Taieri River

Summary Report July 08 - June 09

Otago Regional Council

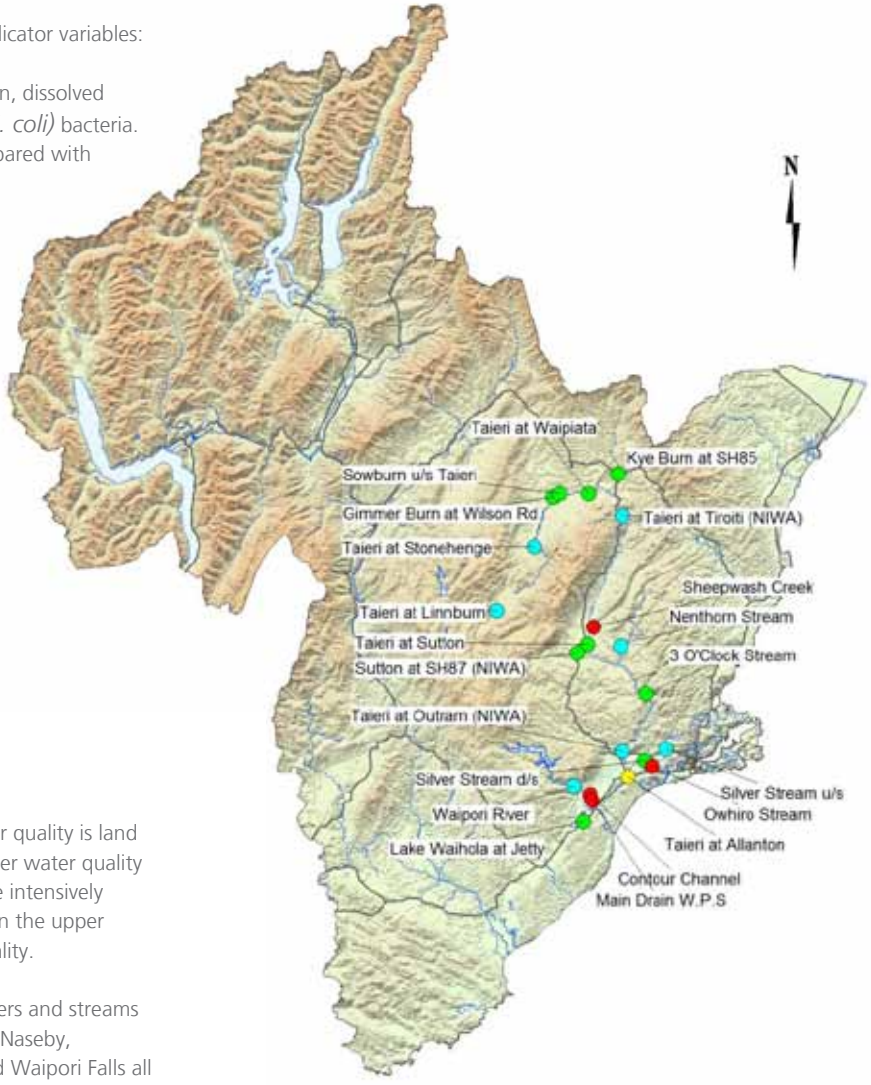
Contents

Water quality monitoring

Between July 2008 and June 2009, the Otago Regional Council (ORC) monitored 18 river and stream sites in the Taieri catchment to assess the current state of water quality. Most sites were monitored bimonthly, other than three further sites (Taieri River at Tiroiti, Sutton Stream at SH87 and Taieri River at Outram) that were monitored monthly by NIWA as part of the national river water quality network.

Sites were classified using a water quality index, derived from median values of six indicator variables: turbidity, dissolved oxygen (% saturation), ammoniacal nitrogen, nitrite-nitrate nitrogen, dissolved reactive phosphorus, and Escherichia coli *(E. coli)* bacteria. Median values of these variables were compared with Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC) and Ministry for the Environment (MfE) and Ministry of Health (MoH) guideline levels, enabling classification of water quality into one of the following groups:

Very Good	All seven values comply with guideline values
Good	Five or six median values comply (to include dissolved oxygen)
Fair	Three or four median values comply (to include dissolved oxygen)
Poor	Two or fewer median values comply with guideline values



The most important factor influencing water quality is land use. In the Taieri catchment, sites with poorer water quality are generally found in areas which are more intensively farmed such as the lower Taieri Plain; sites in the upper catchments generally have better water quality.

