.

Gregory looks at animal welfare issues and the benefits shelter provides. In summary he says "Providing shelter and moving stock to adequate shelter is a moral responsibility which is implicit in the '5 freedoms' described by the Animal Welfare Advisory Committee of NZ, and in general it is difficult to argue that it is a responsibility which either imposes unreasonable cost or is unrealistic to achieve."

The Animal Welfare Act (1999) in **s4** physical, health, and behavioural needs in relation to an animal include **(b)** adequate shelter. In **s10** under obligations, that the above needs of the animal are met in a manner that is in accordance with **(a)** good practice; & **(b)** scientific knowledge.

Indigenous bio diversity on the plains is considered to be less than 1% and intensification impacts on these values. This impact is not confined to the directly intensified areas but generally flows out to surrounding landscape.

The exotic plantings, mainly for shelter, therefore play an important role in corridors for wildlife and for diversity in general (Meurk, Forest & Bird, para 83). Meurk also comments on replacement of trees with tussocks and shrubs. My concern is the removal of current diversity and only partial replacement of area with low plantings.

While I concur with Meurk in principal with the requirements of diversity, I am more supportive of the use of exotics in the mix. The exotic trees are generally faster growing and as effective shelter is a height issue, they play an important role. Whether they are permanent in the mix or part of a succession process is moot, yet the initial shelter they provide is beneficial in establishment of other values.

I also have a bias towards deciduous trees and the changing colours they contribute to the landscape. Shelterbelts can also include other productive values such as timber and food

The Act speaks of 'internalising effects'. Aside from the other benefits outlined there is potential for some carbon off-set in the planting of trees.

The cumulative benefits of all of the above lead me to a simple conclusion- there are long term advantages in designing irrigation and farming systems around good shelter rather than the current, generally, clean slate approach.

13. **Scale of scheme and irreversibility of impact-**

The magnitude of impact is driven by the relationship between the amount of dry land conversion and the land use it is converted to. The first issue has been somewhat confusing throughout the hearing but seems to have settled at potentially 40000 ha of dry land available. This represents a 100% increase of irrigated land within the command area (west of SH 1).

At the same time Synlait are indicating further dry land conversion which in Mabin (supplementary) is included in the already irrigated land.

From a wider perspective I have assumed 40000 ha are currently irrigated east of SH 1 (CRC, per comm.). On that basis, CPW represents a 50% increase of irrigated land within the catchment as a whole. Again, the importance of Te Waihora as the final receiving body comes into focus.

Current land use impacts are in transition and it is generally agreed that they are not fully measured in groundwater yet, and are irreversible.

White (para 3.37) indicates a 126% increase of N load to Te Waihora with a steady state equilibrium of current land use. Further intensification will compound this.

A concern that I have is that further abstraction for irrigation will be considered for mitigation of groundwater mounding issues.

In principal, even if we can halve N leaching from land use, yet we double the intensified area, we are no better off than in the present and the liability remains for future generations.

The Integrated Research for Aquifer Protection (IRAP) is developing modeling that shows N impacts of discharge to groundwater's and how contamination risk increases with concentration of intensive practices within areas. That is side by side intensity versus intense practice interspersed with low impact land use. (CRC workshop, managing cumulative effects of land use, July 2008).

Part of the focus is the impact on the availability of potable water from shallow wells. Needless to say increasing intensity reduces access to the Commons by creating the need to go deeper to access waters influenced by river recharge.

The other issue raised that is worth noting is the use of the MAV of 11.3 mg/L. Is this the figure that we allow ourselves to head towards or do we take a more precautionary approach and use 0.5-0.75 MAV as a trigger of concern? Considering the yet unmeasured and unknown future component of N that is unassimilated within the groundwater, the later approach seems sensible.

The further we go towards MAV, the greater the loss of flexibility for future generations to achieve best outcome for land use in their time, and the greater their risk and liability of contaminated groundwater.

14. **Farming systems fully reliant on water-**

McKenzie (ACWT) spoke of the development of irrigation in the Ashburton District. This has been a move from a 60% farm coverage using flood irrigation to a 100% farm coverage using spray. To maintain reliability on farm storage is being put in place. His comments were made in the light of how having limited resource had driven efficiencies.

Jansen (NTPL) raised the issue of reasonable need and the ability to productively pastoral farm with lower reliability.

