



# River and stream health

Clutha River Annual Monitoring Summary

2005-2006

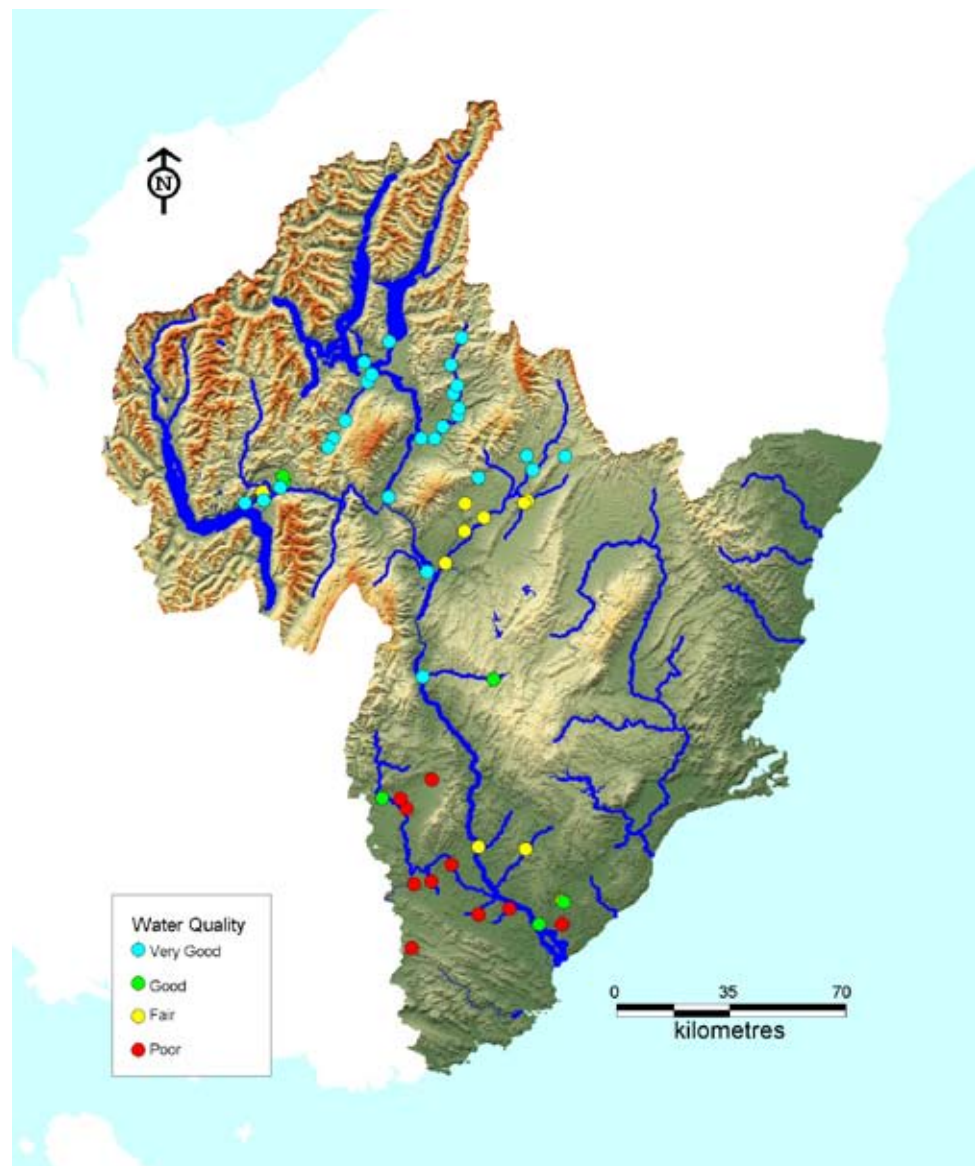
## Key points

- South West Otago's surface water is typically high in nutrients, falling above the ANZECC water quality guidelines for nitrogen and phosphorus.
- The median level of *Escherichia coli* was generally below the DoH guideline level, but was elevated in South West Otago and at two sites in the upper Clutha tributaries.
- There is a reasonable correlation between water quality and biological health.
- The Pool Burn, Ida Burn, Thompson's Creek and Chatto Creek were monitored more frequently during the summer months as part of an irrigation run-off study.