There are few significant discharges into rivers and streams in the Taieri catchment; however, Ranfurly, Naseby, Middlemarch, Waihola, Dunedin airport and Waipori Falls all have consented sewage discharges.

Key Points

• Water quality in the mid-Taieri River deteriorated, then improved further downstream.

• The median concentration of dissolved reactive phosphorus exceeded the guideline at two mainstem Taieri River monitoring sites.

• The median level of *E. coli* in the Sutton Stream exceeded the Department of Health (DoH) contact recreation guideline level of 126 *E.coli*/100ml.

Guidelines and Standards

• The ANZECC (2000) guidelines outlines trigger values for water quality (e.g. nutrients, dissolved oxygen, pH etc). The trigger levels specify 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/ Water Plan which sets targets to maintain and improve water quality within the region.

• The 1992 ANZECC guidelines recommend a season median of less than 126 *E.coli*/100ml. The Mfe/MoH (2003) guideline recommends that a single sample does not exceed 260 *E.coli*/100ml

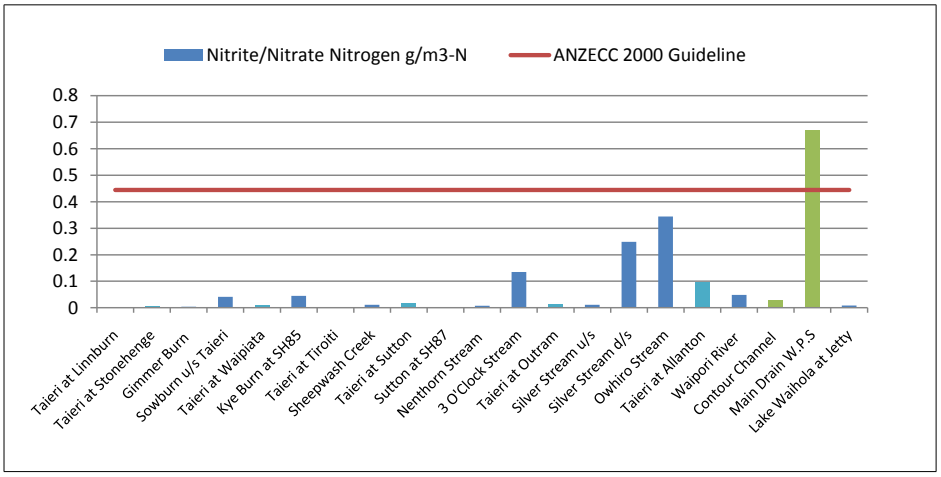
Note: *The red lines on these graphs indicate the ANZECC trigger value or the MfE/MoH guideline level.*

Water quality results

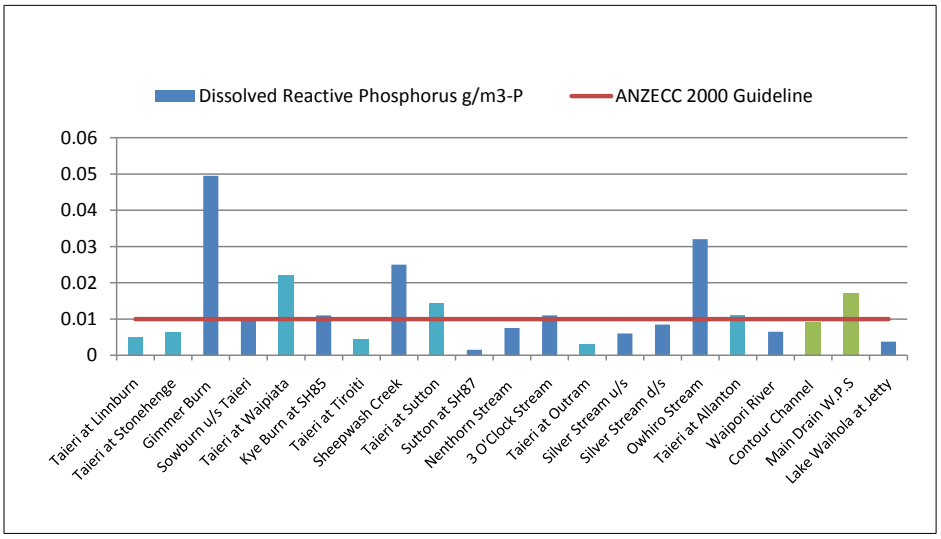
Selected water quality indicators are displayed in the graphs and discussed below. Overall water quality is generally very good or good for the entire catchment. However, Sheepwash Creek, Contour Channel and Main Drain are classified as poor, due to low dissolved oxygen levels (low gradient, meandering, slow flowing, pool like conditions), while the Taieri River at Allanton is classified as fair.
The graphs are colour coded: light blue represents the Taieri River mainstem, dark blue represents Taieri River tributaries and green represents drains.