The concern I raise is one of resilience in terms of production abilities and therefore economic stability. If we find ourselves in the position of having production systems based on a fully allocated water resource and there is shrinkage of that resource, then societally we are vulnerable.

If development is to continue, then it would appear wise to build resilience into that development. A treed landscape is part of this. Shame would be the day that soil loss to wind becomes the concern again, due to lack of available water on some of the intensified open landscape. While this is of low probability it has high impact.

Conscious focus on building carbon (organic matter) levels in soils is also beneficial. Increased carbon increases water holding capacity and also enhances nutrient cycling/availability.

Macfarlane (oral) noted that the soils on his dairy farm are sequestrating 400 kg/ha/year of carbon. Putting in perspective, under a pastoral system we can expect to measure approximately 100 tonnes of carbon stored in the soil. This reduces by 25-30% when land use is changed to arable (Crop & Food, per comm.).

Jones states that a 1% rise in organic carbon % results in an increase of 144 000 litres of water/ha and sequests a 132 tonnes of CO2. Elsewhere, a 1% increase in organic matter in the top 300mm increased water holding capacity by 15mm. The implications are a greater natural resilience of our soils to changing conditions and the ability of farming systems to operate on less water.

15. **Nitrogen inhibitors as a management tool-**

Intensity in production systems has come about from our ability to manage the influence of seasons through the use of water and nitrogen based fertilizers.

Recently our research has been fully production orientated without necessarily incorporating the economic principal of diminishing returns (Riddler, p.22) He continues "For the average dairy farm, the last 15-20% of

their herd adds nothing to profit but results in the bulk of the requirements for supplementary feed and nitrogen used".

Nitrogen fertilizer usage has increased 10 fold in Canterbury in recent times. The major driver on this has been the expansion of intensified pastoralism with the development of irrigation. Its usage increases grass dry matter production/ha allowing more stock units (SU) to be carried. 150-200kg of applied N will increase carrying capacity by 6-8 SU/Ha (0.75-1 dairy cow) on irrigated pasture. By increasing dry matter (DM) production, therefore SU's, the impact is in the increased urine which equates to ~1000 kg N applied.

Monaghan et al indicate with a 3 fold increase of N inputs to pasture (from clover dominant to fertilizer usage) resulted in a 4 times increase in N surplus, a 4-5 times increase in gaseous and leaching loss and a halving of the N use efficiency.

I have concerns about the reliance that is being placed on the use of inhibitors as N Leaching reduction tool. It would be beneficial to look at their use in a wider perspective including economic weighting to reduced gaseous and leaching losses to measure the benefits from reduction.

Kelliher et al (p.5) speak of needing to have data on inputs, timing of inhibitor usage "and stocking and production rate because they determine excretion rate", if we want to get benefits within the Kyoto Protocol.

Intuitively I believe there is a better balance at lower N inputs, especially considering the rising price of N. Inhibitors play a role but do so more constructively if they are used at the front end with minimal inputs rather than being used to mask the effects of high N inputs.

Consider it as a call for more public good science.

16. **Alternatives-**

The current imbalance of groundwater within the Central Plain area is shown through declining well levels and low flows of the spring fed streams. CPW has emphasized the enhancement component of its application and the benefits that will accrue. The modeling by Weir predicts an over balancing resulting in groundwater mounding issues.

A long term approach of balancing the water budget for ground and surface water seems prudent. Synlait indicated that is their intent, driven more by high costs of deep water. This partially addresses the reliability issue with run of river surface water been backed by groundwater.

Mathers (MHPS) spoke of the usage of Turkey nest dams for on farm storage which further increases reliability and takes the risk and cost (loss of land) back to the domain of those that are the direct benefactors.

Transferability of groundwater consents is one of the mechanism that could be used to gain a more balanced approach i.e. redistribution of groundwater consents to support surface water take.

The concern I hold over transferability is that it quickly moves to tradability and a sense of ownership begins to pervade. If it is to be used as a tool then there needs to be a structure of guidance that does not allow the making of profit on a public resource which current usage is free. I clarify this in that there are costs in acquiring usage rights i.e. consent, and costs in distribution, but the resource itself is free.

17. **Climate change liabilities**-

New Zealand has International obligations for Greenhouse gas emissions (GHG) under the Kyoto protocol.

Currently we have The Climate Change Response Act (2002) and are in process of putting forward an Emissions Trading Scheme (ETS).