## Water quality monitoring

In 2005-2006 the Otago Regional Council monitored 34 river and stream sites in the Clutha catchment including 10 sites in the Cardrona and Lindis Rivers to assess the current state of water quality. Six additional sites were monitored as part of an investigation into irrigation runoff on the Ida Burn, Thompson's Creek, and Chatto Creek. The sites are shown in the map below.

There are few significant point source discharges to freshwater in the Clutha catchment and land use has the greatest effect on water quality. The sites with poorer water quality are generally intensively farmed, such as in South West Otago, whereas the sites with good water quality are in the upper catchment, to include the large lakes and upper tributaries.





## Water quality results

Sites were classified using a water quality index, derived from median values of seven indicator variables: turbidity, dissolved oxygen (% saturation), total nitrogen, nitrite-nitrate nitrogen, total phosphorus, dissolved reactive phosphorus, and *Escherichia coli* bacteria.

Median values of these variables were compared with ANZECC and DoH guideline levels, enabling classification of water quality into one of the following groups:

### Guidelines & standards

- The ANZECC (2000) guidelines outline trigger values for water quality aspects that put stress on river and stream health. This specifies a level below which the risk of adverse biological effect is low. Note: The ANZECC trigger values used here are for lowland rivers (< 150m).
- Otago's water quality standards are outlined in the Regional Plan: Water, which sets targets to maintain and improve water quality within the region.
- The DoH (1992) guidelines for contact recreation waters recommend a season median of 126 *Escherichia coli*/100 ml.

Very Good	All seven values comply with guideline values
Good	Five or six median values comply with guideline values
Fair	Three or four median values comply with guideline values
Poor	Two or fewer median values comply with guideline values

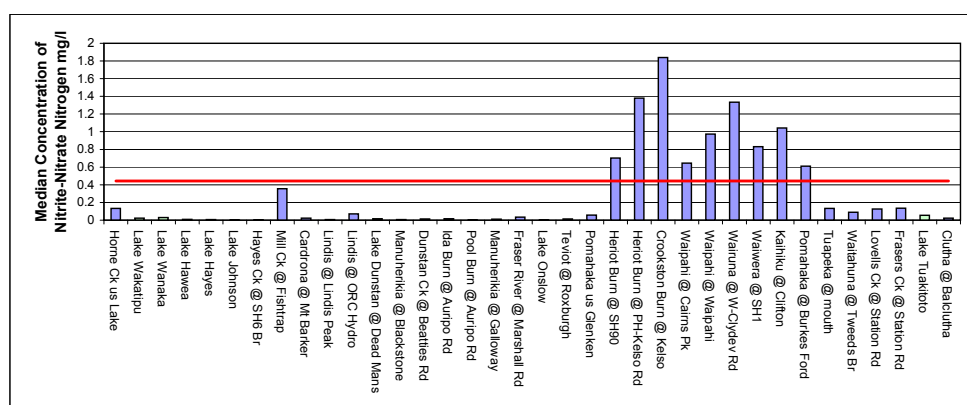
Selected water quality indicators are displayed in the graphs and discussed below. Overall these graphs show that water quality in the lakes and mainstem of the Clutha is generally 'very good', and deteriorates downstream, particularly in the Clutha tributaries and Pomahaka catchment.

Note: The red lines on these graphs indicate the ANZECC trigger value or the DoH guideline level. The graphs represent both lakes and rivers/streams, which are colour coded green and blue respectively.

