53/2

Tim Davis Submission

IN THE MATTER of the Resource Management Act 1991
AND Otago Regional Council
AND Plan Change 5A (Lindis Integrated Water Management)

Tim Davis

My name is Tim Davis

Qualifications

1. I farm Longacre Station in the Lindis Valley, north of Tarras. I have a degree in Agricultural Commerce and a Post-Graduate Diploma in Commerce Subjects, both attained at Lincoln University. I have over 10 years' experience as a Foreign Exchange and Interest Rate Derivatives trader, working for Westpac Institutional Bank in Sydney, at ABN Amro Bank in Sydney and Singapore, and subsequently at Royal Bank of Scotland, in Singapore and Stamford, Ct, USA. I retired from trading in 2012 to return to the family farm.
2. I am a member of the Lindis Catchment Group, and am secretary on the committee.

Intergenerational Farm

3. Longacre Station is a 3340 ha property running approximately 10000 sheep and 400 cattle. It has been in the Davis family since 1960 when it was purchased by my grandfather. It has subsequently been farmed by my Uncles and father, and most recently myself and my wife, Julieanne, along with our two boys, Hugh (6) and Samuel (4).

Affiliation with the Lindis

4. I spent my childhood living within two hundred metres of the Lindis river. Many a childhood summer was spent swimming, fishing, camping and picnicking along the banks of the Lindis. We had a picnic table and bbq set up under one of the willow trees. On warm summer evenings we would often take a picnic down to the river, and with our cousins who lived on the property at the time, would have dinner and do some eeling. I found it a lot easier to catch eels than fish in those days. In fact, I have never caught a fish in the Lindis despite spending probably thousands of hours trying. That is a reflection on my fishing skills, and perhaps the willow trees which now possess an array of lures, rather than a lack of fish.

Loss of Eels

5. To this day, I can still go down to the river and see good sized fish. Unfortunately, the same

can't be said of the eels. Whereas they were plentiful growing up and easily catchable, I don't think I have seen an eel in the river for over twenty years. I note that the ORC found one in 2010 living in the Ardgour stretch of waters. The habitat is perfect for them in the river, but unfortunately, hydro development (and possibly commercial eelers) has caused their demise. Not low flows in the river.

6. Nowadays, I don't have time to take my rod down to the river. But we still swim in the warmer months. This year, with the lower flows, the river felt considerably warmer than usual. I did note the flow at Lindis Peaks. Uncertified, it was in the 700-750 band. Abstraction from our take was approximately 100 l/s as we were on 50% restrictions so the water in the river was likely to be 600-650 level. I will talk about this a little bit later on in my submission.

Lindis River and Longacre

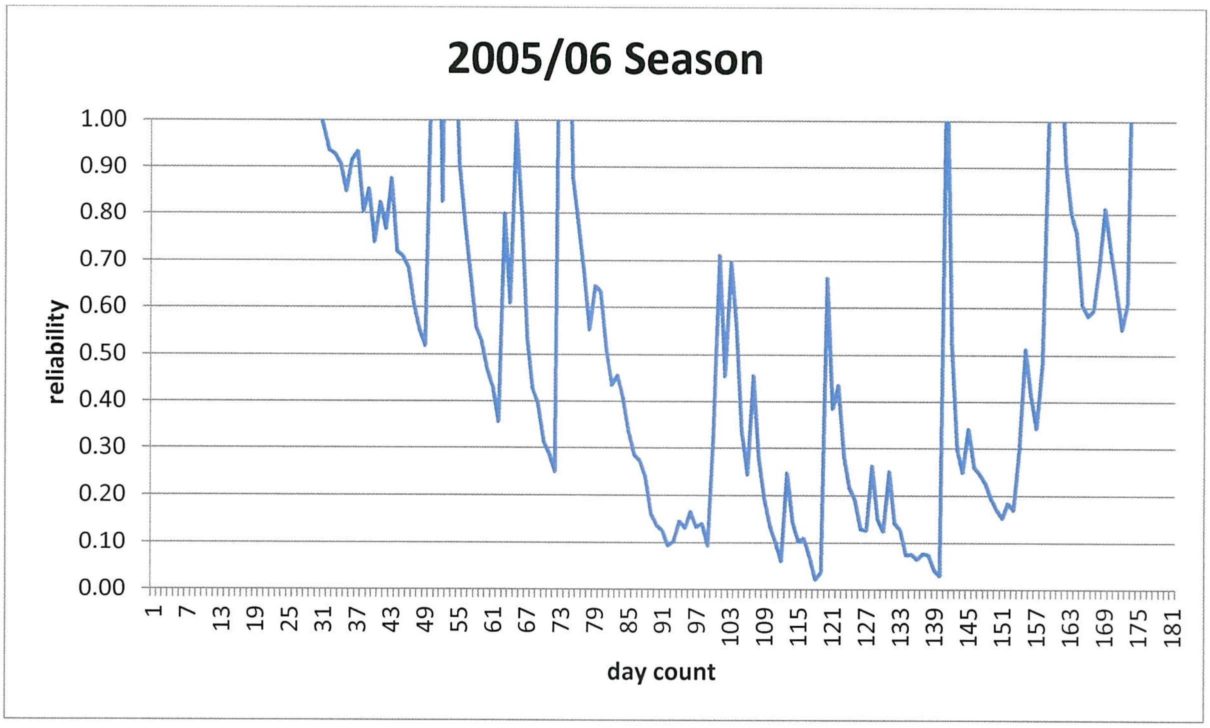
7. So in addition to living next to the river for large parts of my life, the Lindis is also an integral part of my farming operation. Longacre Station has a very good balance of high hill country, mid altitude country and flat land. It has the Lindis river as its western boundary, and the Dunstan Creek as the eastern boundary.
8. The property currently has around 280ha of irrigation, predominately spray irrigated but with a small balance of border-dyke and wild flood. The wild-flood is earmarked for conversion to spray once finances permit.

Efficiency Improvement

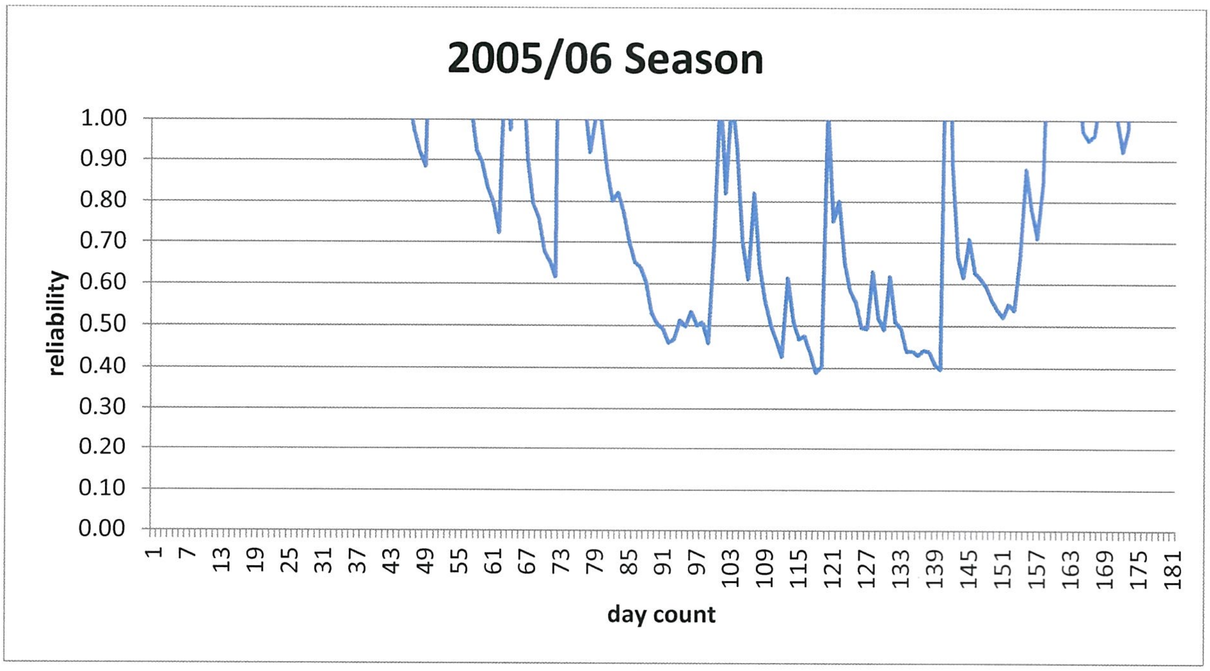
9. The first pivot on the property was put in by my father in 2003, followed by another in 2008 and the last one was installed in 2013. This last pivot replaced an aging border-dyke system, where a new stock water scheme was also installed.
10. The total cost was approximately $500 000, or $6250/ha once cost of clearing trees, border-dykes and fencing are factored in.