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 at only one site, the Main Drain. The other sites were well below the guideline level.

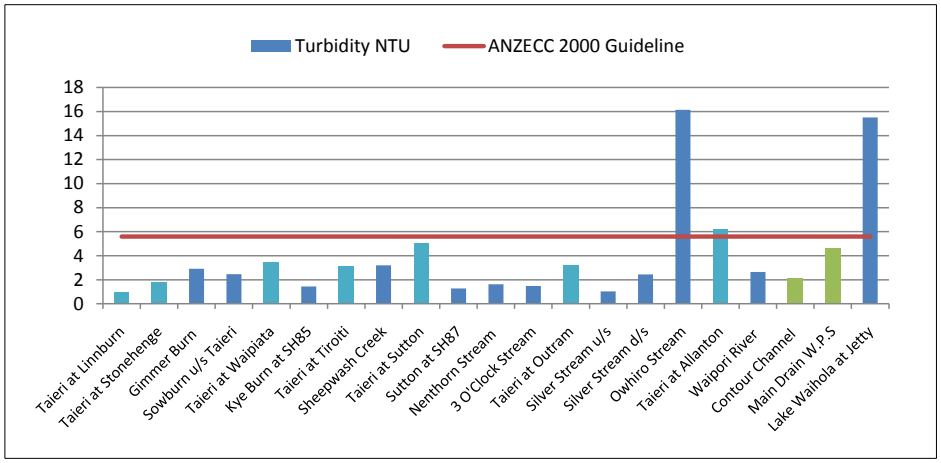


Median dissolved reactive phosphorus (DRP) levels in the Taieri River mainstem exceeded the ANZECC default trigger value at Waipiata, Sutton and Allanton. The Gimmer Burn, Kye Burn, Sheepwash Creek, 3 O'Clock Stream, Owhiro Stream and the Main Drain also exceed the trigger value. Total phosphorus median values followed the same pattern; the only mainstem Taieri River site to achieve the guideline value is Outram.



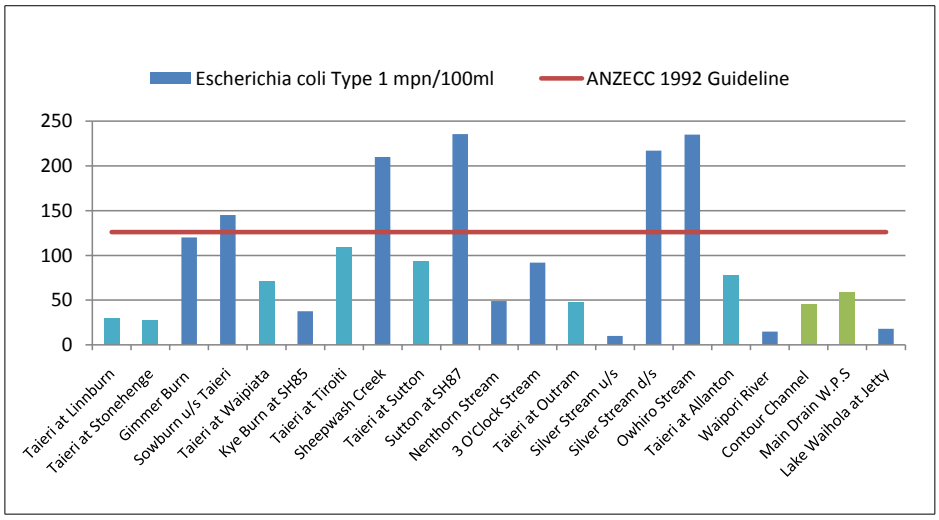
Turbidity

Turbidity was elevated above the ANZECC trigger value at two sites—Lake Waihola and the Owhiro Stream. As Lake Waihola is shallow it has wind driven re-suspension of sediment, and the very shallow, low flowing Owhiro Stream has sediment disturbed by wildfowl. All other sites were below the guideline level other than the Taieri River at Allanton.