### Nutrients

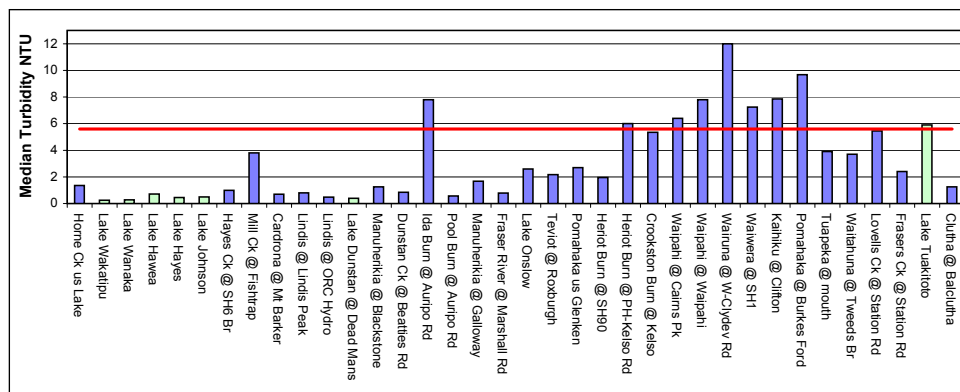
Nitrite-nitrate nitrogen (NNN) is a form of nitrogen primarily derived from land drainage. It is an important nutrient for algae and other plant growth, but can be harmful in higher concentrations. The median concentration of NNN was above the ANZECC trigger value for nine sites, all of which are in the Pomahaka River catchment.

Median dissolved reactive phosphorus (DRP) concentrations were above the ANZECC trigger value for more than half of all sites analysed. These high DRP sites were localised in four areas: small lakes of the Wakatipu basin, the lower Manuherikia River and tributaries, the Pomahaka River and tributaries, and tributaries of the Clutha River.



## Turbidity

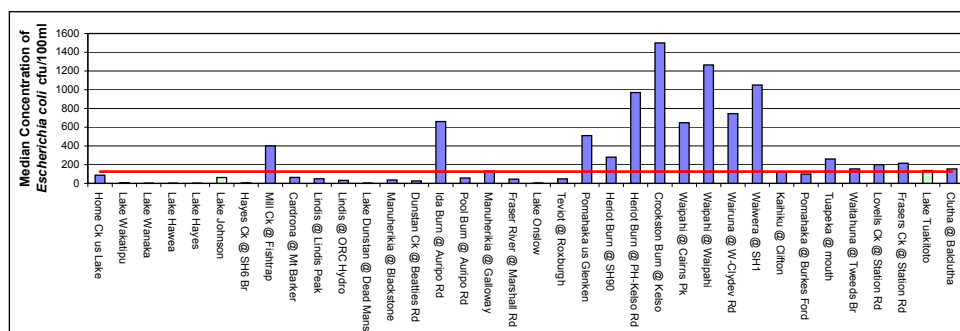
Turbidity was elevated above the ANZECC trigger value in the Pomahaka catchment, Lake Tuakitoto and the Ida Burn (this result is primarily due to irrigation run-off). This graph also shows a general trend for turbidity increasing with distance downstream.



## Bacteria

Median levels of *Escherichia coli* were generally above the DoH guideline (126 cfu/100ml) in the Pomahaka catchment, and the lower Clutha and tributaries. The Ida Burn and Mill Creek also show isolated occurrences of elevated *E. coli* levels.

All other sites showed levels below the trigger value, indicating minimal overall health risk, although bacteria levels may become raised following rainfall events.