Restriction Impacts

11. Despite the dry season and low flows in the Lindis this year, this pivot ran for the full season. We don't have all the certified daily flow for Lindis Peaks for this season as yet, but this year has been very similar to 05/06. (From the very latest data I have been supplied which is up until the 14 March, there were four days less of restrictions this year comparable to the same period in 2005/06).
12. Under a 750 l/s minimum flow, in this comparable dry year, I would have had to turn the pivot off for a total of 60 days.
13. Under a 450 l/s flow this drops to 17 days. A substantial, material difference.
14. This is a very important point to note, as ORCs rationale is we already have substantial restrictions under the current system hence there is little difference. This is very clearly not the case.



Graphical representation of restrictions on demand of 1500 l/s with flow at Ardgour at 750 l/s. Most reliable pivot turned off when flows drop below 32%. Equates to 60 days in this season.



Graphical representation of restrictions on demand of 1500 l/s with flow at Ardgour at 200 l/s. No days are below 32% reliability, main pivot remained on all summer. Restrictions on other areas.

So what would be the effects of this on my business?

Winter Feed

15. Irrigation plays three roles on my property. Firstly, and most importantly, it grows winter feed. Winter is our limiting factor in the Lindis. So we have to supplement stock intake with

crops, silage and supplements along with autumn saved grass. We plan this a year in advance, as preparation of crops take time and money. It is not something we can decide to do once we realise it is a dry year, or once we realise we are short of feed.

16. This year we have under irrigation 28ha of fodder beet and 9 ha of swedes. This is grown under our most reliable pivot, and will grow a minimum of 800t DM of high quality feed.
17. Before we had spray irrigation, we would grow dry land turnips. Turnips have lower feed quality than both swedes or fodder beet.
18. In an average year, i.e. sufficient rainfall to grow turnips, I would need to sow 100ha to get the same DM production. In a dry year like the one we have just had, that 100ha would be lucky to grow 400t of DM.
19. The cheapest form of feed I could buy to replace that is palm kernel, which I refuse to use due to biosecurity risks, or barley. Best price I could land Barley is $330/t and I would need 450t. This will equate to just under $150,000. (**appendix 1**)
20. So as well as using less land, irrigation gives me a guarantee. Had we needed to turn the pivot off to maintain a 750 l/s min flow (estimated 60 days of less water), yield in the crops will drop substantially.
21. My feel would be at least 30%, as when flows are low, ET is high and thus plant growth would stop quickly. The cost of barley to replace this loss of production is just under $90 000 (**Appendix 1**).
22. Essentially, it is likely to rule out growing fodder beat as a crop, as it is expensive to grow if yields are not high due to the costs of sowing and land preparation.
23. Under a 450 l/s minimum flow, the 17 days of the pivot turned off would still have an impact but production losses will be a fraction of 30%. This is due to the short duration when the pivot would be switched off, i.e. 5-7 days at a time, due to the intermittent nature of the low flows.
24. As you can see, these costs are greater that what Berl estimated for the entire Lindis catchment, and I have only identified costs on a 37ha section of one pivot.

Fattening Stock

25. We use irrigation to fatten hoggets in the Spring, lambs in the Summer, and 1yr old cattle over the Summer.
26. Irrigation has enabled us to change our cattle policy considerably. Before pivot installation, we used to take all fattening stock through a second Winter. Now we fatten all stock before the second Winter. The effect is we can double the cow numbers, which doubles the amount of stock to fatten, but we haven't changed the number of cattle we take through the Winter, thus doubling income for the same numbers. As mentioned, the Winter is our limiting factor.
27. In a year like this one, our ability to fatten stock gets tight. This is due to irrigation restrictions we currently experience on our hard hose and smaller pivots. The main pivot still operates fully. However, having to turn off our main pivot as well, all fattening stock would have to have been sold store, resulting in large losses of potential income.

28. The store/fattening price differential has a minimum spread of $300 (i.e. breakeven margin required by finishers when buying stores). When there is pressure on selling this margin widens due to demand supply fundamentals. Over the 160 cattle which we fatten, this leads to a loss of potential income of a minimum $48 000.

29. Not only that, due to the inability of being able to grow fodder beet reliably, we would have to consider reverting to our old cattle system of taking stock through two winters, halving our cattle income on a permanent basis.

Dryland Integration

30. The third main use of irrigation is a buffer for the remainder of the farm. This is very hard to quantify the importance of.
31. In dry years the low and mid-altitude country pasture growth rates collapse. We have to be very careful about over-grazing and doing damage to the tussocks which provide a range of benefits for stock, grass growth and water shed.

Photo showing mid-altitude country with adequate moisture

Most of our ewes, after weaning lambs, head out to the high country. This is located out in the Dunstan Creek, and this area supports around 4000 ewes from February to May. The remainder have to be farmed elsewhere on the property. The irrigation provides us the ability to destock the sensitive tussock lands. So we run 2-tooth ewes on and off irrigation as feed dictates. Without this ability, we would have to either destock, or buy in feed.

Photo illustrating the impact of dry conditions on mid-altitude country

32. Again, barley is the most cost-effective feed source, and to provide feed for them for 120 days would cost around $52000. (**Appendix 1**)
33. At present, not only do we have all our 2-tooth ewes on irrigation, we also have 2000 lambs. They would have to be sold store. At current prices, I would expect to receive an average $55 each sold store. Taking them through the winter, I would expect to get $30 of wool and average $110 as prime lamb. This represents a net loss of income of $170 000.

Total Impact of 750 l/s on Longacre's survival

34. So adding all of this up leads to a quantified loss of income of $360 000. Adding to this we still need to cover the farm's fixed costs, make repayments on our pivot, and service our debt. This quickly becomes unsustainable and over the medium term view it as bankruptcy.
35. We have just looked at what this looks like from current to 750 l/s in a dry year. The value of irrigation to our property can-not be overstated. We are committed to it, having funded our development already and carrying substantial debt which we need to service.

Property comparison – completely dryland vs dryland with a small amount of Irrigation (8%)

36. To quantify its value to our property another way we can compare Longacre to a property without irrigation. While all properties are different, it just so happens we have a neighbouring property that is very similar to ours. Similar in respect to size, balance, and class of stock run. Both run superfine sheep, in fact their genetics have been selected from the same studs for over twenty years. This property was also owned by my Uncle for a period of time so I have knowledge of its stocking rates and performance.

	Neighbour	Longacre
Production KPIs		
Effective Area (ha)	3521	3340
Stock Units	8257	10132
Lambing %	70	74
Wool Kg/SU	4.1	5.25
Sheep Deaths %	6	5.9
Average Wool Price / Kg	14.89	14.4
Cow Calving	90	109
Cattle Death %	3	0.3
Financial KPIs		
Animal Health / SU	4.83	3.99
Fertilizer / SU	8.87	8.87
Feed / SU	4.97	6.93
GFI / SU	**99.65**	**126.52**
GFI / Ha	226	384
FWE / SU	40.3	68.55
FWE / GFI %	40	54
EFS / SU	59.36	65.8
EFS / Ha	**139.2**	**199.6**

Figure 1. Actual performance indicators of Longacre and Neighbours in 2012.