Bacteria

Median levels of *E. coli* were above the ANZECC (1992) guideline (126 cfu/100ml) at five sites, shown in the graph below. The MfE/MoH contact recreation guideline is 260 cfu/100ml for a single sample; the only sites not to breach this level at any time were Lake Waihola, the Taieri River at Stonehenge, Waipiata and Linnburn, the Waipori River and the Silver Stream. All other sites breached this contact recreational guideline at some point during the year. The public are advised to avoid swimming during heavy rain and for up to two days afterwards, as bacteria levels are likely to be high.



Other Analytes

- Dissolved oxygen saturation of less than 80% is considered insufficient for biological health, RMA 1991. Three sites recorded minimum levels below 80%. The Taieri River at Linnburn (69%) Owhiro Stream (67%) at Lake Waihola (74%).

- The Silver Stream at Riccarton Road recorded a maximum pH level of 9.3. This was the only site to have pH levels above the ANZECC 1992 guideline values (pH 6.5 to pH 9.0).

- The highest recorded water temperature was in the Silver Stream at Riccarton Road at 25.3 °C.

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 an index 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.

Mayfly (*Deleatidium*). Source: Stephen Moore

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 tell us much about the quality and condition of the site in which they live.

Macroinvertebrate health

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

	Total species	EPT Taxa	MCI	SQMCI
Poor	<10	<5	<80	<4
Average	10-20	5-15	80-99	4-5
Good	>20-30	>15-20	>100-120	>5-6
Excellent	>30	>20	>120	>6

Taieri River macroinvertebrate health 2009

	Total species	EPT taxa	MCI	SQMCI
Owhiro Stream	15	2	69	2.6
Silver Stream at Riccarton Rd	15	5	97	3.5
Waipori River at Waipori Falls	27	14	105	5.6

There is no change to previous years. The Owhiro Stream is a very silty slow flowing stream dominated by oligochaete worms, and *Potamopyrgus* (bivale snails), the Silver Stream has good water quality, but marginal habitat due to the modified system (flood banks, straightened channel), the Waipori River is also a modified system, it has good water quality but macroinvertebrate health can be limited due to the hydroelectric scheme and the rapid rise and fall of water level.

Algae (periphyton)

Excessive amounts of periphyton, in particular filamentous algae, can reduce the amenity value of waterways by decreasing their aesthetic appearance, reducing visibility, and being a physical nuisance to swimmers. While algae are a useful tool for monitoring the nutrient conditions in rivers and streams, it is just one method used in order to get a complete overview of the river system. Factors other than nutrient levels also influence the composition of benthic algal communities. These include substrate character, the flow regime of the river, the amount of light reaching the river bed and the water temperature.

Algal samples were collected at three sites. Algae were given an abundance score ranging from 1 (rare) to 8 (dominant) based on the protocol of Biggs and Kilroy (2000).

Algal species recorded in 2009

River	Owhiro Stream	Silver Stream	Waipori River
Site	Burns Street	Riccarton Road	Reserve
Filamentous Green Algae			
Cladophora	6		
Microspora	6		5
Mougeotia			
Oedogonium	3		5
Rhizoclonium			3
Ulothrix	3		1
Filamentous Red Algae			
Audouinella		3	3
Cyanobacteria			
Oscillatoria		3	1
Diatoms			
Cymbella		4	
Fragilaria		2	
Frustulia			1
Gomphoneis			1
Gomphonema		2	
Melosira		2	
Naviculoid diatom	3		
Nitzschia			1
Rhoicosphenia	2		
Surirella		1	1
Synedra	3	2	1
Tabellaria		2	
Phytoplankton			
Cosmarium		2	

Codes based on Biggs and Kilroy (2000) Stream Periphyton Monitoring Manual: 1=rare, 2=rare-occasional, 3=occasional, 4=occasional-common, 5=common, 6=common-abundant, 7=abundant, 8=dominant

The invasive species *Didymosphenia geminata* (Didymo) was not found at any sites in the Taieri catchment. Cyanobacteria (blue green algae) was found at two sites (Silver Stream and the Waipori River). Microspora was common in the Waipori River, which was visible as a green mat and the Owhiro Stream had common-abundant Cladophora and Microspora, filamentous green algae which are common in nutrient rich water.