## Other analytes

- Ammoniacal nitrogen is the combination of ammonium ions (NH<sub>4</sub>) and ammonia (NH<sub>3</sub>). Levels of ammoniacal nitrogen were well below the ANZECC guideline level of 0.9 mg/l in all samples analysed. However, Wairuna Stream (0.065 mg/l) showed a substantially higher concentration of ammoniacal nitrogen than all other sites. NH<sub>3</sub> is the main toxic component of ammoniacal nitrogen, the toxicity of which is dependent on pH and temperature. Taking these factors into account, levels of NH<sub>3</sub> were well below the guideline value (0.021 mg/l) at all sites.
- Water at all sites was neutral with respect to pH, falling within ANZECC guideline levels.
- Dissolved oxygen saturations should be above 80%, which was the case at all but four sites: Pool Burn, Lake Onslow, Frasers Creek, and Lake Tuakitoko.
- Total nitrogen was elevated above the trigger level at most sites in the Pomahaka catchment and at several sites in lower Clutha tributaries, as well as at Lake Johnson in the Wakatipu basin.
- Total phosphorus was elevated above the ANZECC trigger value in four main areas: Lakes Johnson and Hayes in the Wakatipu basin, the Manuherikia River and its tributaries the Ida Burn and Pool Burn, most sites in the Pomahaka catchment, and in the tributaries of the lower Clutha River.



## Recent ORC Reports

- Monitoring the effects of irrigation runoff on water quality (Thompsons Creek, Ida Burn, Chatto Creek), May 2006.
- A review of the sites chosen for the river and stream health monitoring programme, based on best information needs, best practise, and the Otago Regional Council's management objectives, March 2006.
- Water Quality of the Lindis and Cardrona Rivers, May 2006.
- 'Surface Water Quality in South West Otago' (June 2004) has more details on the Pomahaka catchment.
- The effect of irrigation runoff on water quality, May 2006.

## Ecosystem health

Ecosystem health takes into account a wide range of inter-linked factors, such as water quality, habitat and instream biota. It is generally assessed using two communities that are important to the food chain in rivers and streams: streambed macroinvertebrates (e.g. insects, crustaceans, snails, worms) and periphyton (e.g. algae).

These biological indices put a large amount of information into a compact form. They are therefore inherently coarse tools that give a broad view of general patterns. However, they are useful as the presence or absence, abundance and distribution of species can inform us greatly about the quality and condition of the site at which they live.

A key component of the MCI index is the availability of suitable habitat. As the MCI index is specifically designed for stony riffle substrates in flowing water, MCI values can vary due to the availability of suitable habitat and not necessarily due to water quality. As substrate type can vary greatly between riffles, it is often more appropriate to compare changes in MCI values at the same site over a period of time, rather than between sites throughout a catchment. However, taking this limitation into account, the MCI index is still useful for noting improvement or deterioration in water quality at an individual site over time.

## Criteria for Macroinvertebrate Health

Macroinvertebrate Index	Poor	Average	Good	Excellent
MCI	<80	80-99	110-119	>120
SQMCI	<4	4-4.99	5-5.99	>6
Total species	<10	15-20	20-30	>30
Total EPT species	<5	9-15	15-20	>20

## Clutha River Macroinvertebrate Health 2006

Sample Location	MCI	SQMCI	Total species	Total EPT
Cardrona River @ Larches	100	5.1	14	6
Fraser River @ Marshalls Rd	113	6.2	17	10
Lindis River @ Lindis Peak	110	5.4	20	11
Lindis River @ Ardgour Rd	104	5.6	15	6
Mill Creek @ Fish Trap	91	4.4	15	7
Waipahi River @ Cairns Peak	103	5.3	18	9
Waipahi River @ Waipahi	89	4.4	22	9
Cardrona River @ Larches	100	5.1	14	6
Fraser River @ Marshalls Rd	113	6.2	17	10



## Biological indices

- EPT species – this index is a sum of the total number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) species collected.
- MCI – The Macroinvertebrate Community Index is based on adding the “pollution tolerance” scores of all species found at a site. Species that are very sensitive to pollution score highly whereas more pollution tolerant species receive a low score.
- SQMCI – The Semi-quantitative Macroinvertebrate Community Index is a variation of the MCI that accounts for the abundance of pollution sensitive and tolerant species.

## Contact

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