37. The properties carry slightly different numbers, due to the ability of more stock being able to be run on irrigated land due to the higher production. However, gross farm income(GFI) is dramatically different, 126.52 SU for Longacre, and 99.65 SU for the neighbours.
38. Over the whole property, this amounts to a difference of $459 000. As stated, Longacre has 280 ha of irrigation. (In 2012 we ran more flood and border-dyke irrigation, as our latest 80ha pivot hadn't been installed, as well as 50ha of hard hose on previously wide flood irrigation. So this will **understate** the current value)
39. This equates to a marginal GFI per ha of $1640.
40. As expected, the GFI is higher than the direct costs highlighted in the first section. This is due to other benefits of irrigation, such as better fed stock, higher conception rates due to the ability to flush stock, higher weights of lambs in the Spring.
41. It is also the result of being able to plan with certainty. Because of seasonal uncertainty, the neighbours can't plan to sell prime stock, or contract stock at certain times of the year. It changes the whole dynamic of the property. This clearly illustrates the benefits of what irrigation brings.

Naturalised Flow Series Errors

42. OPUS was contracted by the ORC to provide a hydrological analysis of the Lindis catchment. This analysis was then subsequently used by BERL economics to write an economic impact study.
43. The ORC's naturalised flow series has been used as the basis for the OPUS report, and quoted "constraints of the project meant that the naturalised flow series was adopted and accepted as correct"

MALF calculations

44. I have reviewed the naturalised flow series, and find it has some small errors and assumptions that are questionable. The latest calculated MALF for the river is 1745 (section 42 report). A lot of the expert evidence prepared for the hearing have this incorrectly noted. This doesn't take in the current year which will reduce it further. Due to the relatively short duration of records, this number will remain to be volatile for some time yet and any decisions based on a % of MALF will be obsolete very quickly.

Tributary calculation errors

45. Where I have some major issues is with the tributary data. The 7-day low flow tributary data is calculated on flows of Lindis Peaks at levels around 1200 l/s. Analysing the data on Cluden Creek, I find there is a variation as to the contribution this creek makes to the main stem. Essentially, as flows drop the % contribution reduces. At 1200 l/s at Lindis Peaks the contribution is 9% and this increases to 12% at higher flows.
46. Rocky Creek, one of the tributaries, is above the Lindis Peak site; hence it has been double counted. While there is abstraction from Geordie Hills Station, the ORC also added in another 50 l/s to take this into account. As Geordie Hill is the only active irrigator, we can assume that 30 l/s (low flow of Rocky creek – Geordie Hill's water right) is taken by Geordie Hill and no additional amount is needed to be added in for irrigation abstraction.
47. Of the remaining 5 tributaries only one reaches the Lindis River, that being Cluden Creek. The remaining tributaries all run dry in low flows before reaching the river. The idea of the naturalised flow series at Ardgour is to estimate the flow **in the river**, not to estimate total catchment water availability.

Total impact of errors

48. What does this mean? At the MALF level not a lot, i.e. when the river at Lindis Peaks is flowing above 1200 l/s. But it begins to overestimate the water in the Lindis at Ardgour Flow recorder when Lindis Peaks drops below this level.
49. To highlight this, we can look at the lowest flow at Lindis Peak of 672 l/s. ORC's naturalised flow is 829 l/s, which equates to LP + 23%. At a flow of 1200 l/s at LP, the naturalised flow equates to LP + 16%. So despite the tributary catchments being lower in altitude and having less rainfall, their contribution to Ardgour naturalised flow as calculated by ORC **increases** as the river drops, not decreases as should be the case.
50. The only water that connects to the main stem at low flows is Cluden Creek. Which taken at 9% of the main stem, would give a low flow at Ardgour of 732 l/s. If we take the same % of tributaries when the river is higher, i.e. 16%, gives us a low flow of 778 l/s.

51. The reason I highlight this is to give an indication of the 100% reliable water in the Lindis, somewhere between 732 and 778 l/s, which equates to an average of 755 l/s. So the proposed minimum flow will take all the reliable water out of the river, leaving nothing left for irrigation when we get to low flows. While this only occurs for short periods at this level, if we were to take an aggregate of the number of days where naturalised flows are between 750 to 1000 l/s, the numbers become significant.
52. In the 05/06 season there were 34 days where naturalised flows were below 1000 l/s. This highlights the folly of those asking for a minimum flow above 750 l/s. They don't occur naturally, so how can it be expected that you as commissioners can deliver it.

Mean vs Median

53. Another point highlighted by OPUS of the flow regime of the Lindis is the extended periods of low flow. Quote "This is highlighted by the mean daily flow of 6.3m3/s being 50% larger than the median daily flow (4.4m3/s)."
54. While not as pronounced as the mean daily flow, the mean 7-day low flow is also higher than the median 7-day low flow, approximately 10% more.
55. This is further illustrated that the calculated MALF falls very close to the 75th flow percentile, not the 50th percentile.
56. So we would expect in an average year, the 7-day low flow to be 1580 l/s, similar as the ORCs calculated MALF of 1600 l/s when 450 l/s was originally recommended as the minimum flow for the Lindis river.
57. This was one of the reasons ORC used to justify a higher minimum flow, that there was more water in the river than originally thought. I don't believe it was a relevant argument at the time, and this just highlights why that sort of argument becomes unusable.

Review of OPUS International Consultants Lindis Catchment Hydrological Analysis

58. Opus uses the naturalised average daily flow series plotted against abstraction and irrigation demand, and compares the potential impact on minimum flows of 450, 750 and 900 l/s measured at the Ardgour Road monitoring site.
59. On irrigation demand, Opus compares a range of different extraction rates.

- existing **allocation** of 4134 l/s. This is the current consented take out of the Lindis River, not the actual take. The results of this analysis have no relevance. This amount of water is physically unable to be taken, similar to many other dry catchments in Otago

- Existing allocation of a calculated 'Lindis water only' extraction at a rate of 2084l/s. Opus has looked at command areas of two recent schemes that overlapped areas where Lindis water is currently allocated to. As these areas are assumed to have two sources of water they were removed from the Lindis catchment, reducing the area that must be irrigated from Lindis water from 3184 to 2420 ha. They then distributed the existing allocation over the whole area, (including the command areas of land that has never been irrigated from Lindis water) and then reduced the allocation on a pro-rata basis. Hence why the allocation is approximately 50.5% of current abstraction despite the land area being 76% of previously land irrigated from Lindis water. Again this analysis and results will be discarded as it is a theoretical number bearing no similarity to current or future realities, as irrigators are able to use two sources of water on the same area of land as long as it is efficient.

- Current area using efficient irrigation. Assumes adoption of efficient irrigation systems throughout all areas which currently get water from the Lindis Catchment. (including the portions of the two command areas which can get water from the Lindis Catchment) Maximum daily abstraction is calculated at 1515 l/s. This scenario is the most likely to occur post-2021 with regards to abstraction rate. Irrigators will be allocated an amount of water that is deemed efficient to irrigate their land thus forcing irrigators to switch to a system designed around efficient application methods, primarily spray. A number of users have already made this change or are part way through.

  Opus calculates that 100% supply security would be available for half of the irrigation periods modelled under no minimum flow, while the maximum number of days on some restriction would be 24 days. (In comparison to the 180 days that Opus calculated under total current water allocation) While no comments are made, graphical representation is made that supply security falls to approximately 62%. Furthermore, Opus states "The various minimum flows which have been suggested would have a significant effect on water supply security ..."