Periphyton

• Periphyton samples were analysed according to the relative abundance using an inverted microscope method outlined in Biggs and Kilroy (2000).

• Samples were inspected under 200-400x magnification to identify algal species present using the keys of Biggs and Kilroy (2000), Entwisle et al. (1988), Moore (2000) and an unpublished key (National Institute of Water and Atmospheric Research, Christchurch, New Zealand).

• Algae were given an abundance score ranging from 1 (rare) to 8 (dominant) based on the protocol of Biggs and Kilroy (2000).

Flow monitoring station Taieri River at Tiroiti

Key points

• Fish species diversity is an indicator of stream ecosystem health.

• Diversity varies naturally based on a number of factors including geology, topography, hydrology, groundcover, climate and altitude.

• Streams located near coastal environments often contain relatively high species diversity due to mild climates and the fact that many species spend parts of their lifespan in both fresh and salt water.

• Exotic species such as trout are known to limit the range of native species through predation and competition, and often streams with large numbers of exotic species show lower densities and diversity among native fish species.

Fish

Observations of fish species in the Taieri catchment 2009

Electro-fishing was conducted in the summer of 2009 in six streams across the Taieri catchment, with six species of fish being observed. The most widely distributed species in the catchment is the exotic brown trout (observed at five of six sites), while lamprey and the redfin bully were the least frequently observed, being caught at only one site each. The most common native fish was the longfin eel which was observed at 50% of sites.

Site	Common bully	Redfin bully	Eel	Longfin eel	Roundhead Galaxias	Koura (Crayfish)	Lamprey	Brown trout	Number of species	% Fish exotic
Gimmer Burn						1		1	2	50
Kye Burn at SH85				8	94			7	3	6
Pig Burn above O'Neill Rd				4				22	2	85
Sheepwash Creek			2						1	0
Silver Stream at 3MH	67	1		20		6	3	215	6	69
Sow Burn above Duffy Lane								11	1	100

Fish species diversity among the Taieri sites averaged 2.5 species per site, which is lower than the Otago average of 4.83 species per site. Diversity is highest at sites closer to the coast; in the Taieri catchment the Silver Stream was the nearest site to the coast and recorded the highest number of species (six).

Longfin eel

River flows

The rate of flow is an important determinant of the biological health of a stream or river, especially the extreme high and low flows. Low and high flow statistics have been calculated for a number of sites throughout the catchment from 1 July 2008 to 30 June 2009.

The Taieri catchment experienced three high flow events during the year: August 2008 and March and May 2009. Peak flows at sites in the lower catchment were around the mean annual flood. Peak flows in the Taieri River at Tiroiti in May 2009 were slightly higher than the mean annual flood with high flows in the Kyeburn contributing a significant flow here. With a long period of recession during the summer, the lowest flows occurred in late January/early February. At most sites, low flows were around 50% below the mean annual low flow (MALF). The Silver Stream was the exception with its lowest flow above MALF.

Comparison of high and low flows during 2008/09 to historical records

Site	7-day low flows			Flood flows	
	2008/09	Historical (MALF)	% change	2008/09	Historical (mean annual flood)
Taieri River at Tiroiti	1.06	1.98	-46	152	104
Taieri River at Sutton	1.33	2.75	-52	158	137
Taieri River at Outram	1.81	4.24	-57	389	466
Deep Stream at SH 87	0.241	0.498	-52	93.8	114
Silver Stream at Riccarton Road	0.078	0.060	30	64.7	58

*Note: all flows are given in m^3/s

Silver Stream at Riccarton Road (Otago Regional Council)

Key points

- The 7-day low flow refers to the lowest 7-day flow average for a given year.
- The 7-day Mean Annual Low Flow (MALF) is the average of all of the 7-day low flows over the term of record.
- The mean annual flood is the average flood flow expected each year based on the length of the flow record.

Recent Otago Regional Council reports

- Lake Waihola and Lake Waipori: Trophic Level Status, March 2005.

- Monitoring the effects of irrigation runoff on water quality (Gimmerburn, Sowburn and Pigburn), May 2006.

- State of Environment Report, Surface Water Quality in Otago, May 2007.

Waipori River at Falls Reserve

Further information on the Taieri River is available on the ORC website:

www.orc.govt.nz

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