The results of the tributary flow monitoring indicate that the smaller southern tributaries of the Lindis, such as 8 Mile Creek, Tim Burn and Wainui Creek contribute very little to the main stem of the Lindis during the latter parts of the irrigation season. With its larger catchment area and higher altitude, Cluden Stream contributes significantly more water to the lower Lindis than all the other tributaries combined. Much of the base flow in Coal Creek is sourced from augmentation from Cluden Stream, and it is likely that, without this contribution, low flows in Coal Creek would be similar to those in the Tim Burn.

Table 1 provides a summary of flow statistics for the combined 2012/13 and 20013/14 irrigation season for both the measured and naturalised flow sites.

Table 1 Comparison of low flow statistics for the 2012/13 and 2013/14 irrigation season

Site	Term of record	Catchment area (km²)	MALF	2012-2014 7-day low flow	Catchment yield at 7-day low flow (l/s/km²)
Lindis at Lindis Peak	38	542	1,551	1,277	2.36
Lindis at Ardgour Road	9	1,045	262	236	0.23
Naturalised Lindis at Ardgour Road	2	1,045	1,864*	1,534	1.47
Rocky Creek	2	23	NA	30	1.30
Cluden Stream at Stock Yards	2	116	NA	120	1.03
Coal Creek at Gorge	2	27	NA	35	1.30
Tim Burn at Gorge	2	10	NA	8	0.75
8 Mile Creek at Irrigation intake u/s	2	6	NA	3	0.50
Wainui Creek South Branch at Hut	2	19	NA	16	0.84

*Calculated using the Lindis Peak 7-day low flow/MALF ratio

What is the natural flow of the Lindis River?

Using the flow records from the six tributaries that were monitored from 2012 to 2014, a naturalised flow has been estimated for the Lindis at the Ardgour Road flow recorder. All of the tributary flow recorders were located either upstream of known water takes, or in the case of Coal Creek and Cluden Stream, in a location that captured all flows before they were taken out of the sub-catchment (see previous page).

The flow sites used in this study cover around 70% of the Lindis catchment above the Ardgour Road flow recorder. However, much of the area not captured by this study is relatively low yielding and does not contribute significantly to base flows.

The naturalised Ardgour Road flow was calculated by adding 50 l/s to the Lindis Peak flow to account for upstream takes, and then summing together the flows from the six monitored tributaries. Although this is an improvement on historic MALF calculations, it still has several limitations. It does not account for water yields downstream of the tributary flow recorders; nor does it account for several small tributaries that were not monitored as part of this study. While this may lead to a slight underestimation of natural flows, this may be offset to some degree by loss of some surface flow in the Lindis Alluvial Aquifer in the reach immediately above the Ardgour Road flow recorder.

The flow records from 2012 to 2014 show that Cluden Stream and Coal creek contribute a significant amount of water to the middle reaches of the Lindis catchment. This is reflected in the naturalised MALF for Ardgour Road, which is 16.5% greater than the previous MALF estimate of 1,600 l/s made in 2006. The calculation of a naturalised MALF for Ardgour Road also gives an indication of the amount of water abstracted from the river, with the 2012-2014 7-day low flow at Ardgour Rd only 15% of naturalised low flow over this period.

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Lindis catchment water resource study

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

Otago Regional Council

The Lindis River is situated in Central Otago, has a catchment area of 1,055 km², and flows into the Clutha River/Mata-Au, about 6 km upstream of Lake Dunstan. The lower Lindis catchment is one of the driest areas in New Zealand, with very little rainfall occurring throughout the summer months. The upper Lindis catchment however, contributes significantly more water due to a combination of its higher altitude and the presence of high-yielding vegetation such as snow tussock.

Average low flows in the upper Lindis catchment have been measured at 1,550 l/s at Lindis Peak, while flows in the lower catchment at Ardgour Road drop below 250 l/s most years. Due to moderate losses to groundwater and heavy water abstraction, the Lindis River generally flows intermittently upstream of the Ardgour Road flow recorder, and is completely dry between the SH8 Bridge and the Clutha confluence from January through to the end of April. Historically, Lindis Peak has been used as a proxy for 'natural' flows for the entire catchment.

To inform the minimum flow process and the transition away from deemed permits, the Otago Regional Council (ORC) installed six temporary flow recorders in tributaries of the Lindis in 2012. The flow monitoring results have been used to calculate natural catchment yields, for both individual tributaries and the wider catchment. This information can also be used assist in setting residual flows for specific tributary takes, to understand the effect of a future minimum flow, and to assess the feasibility of on-farm water storage that may allow irrigators to increase their access to water within the constraints set by minimum and residual flows.

The results from this monitoring for the 2013/14 irrigation season (Oct-April) are presented overleaf and represent what flows would be in an average season.

The Lindis River below the SH8 Bridge at a flow of 2,600 l/s at the Ardgour Rd recorder

Flows in the Lindis catchment during the 2013/14 irrigation season