- Efficient irrigation on land Opus deemed to be only irrigable from Lindis water. i.e. 2420 ha using 1146 l/s. With no minimum flow Opus concluded there would be only 3 irrigation seasons between 1976 and 2004 where there was insufficient water available from the Lindis catchment to meet irrigation demand. Supply security in the worst of those 3 years was approximately 82%. (I.e. irrigators would still receive 82% of their allocation). **"The imposition of a minimum flow regime would have a significant effect on both the number of days each irrigation season, and the duration of continuous periods when 100% supply security could not be met. The effect of any minimum flow requirement increases with the magnitude of that flow."**

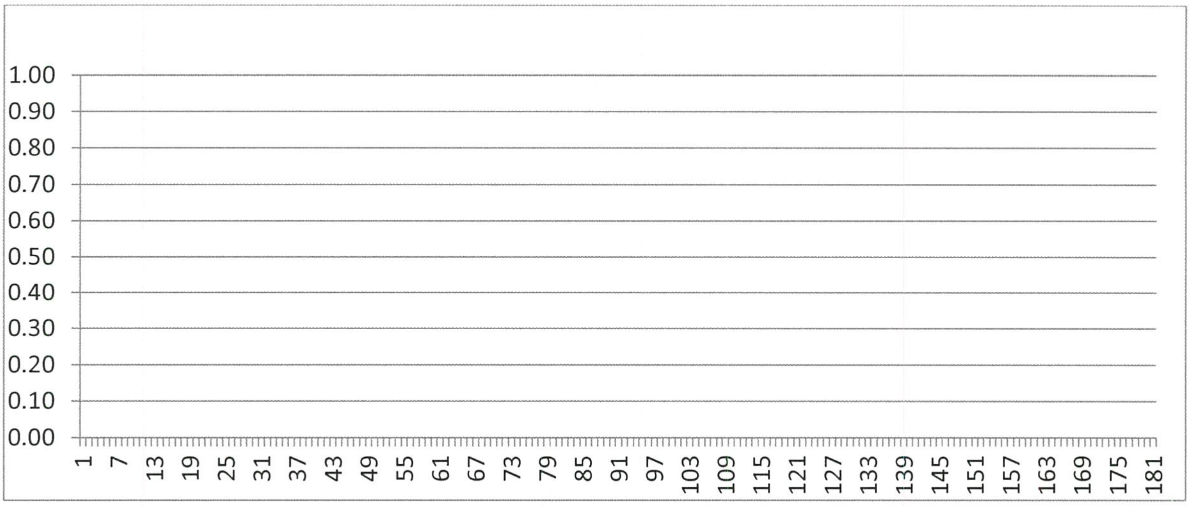
Conclusions

60. Opus concludes that "The effects of a specific minimum flow are greatest when efficient irrigation systems are used to irrigate those areas of the Lindis Catchment which currently do not have access to alternative water sources".
61. This is the reality of the situation. The ORC have estimated an abstraction rate in the order of 1100 l/s, while the Lindis Catchment Group estimates a higher 1550 l/s. Both of these scenarios have been modelled by Opus and under both of them the effects of the imposition of a minimum flow are pronounced.
62. This makes sense, as under the current situation there is approximately 550 l/s of 100% reliable water. With a 750 l/s, there is no 100% reliable water available.
63. **ORC claims that the imposition of a minimum flow of 750 l/s has little impact on water availability are at stark odds with the report that Opus has written.**

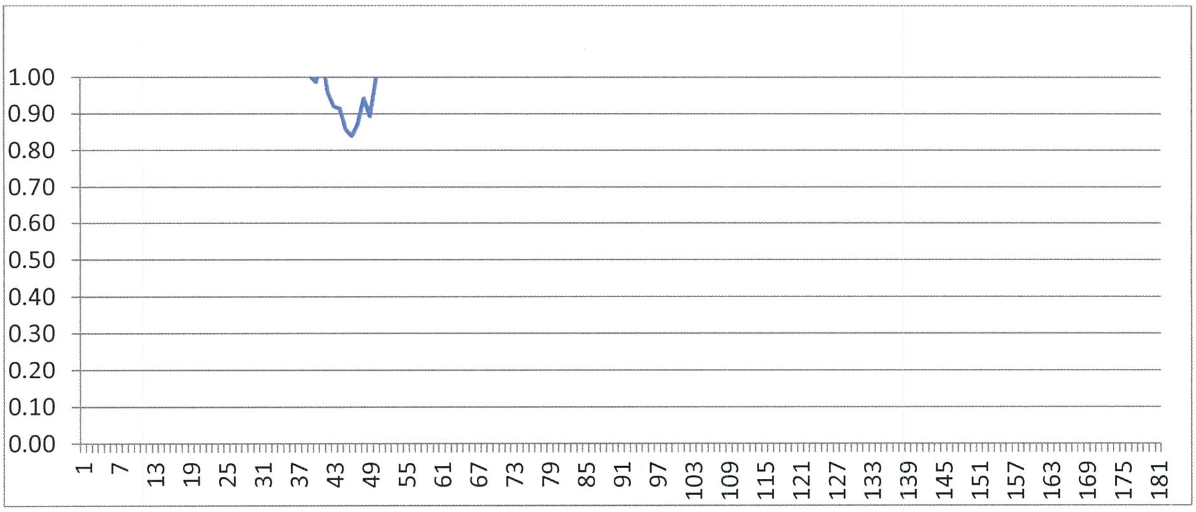
Lindis Catchment Group's reliability model

64. I have done a lot of work with LCGs water model. Initially we contracted a consultant to develop a base model for irrigators. This was so we could easily see what restrictions of various minimum flows would be given historical water flow records. We gave ORC a copy of this model, and they have developed it further to suit their needs.
65. I have made continuous improvement to our model so we can easily model abstraction restrictions. It is based on flows from Lindis Peak data recorder as these flows are unaltered.
66. I have added in a tributary addition to the value of 16.5% of Lindis Peak flows to simulate the naturalised flow at Ardgour. This is the % that tributaries were recorded as a function of Lindis Peak flows in the 2012-2014 period.
67. At lower flows it is likely that this % is substantially lower. Likewise, at higher flows I would expect this % to increase.
68. As with all models there is a trade-off between total accuracy and ease of use. I feel with the lack of knowledge on the hydrology of the Lindis and the large degree of uncertainty as to what levels of groundwater are available that this model has a more than adequate degree of accuracy given the constraints.
69. The mathematics are relatively easy to use. For a given flow required at Ardgour, we can subtract this from the modelled flow, and then divide what abstraction demand is, to get a given level of reliability.
70. Using 1500 l/s demand, I can graphically show the difference between current no minimum flow, to 450, and then to what a 750 l/s would look like.

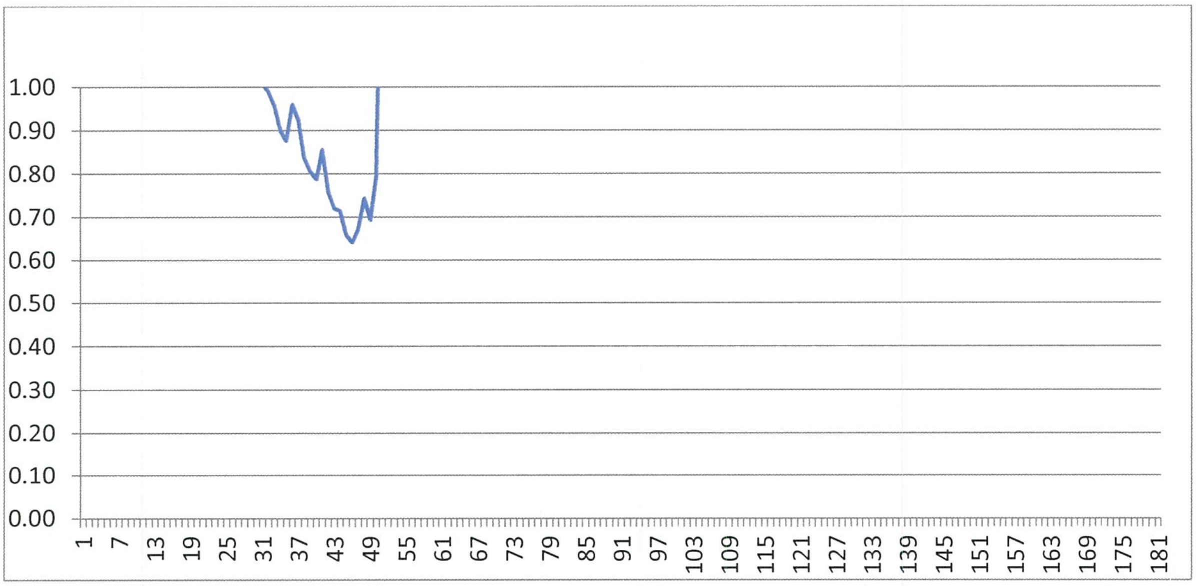
2010/11 Season – Best year of last 10. MALF year/75th Quartile flow. (1 in 4 year)



Graphical representation of restrictions on demand of 1500 l/s with flow at Ardgour at 200 l/s.