Agriculture is responsible for 50% of our liability and nitrous oxide (N2O) from soils produces 1/3rd of that liability. Kelliher et al (p.5) go onto report that by 2004 N2O levels were 24% greater than 1990 levels and". concurrent with the increase in the quantity of urine excreted onto agricultural soils by grazing dairy cattle".

Jan Wright (PCE,p.9) states "The authors of the 2007 Agresearch/Landcare report conclude that current intensification of dairy farm- through increased use of maize silage and nitrogen fertilizer in particular- reduces the GHG and energy efficiency of New Zealand farms". She also notes "that

importation of increasing amounts of palm kernel meal from Indonesia and Malaysia is another development in the wrong way".

Land intensification of this scale increases society's future liabilities under the Protocol on top of continued degradation of the water resource. These liabilities are not born totally by the individuals who create the problem (polluter pays principal) which in fact is a subsidy by wider society.

The rebut to this is that society benefits through economic growth and any costs to the producers would be reflected in increased shelf prices to consumers. That holds if current product price is cost of production and reasonable profit i.e. local market. This is not the case with prices reflective of global demand and the advantage sitting with the producers. With this there is an increase in inequity, born largely by those of lower socio-economic means.

The trickle down benefits claimed simply dry up.

18. **The future of Christchurch groundwater-**

White (para 9.4, p.5, supplementary) raises concern over the reduction of recharge (0.5m/s) and the potential of saltwater intrusion. I concur.

Further to that I am concerned with potential issues related to groundwater mounding and its impact on the south western boundary between the Christchurch zone and the wider plains and implications on recharge.

If the mounding has greater impact on this boundary than Weir predicts the result would be a raising of the Christchurch groundwater's. This represents an increase in head pressure and logically creates further resistance to a depleted river recharge. English intimated this yet his main area of concern was the lack of data on which to make good decision.

19. **RMA implications-**

I concur with concerns raised over enforceability of conditions because of duplicity of the entity and the disconnection this entails.

I concur over concerns of the use of adaptive management and the lack of detail from a perspective of wider societal input and robust public discourse,

particularly around the Farm Management Protocol. This document underpins the scale of effects of the proposal.

I concur with DOC on the reliance on monitoring when little detail is given on what and how and the benchmarks to be used.

I concur with concerns around transference of consents and/or their relinquishment.

I concur with the general theme of cumulative effect which seems to be prevalent around water quality to groundwater, quantity (both surface and groundwater), environmental values, and amenity values.

20. **Final stance-**

I seek to have this application declined as it is currently tabled. I accept the need of irrigation for productive values but due to the scale and decisions of the past, the long term costs are too high.

I request this is from a perspective of nationally unresolved issues around water quality and quantity and land use and that the granting of this application will compound.

Any future development of this catchment needs a more holistic approach. This includes a long term vision which firstly recognizes then embodies mitigation processes for past effects and creates more robust systems for the future.

This is beyond the role of the applicant and the current consent process. Issues expressed above are difficult to address while on the run.

References-

Gregory N. G. The role of shelterbelts in protecting livestock: a review. NZ Journal of Agriculture. 1995. Vol 38: 423-450.

Jones C. Soil carbon impact on water retention. Grain & Graze workshop. 2006. Soilcarbonwater.blogspot.com.

Kelliher, Clough and Clark. Developing revised emission factors for N2O emissions from agricultural pasture treated with nitrification inhibitors. Final Report. MAF project reference H0156/06. 2007.

Krom & Weir. Aqualinc. CPWES-Assessment of effects in the groundwater Environment. 2006. Report LO5248/2.

Monaghan et al. NZ Journal of Agricultural Research.2005.Vol.50:181-201.

O'Donnell L. Climate change-an analysis of the policy considerations for climate change review for the Canterbury RPS. CRC. Report R07/4. 2007.

Radcliffe J.E. Shelterbelt increases dryland pasture growth in Canterbury. NZ Journal of Experimental Agriculture. 1985. Vol.13(2) 181-190.

Riddler B. Profit focus needed for sustainability. Countrywide, Southern Edition. Vol 9, No 4. April 2008.

Smail. Farm Forestry. 1979. 21(1): 11-13

Tait and Cullen. Some external costs of dairy farming in Canterbury. Commerce Division, Lincoln University. 2006.

Wright J. Climate change (Emissions Trading & Renewable Preference) Bill. PCE to the finance & expenditure committee. May 2008.