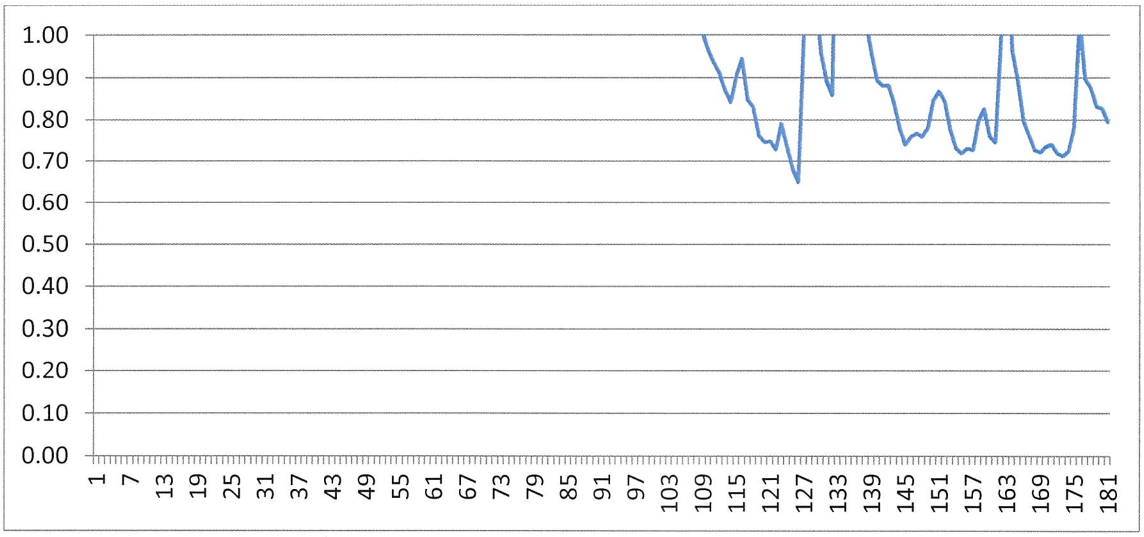


Graphical representation of restrictions on demand of 1500 l/s with flow at Ardgour at 450 l/s

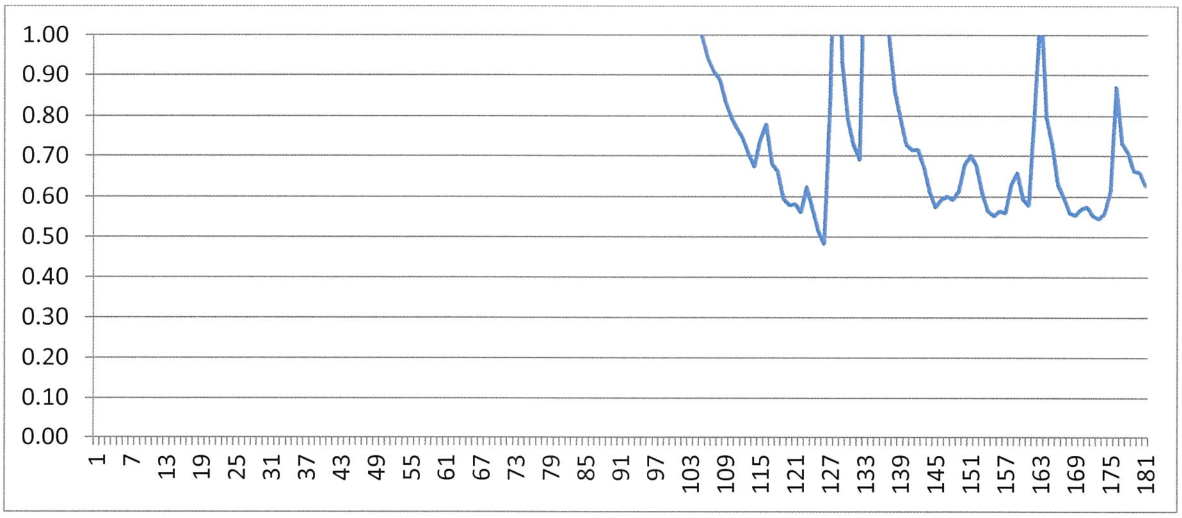


Graphical representation of restrictions on demand of 1500 l/s with flow at Ardgour at 750 l/s.

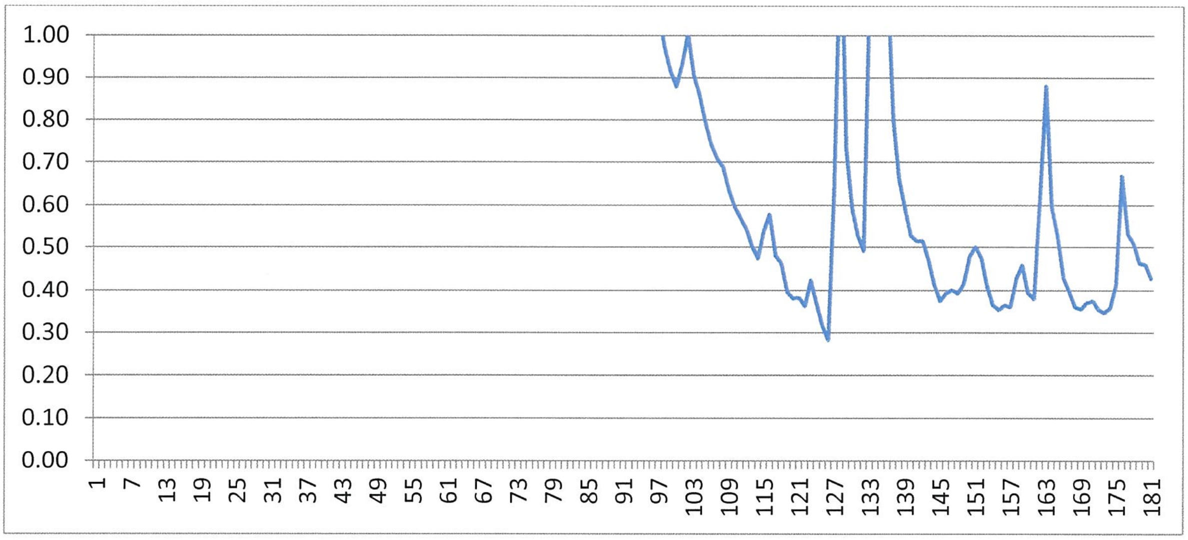
2006/07 Season – 25th Quartile flow. (1 in 4 year Ave) (5 years been worse in last 10)



Graphical representation of restrictions on demand of 1500 l/s with flow at Ardgour at 200 l/s.



Graphical representation of restrictions on demand of 1500 l/s with flow at Ardgour at 450 l/s.



Graphical representation of restrictions on demand of 1500 l/s with flow at Ardgour at 750 l/s.

71. As demonstrated, from current situations of flow (200 l/s) to 450 l/s, irrigators lose 16% reliability when on restrictions.
72. This increases to 36% when minimum flow imposed increases to 750 l/s. This doesn't include a management flow.

Management flow:

73. At present irrigators all take cuts as the river drops based on what water LIC is receiving. Once a minimum flow is introduced, irrigators will continue to do the same, while also making sure that the river doesn't hit the imposed minimum flow. If this happens, then all takes have to stop until the flow goes back above the imposed limit. The effect of this is that there will need to be a buffer above the minimum flow as to when irrigators increase restrictions.

74. From conversations with ORC technical staff with experience in other catchments, this is likely to be in the vicinity of 50 l/s. So for a minimum flow of 450 l/s, irrigators will increase restrictions when the flow gets to 500 l/s to ensure the river doesn't get close to total cut off. So it should be noted by the panel, that any minimum flow will actually have a higher **effective** minimum flow.

Economic impact of minimum flow

75. Current low flows of the Lindis river at the Ardgour measuring device are in the vicinity of 200 l/s. While they often go below this level, especially in very dry periods, for the purpose of this exercise we will use this level as the minimum flow of the current regime.

76. While modelling of the impact of a particular minimum flow at the individual farm level is rather difficult, on a catchment wide basis it is relatively simple. At the farm level, we run into issues of variability. For example, differing farm sizes, the amount of irrigation relative to the whole operation, the impact efficient irrigation will have on a change in land use, farming policies in relation to store stock/fattening stock, climatic variation and the effect this has on non-irrigated land, to name a few.

77. On a catchment wide basis all we need to assume is that the same economic rationale is employed regarding installation of expensive efficient irrigation systems. For example, a pivot system will only be installed if it has 99% reliability, k-line at 90% and so on. So for an individual farm who may have 200ha of irrigable area, actual installation of various irrigation systems will occur at the same point of reliability. It is okay for this to be different amongst individual farmers, just as long as the assumption remains constant. So on a catchment wide basis, as availability of water and hence reliability decreases, so does the installation of new irrigation infrastructure.

78. With this assumption, it becomes very simple to model what the effect on the catchment will be, and then by using standard economic multipliers we can model the effect on the local and regional economy.

Minimum Flow at 450 l/s

79. For a minimum flow of 450 l/s, we have a loss over the current model of 250 l/s. At an application rate of 5 mls/ha per day, this equates to a loss of 430ha of 100% reliable

irrigation. Why 100%? The lowest flow at Lindis Peaks recorder is 672 l/s. If we add 10-12% as an approximation of water added from Cluden Creek and other tributaries, we get a naturalised flow of somewhere in the vicinity of 750 l/s at the Ardgour flow recorder.

80. So using gross margin analysis from the latest Lincoln University Budget manual (2014) we can estimate the value this irrigated land will return. Fully reliable irrigation gives farmers a lot more options than partially reliable. Fodder beet, small seeds, barley are able to be grown confidently when there are no issues regarding loss of water.
81. Fodder beet has a gross margin of 3381/ha @25t, white clover seed 2821/ha @900 kg/ha, Barley 1392/ha @ 7.5t. Due to the need for crop rotations and also for providing the right mix of feed at the right times, it is likely that a range of crops/fodder are grown at the same time. If we take the view that a farmer has these three options (or similar, wheat can be substituted for barley and will return more, Kale for fodder beet which will return slightly less) evenly spread, we have an average return of 2531/ha.

It should be noted that these gross margins are a reflection of what is currently being grown under 100% reliable irrigation now. One only has to drive up the long straights of Tarras to see Fodder Beet grown extensively (photo on left taken at Lindis Peaks Farm), likewise the large Barley crops on the terrace above Tarras, and small seed crops past Maori Point. Carrot seed is also grown which has an indicative gross margin of 11,000/ha, but not included. Likewise, the potential for horticultural crops such as cherries, or vineyards is also not included but I know are being considered by some.

82. Over 430ha, this represents a direct loss to the farming community of $1.088 million without taking in current land use. Using a 5-year average of actual returns of a property in the Lindis Valley of $205/ha, the net benefit of the irrigation is just over $1 million.

83. We can then use Berl economics' report done for the ORC to estimate the wider economic impacts on the region's economy. Using the same ratios as Berl does between farm return and those to the region, we find there is a loss of $1.819 million to the Central Otago District and $2.444 million to the wider Otago region.

Minimum flow of 750 l/s

84. A loss of 550 l/s over the current minimum flow of 200 l/s leads to a loss of 948 ha of 100% irrigated land. Using the same figures above, we see a direct loss to the farming community of $2.205 million. To the Central Otago region of $4.009 million and the wider Otago region

of $5.387 million. These are annual figures. This does not take into account the losses to the region associated with infrastructure not being put in.

Results compared to Longacre Station

85. Earlier in my submission I talked about the value of irrigation to my property, Longacre Station. I highlighted what direct costs and loss of income would look like if I had to turn off my main pivot in a dry year. I also compared the value of irrigation to my farm when compared to a very similar dryland operation. I came up with the figure of $1640 /ha, as opposed to $2531 above.

86. So what is correct? **Both**. When I compared properties, the irrigation on Longacre wasn't fully developed. It still had a large area of flood and border-dyke irrigation. It was also not 100% reliable. What I have calculated above is the loss of **100% reliable** irrigation.

87. Valuations will always differ depending upon who does them and the method involved. What is most important is that they both are very material, and quite clearly highlight how important irrigation is not only to the local community, but also the region and beyond.

Berl Analysis

88. It is interesting to note the large differences in the analysis between Berl and my own. This is due to the way Berl have tried to calculate the effect of restrictions on irrigation. They have used Opus modelling of the total consented, not actual, water use. This bears no relation to reality. Not only that, they use this data on a pro rata basis on number of days of unrestricted irrigation. This essentially lumps days with 99% of water with days of 1% of water. When water becomes restricted, irrigators roster and cut back abstraction rather than turn off completely.

89. The report is also very hard to understand, almost to the point where they aim for the reader to be bamboozled. Sometimes it is easier to look at the results and see if it passes what I term "the common sense" test. The results of Berl say that from the current no flow restrictions, to one with 750 l/s, farmers will only produce a gross margin of $100 000. This is enough water for 948 ha of 100% irrigated land? To put spray irrigation on this at $6000 / ha is $5.6 million. Do they really think banks would lend money on any irrigation in the country if this was the case?

90. Obviously, what has come out is put simply, rubbish!

91. So why does Berl come out with such a misguided, factually flawed report? Perhaps a clue is given in the executive summary. "It is argued that restricting water allocations will result in significant environmental benefits without necessarily having a negative impact on economic activity".

92. It is the duty of the ORC in the section 32 report to try to quantify economic costs/benefits, not try to obscure and downplay them as Berl has done. But I don't lay blame at them, they quite clearly let us know in their report the result expected of them!

Values of the Lindis River

93. It must be remembered from the outset, the Lindis river from the Cluden Creek upwards will not change in appearance or flows as a result of the imposition of a minimum flow. It is largely unaltered from a flow perspective. This is by far the largest section of the river, and its low flows are lower than the Naturalised Ardgour Flow. Lindis Peaks has low flow measured at 672 l/s.

Cluden to Ardgour Recorder

94. The next portion of the river, from Cluden Creek to the Ardgour flow recorder, is characterised by dewatering due to abstraction by irrigation in large takes and losses to groundwater. There is plenty of photographic evidence to display the poor state of the river in this section.
95. The Lindis Catchment Group (LCG), in conjunction with the Lindis Irrigation Company(LIC), plan to decommission the large takes in the vicinity of Cluden Creek, to be replaced by smaller takes closer to their point of use. Aqualinc, commissioned to do some economic analysis for the LCG, has estimated the cost to do this at between $2-3000 per ha. Further enquiries to local irrigation companies has estimated this cost to be closer to $3000/ha.
96. For 1500ha using $2500/ha, gives a total cost to do this of $3.75million. While there are some large efficiency gains to be made and a reduction in the cost of maintaining races, the other motivation is to increase in-stream habitat in this section of river.
97. The ORC, by way of rejection of Tarras Water Ltd, thought the environmental value of raising the Lindis minimum flow from 450 to 750 l/s was not worth $2million. The irrigators of LIC will have to spend $3.75 million. This will result in better values for the losing stretch of this portion of the river than a 750 l/s min flow under the current take arrangements.
98. There will also be some irrigators who can't afford the required upgrades and may have to return to dryland.

Below SH8

99. The section of river that values are in dispute, is below SH8 bridge. This stretch of the river is characterised by gravel outwash, a changeable riverbed, losses to groundwater and lack of deep pools.

In this following section, I would like to give my views regarding some of the values deemed important by the ORC in its' community consultation and not covered by expert evidence.

Swimming/paddling/wading/camping:

100 The Lindis river is used extensively over the summer months for swimming and paddling. There are numerous campers along the banks over the Christmas/New Year period, especially upstream of SH8 bridge.

101 Swimming in the Lindis is done in natural pools. The nature of the Lindis is unlike meandering rivers found in low country areas. Pools don't require high flows to swim in, they are naturally deep. I mentioned at the start of my submission about swimming in the river below my house with an indicative flow of somewhere in the vicinity of 600-650 l/s. The pool was great for swimming, despite the riffles being at a flow where the level was

hardly above ankle high. A flow of 450 l/s will more than adequately connect pools in the areas above SH8 to provide for swimming.

Paddling

102 Important for young children, the values are different. As flows increase, the value may decrease. As water levels rise they become more swift. The was highlighted to me when talking to a family with a toddler. They were paddling downstream of SH8, when the Ardgour flow recorder was at 500 l/s. I asked them why they were not further upstream where flows were higher, their response was it was too dangerous for their child. I took particular attention to this as with young children of my own, I have a similar view. Higher flows could be found for over 70km upstream, so values were present for anyone who wanted higher flows, but this is not always the case for the younger ones in the community.

103 As we approach the Clutha Confluence, flows drop to lower levels, however, this stretch of the river is a lot less accessible, and obviously has dangers associated with the proximity to the Clutha.

Camping

104 Camping is not impeded by any minimum flow. The **use** of the river by campers is covered above.

105 It should be noted that this is a vast improvement from the current situation.

Kayaking

106 It was noted that kayaking was a value on the river. I have jet-boated on the Lindis River. It is tough and required a lot of cutting of willow trees that form debris dams at numerous points. Once flows drop below 3500 l/s jetboating ceases to be possible. Kayaking would be in a similar situation.

Natural Character

107 It was told to us by the ORC that tourists regularly complain that there is no water in the river as they cross SH8 bridge. It must cost Ecan a lot of time on the phone to tourists as most rivers in Canterbury are dry when you cross them. 450 l/s will ensure water below the bridge. Towards the confluence, the expanse of gravel and riverbed no matter what flow is in there, will look a fraction of what would be deemed a full river.

Fishing

108 Reading expert evidence it is hard not to think that the Lindis is a poor fishery. Aaron Horrell describes when he first came to the Lindis in the early 90s that it wasn't the fishery of five years previous. (paragraph 12, Submitter 36) This is not a result of any abstraction, as the current abstraction methods had been in operation for decades. It's more likely a result of perception and somewhat changeable nature of trout. I note in the Water Quality report of the Lindis River that trout densities can vary greatly with an observed range in the SoE report at Ardgour Road bridge from 1.3 – 3.0 fish / 100m2 to 16.4 fish/100m2 in 2010.

109 It also reinforces a conversation I had with a fisherman this past Monday, 28 March. Jan Hron is from the Czech Republic and was fishing in the Lindis just south of Elliot's Bridge. He

saw over 15 good sized fish in a 500m stretch, having three hooked on and reeling this one in, photographed below. His judgement of this fish was that it was 55cm, in excellent condition and gave a great fight. In comparison to a fish he caught on the Hawea River three weeks ago, described as in very poor condition, with little fight.

His other comments were the willows made it extremely difficult to fish, and combined with lack of flow (sub 1500 l/s at Lindis Peaks) it was difficult to land the lure in the correct spot without catching weed. Furthermore, the next morning, Monday 28th, he saw a lot less fish and the ones there were not interested.

Jan Hron, fish caught south of Elliot's Bridge, Lindis River Sunday 27 March.

Jan Hron, fish caught south of Elliot's Bridge, Lindis River, Saturday 26 March

Connectivity

110 I have read all of the expert evidence supplied to the hearing about connectivity. This seems to be the most contentious issue. From the data I have seen, connectivity occurs at flows below 450 l/s. I would also like to quote from ORC-update of scientific work in the Lindis catchment:2008-2015 (Dale/Olsen) "estimating flow losses on the falling limb of a flow recession may over-estimate flow losses".

111 There is some expert evidence tabled that suggests larger losses to groundwater than 450 l/s. However, often there is a reason for this, such as a long period of low flows preceding the observation or time delays between observation of drying and the automatic flow recorder.

112 It should be strongly noted, if this **IS** the case, i.e. larger losses to groundwater, then the propensity of the Lindis River to go dry naturally increases. Again, the commissioners are being asked to implement a value (connectivity) that doesn't always occur naturally.

113 I do have a solution however that should appease both sides. Have maintaining connectivity as a sub-condition. This can be achieved by installing a camera or temperature recorder at the confluence. The site will have cell connection so having this telemetered to the ORC like all measuring takes is entirely possible.

Water Quality

114 Water quality of the Lindis is generally very good. The latest water quality report was posted to the ORC's website. Most measurements of water quality were well within the ORCs guidelines. This is despite irrigation being present in the valley for over 100 years. TN and NNN breached ORCs guidelines in the latest report. Regardless of the arguments for and against water quality, farmers will have to abide by water quality regulations whatever the minimum flow. This has been addressed in PC6A which will take effect in 2020.

Water Temperature

115 Water temperature is a river quality related to a lot of the fisheries values. Water temperature is an issue particular to the sports fishery, especially in the lower river where recorded water temperatures often exceed those tolerable for trout, even with flows up to 1400 l/s. I noted a lot of the expert evidence were calling for higher flows to lower temperatures in the water in the lower part of the river. This is despite the current stretch of water in the Ardgour that is isolated has its flows provided by cooler groundwater.

116 I want to bring to the attention of the hearing panel a quote from ORC's scientific update(Dale/Olsen). 'Generally, as river flows increase there is less diurnal fluctuations and average and maximum temperatures are lower. However, this pattern may not hold in streams with substantial inputs of groundwater, as groundwater inputs may reduce temperature".

117 Furthermore, I note water temperatures collected at both Lindis Peaks and Ardgour Flow recorders. These are the only two years I found where there is a record of temperatures for both sites. (**Appendix 2**)

118 It shows that water temperatures at Lindis Peak were generally higher than Ardgour Road. While I don't have the flows these were recorded at, maximum temperatures are generally associated with the heat of summer and hence lower flows. Lindis Peaks had low flows in 06/07 of 1105 l/s and in 07/08 of 911 l/s. It can be safely assumed that the lower Lindis would be dewatered at these flows.

119 I put this to the hearing panel: once the minimum flow is implemented, and connectivity restored, what will be the effect of increased flows of warmer water on the fishery in the lower levels?

120 Remember, the temperature's recorded were at Lindis Peaks. The water still has to travel over riverbeds for many kilometres before it reaches the lower river, thus it is likely to be substantially warmer when it reaches the Ardgour section.

121 There are always un-intended consequences of changing an established ecosystem. The present one has been in force for over 100 years, with inhabitants of the river adapting to what occurs. The present ecosystem is widely described by fisheries experts, in its current state, as being an important hatchery for the nationally significant Upper Clutha fishery. Water Temperature is currently a limiting factor for trout habitat now. It may-be more common once a minimum flow is introduced.

122 Similarly, the decommissioning of the large irrigation takes and open races will also have an effect. There are large numbers of yearling trout present in these races. A side-effect of their closure may well result in a large decrease yearling habitat, the opposite of what this plan is trying to achieve.

Low-flow stepped flow

123 Spray irrigation requires reliability. The implementation of a minimum flow will reduce the available 100% reliable water, and therefore overall irrigation reliability will reduce. In response to LIC's proposal to decommission the large irrigation races, I think there needs to be some compromise to maintain some reliability for irrigators at low flows. It must be remembered the large costs that LIC members will bear to ensure the losing reach above the Ardgour bridge will maintain connectivity and improve habitat for resident fish populations at all times.

124 I propose that when flows drop at Lindis Peaks below 1000 l/s, then flows in the river below SH8 are allowed to disconnect from the Clutha to a point somewhere in the vicinity of 100 meters downstream of the bridge. This is likely to allow another 150-200 l/s be made available to irrigators for that short time. This is a relatively rare occurrence. Including the current year, flows have dropped below 1000 l/s at Lindis Peaks seven out of 40 years. Of these, only four were meaningful. I fully acknowledge the loss of connectivity values, especially to Kai Tahu. But it will be for short durations, and occur on average less than one year in five.

Storage

125 Storage is often talked about to increase reliability. There are not a lot of sites, if any, available for large scale storage in the Lindis. So on-farm "turkey nest" storage is the only option available to some, not all irrigators. Financial costs will restrict most irrigators from putting in storage. Storage would also be wanted to be used most years, otherwise it is

largely a dead cost. Hence, in extreme low flows it is likely that any storage put in would have been exhausted by the time flows got to this level.

126 An indicative cost to put in storage is between $3-6 per cubic meter. In the 2005/06 season, at a cost of $4.50 a m3, the cost to store the level of water that could be available to irrigators assuming another 175 l/s would be available is just over $2.7 million. **Appendix 3.**

Primary flow

127 The ORC has proposed a primary allocation block of 1000 l/s. Estimates of current primary abstraction is 2300 l/s. The ORC has incorrectly assumed that application methods are all inefficient, thus when irrigators are required to shift to more efficient methods, water will be freed up. This is at odds with the water plan which entitles irrigators to use the improved efficiencies on farm.

128 Furthermore, they have also decided to carve out the Tarras area that currently gets water from the Lindis to lower the forecast demand, despite acknowledging that these irrigators will still be able to abstract water from the Lindis post-2021 if the Lindis is the nearest practicable water source (water plan 6.4.0C)

129 It is another example of the ORC trying to obscure the realities of what is happening on the ground to suit their change in recommendation from 450 to 750 l/s.

130 The findings of the LCG last year were that under fully efficient irrigation 1550 l/s would be required. Later estimates were that demand may be higher and require a primary allocation block of 1900 l/s.

131 While the ORC maintain that the primary allocation is a sinking lid and no irrigator will lose their primary status, it has come to my attention that this may not be the case.

132 It is also contrary to the allocation models that ORC have consistently supplied, which always illustrate the lower primary allocation block of 1000 l/s, not the higher replacement primary allocation if a sinking lid was implemented.

133 We have been assured by senior management on many occasions that the sinking lid is what the policy is. On ORC's recent track record, I fear that once the legalities of over-allocation, what this plan change is all about trying to solve, are realised a back-track will occur. This would be a very serious breach of trust.

134 As mentioned we are virtually fully converted to spray, on the premise that it is a condition to get our primary allocation replaced. I would be very interested to hear how the ORC would then plan to pro-rata allocation. Not only do I ask for a primary allocation of 1900 l/s, I also would like a sinking lid policy to be expressly written into the plan, and that no primary allocation will lose status as long as efficiency and history of use criteria are demonstrated.

Catchment Map

135 I believe all irrigators on the Lindis should be treated equally. The policy of alternative source (6.4.0C) should be applied to all irrigators on the Lindis, not just those in the Tarras side. Trying to carve this catchment area out to lower demand forecasts in the economic and hydrology report was very under-hand.

Conclusion

136 Apologies for such a long presentation, but there is a lot to cover and the impact on my personal situation and that of other irrigators is very large no matter what flow will be imposed. Irrigators and the local community are the only group whose values are going to decrease. All other groups will see their values increase.

137 Not only that, the values of irrigators are directly related to livelihood. One that has been built on over 100 years of irrigation from the Lindis. No other group has their livelihoods at risk. Their values are recreational or cultural. No one else is going to lose their business, lose their homes or lose their jobs. The impacts are large, are real and are frightening.

I urge the panel to recommend the following proposals:

- 450 l/s minimum flow with guaranteed connectivity
- A drought flow, set when Lindis Peaks drops below 1000 l/s, guaranteeing flows below SH8 bridge
- A primary allocation of 1900 l/s, applied to all those taking water from the Lindis river.

Photo taken south of Ardgour flow recorder, 537 l/s

Appendix 1

Cost of Barley Feed

Barley has a dry matter percentage of 88%, so required tonnage is equal to DM * 1.12

Calculation to replace 400t of winter feed under dryland irrigation
400*1.12*330 = 147 840

Calculation to replace loss of irrigated winter feed under 750 l/s min flow
800*.3*1.12*330 = 88 704

Calculation to buy replacement feed for 2-tooths
number of ewes * Daily feed requirements (kg) of barley for maintenance *cost *days /conversion from KG to T
1200*1.12*330*120 / 1000 = $53 222

Appendix 2

Site		Year	Instantaneous Temperature min	max	mean	Moving Average Max 2hr	Max Weekly
Site	Lindis Peaks	2006/07	0.1	20.1	9.1	20	16.7
		2007/08	0.1	20.3	9.8	20.3	17.7
	Ardgour Road Recorder	2006/07	0.1	20.9	9.9	20.9	16.6
		2007/08	0.6	20.2	9.7	20.1	16.2

Max weekly temp at Lindis Peaks, 04'05 season	18.5
Max weekly temp at Ardgour Road, 08'09 season	17

Table 6.2 Water Temperature Statistics for two sites in the Lindis River
Water Quality Study: Lindis River
Catchment

Appendix 3

Calculation of Storage costs in the 05/06 season when flows at Lindis Peak drop below 1000 l/s. Required storage is either the flow rate below 1000 l/s or 175 l/s, whatever in the least.

Day	Jan	Feb	Mar	April		
1		-175		-119		
2		-167		-138		
3		-175				
4		-142	-76			
5		-175	-112			
6		-174	-175			
7		-175	-175			
8			-16			
9			-161			
10			-175		total l/s	7002
11	-34		-30		l per day	604972800
12			-172		cubic m	604972.8
13			-175		cost 4.50	**2722377.6**
14		-41	-175			
15			-175			
16			-175			
17		-108	-175			
18		-175	-175			
19		-175	-175			
20		-175	-175			
21		-35				
22		-170				
23		-175				
24		-175	-35			
25		-175				
26	-4	-175	-20			
27	-48	-175	-39			
28	-147		-64			
29	-175		-105			
30	-175		-137			
31	-175		-158			

References

Financial Budget Manual 2014

Lincoln University, David Askin B Ag. Sc. (Hons), Ph D, Virginia Askin B.C.M (Accounting)

ORC. 2016. Update of scientific work in the Lindis catchment: 2008-2015. Prepared for Otago Regional Council by Matt Dale and Dean Olsen, Resource Science Unit. January 2016, Dunedin

ORC. 2008. Management flows for aquatic ecosystems in the Lindis River. Prepared for Otago Regional Council by the Resource Science Unit, July 2008, Dunedin.

Section 32 Evaluation Report - Proposed Plan Change 5A (Lindis: Integrated water management) August 2015

Lindis catchment water resource study River flows, water use and flow statistics for the Lindis catchment October 2012 to April 2014

Economic impacts of minimum flow regimes on the Lindis River A report to Otago Regional Council

March 2015

Authors: Kel Sanderson, Natalia Fareti, Jack McConchie (Opus) Stephen McNally (Opus)

Lindis Catchment Hydrological analysis to support an economic assessment of the potential impact of a minimum flow regime for the Lindis River

Sheryl Paine & Jack McConchie Opus International Consultants Ltd Water Resource Scientist &Technical Principal

Water quality in the Lindis River catchment January 2016

Dean Olsen, Resource Scientist

Published January 2016