

Water quality in Otago

Water quality

July 2015 to June 2020



Introduction

The Otago Regional Council (ORC) is responsible for managing Otago's surface-water resources and carrying out regular and extensive long-term water-quality monitoring, as part of its State of Environment (SoE) programme. This report card documents the results of ORC water-quality monitoring undertaken between July 2015 and June 2020 and NIWA monitoring undertaken between January 2015 and December 2019.

Water quality

Schedule 15 of the Regional Plan: Water for Otago sets out the numerical limits and targets for achieving acceptable water quality for all catchments in the Otago region. The receiving water limits and targets (outlined in Table 1) are applied as five-year, 80th percentiles, when flows are at or below median flow.

Table 1: Water quality standards (five-year, 80th percentiles, when flows are at or below median flow)

Schedule 15	Nitrite-nitrate nitrogen mg/l	Dissolved reactive phosphorus mg/l	Ammoniacal nitrogen mg/l	<i>Escherichia coli</i> cfu/100ml	Turbidity NTU	Total nitrogen mg/l	Total phosphorus mg/l
Group 1	0.444	0.026	0.10	260	5		
Group 2	0.075	0.010	0.10	260	5		
Group 3	0.075	0.005	0.01	50	3		
Group 4			0.10	126	5	0.55	0.033
Group 5			0.01	10	3	0.10	0.005

114 SoE sites were monitored every month, with six sites monitored monthly by NIWA (as part of the National River Water Quality Network). To enable classification of each site into one of four groups (Table 2), ORC uses a water quality index. Figure 1 shows the results.

Table 2: Water quality index

Grade	Number of parameters complying with water quality standards (June 2015 to July 2020)
Excellent	All five parameters (Table 1) comply
Good	Four (of the five) values comply
Fair	Three (of the five) values comply
Poor	Two or fewer (of the five) values comply

Nutrients: Nitrite-nitrate nitrogen (NNN) and dissolved reactive phosphorus (DRP) are the biologically available nutrients used for algae and plant growth. NNN is a form of nitrogen, mainly derived from land drainage, and DRP is a form of phosphorus, mainly sourced from effluent and fertiliser. Ammoniacal nitrogen (NH₄-N) can indicate the presence of effluent in water.

E. coli: *Escherichia coli* (*E. coli*) are a bacterium which is used as an indicator of the presence of harmful micro-organisms in water (e.g. human or animal faeces). This can be used to gauge whether water is suitable for stock drinking, swimming, surfing or other recreational activities.

Turbidity: Turbidity is a measure of the cloudiness of water, determined by how much light is scattered by suspended particles. Streams with 'high turbidity' often have high suspended sediment loads. Having high turbidity can reduce light penetration, which can affect photosynthesis. High sediment loading also tends to smother the streambed, which reduces macroinvertebrate and fish-spawning habitat.

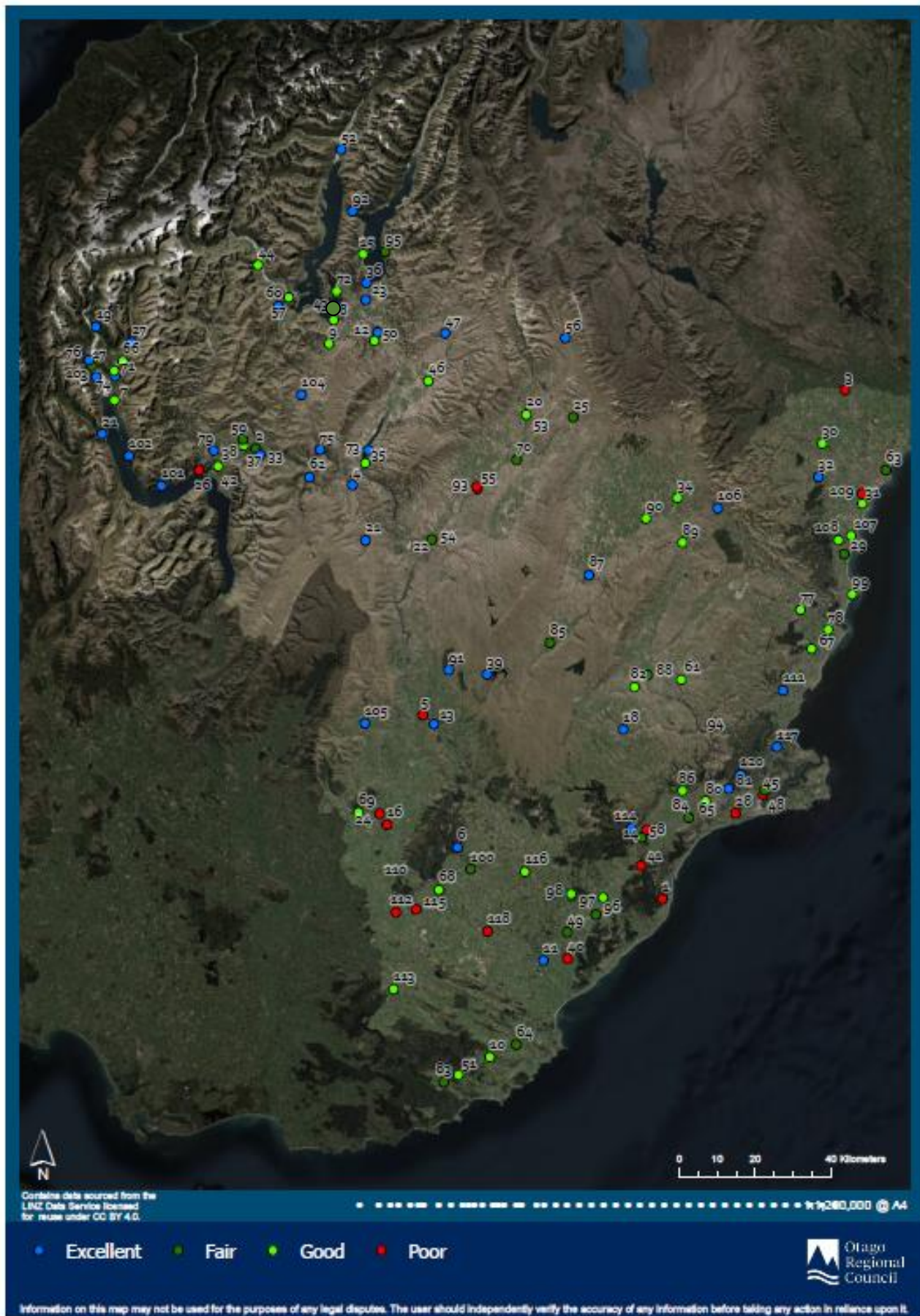


Figure 1: Results of SoE water-quality monitoring (2015 -2020). Site numbers refer to sites in Tables 3-7.

Water-quality monitoring: Results

Table 3: Group 1 sites showing water quality results. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets. Sites with an ‘*’ have been monitored for less than five years, therefore the grade is interim. Sites monitored by NIWA are shown with an ‘N’

Site #		Site Name	Grade	NH4-N	E.coli	DRP	NNN	Turb
				mg/L	cfu/100ml	mg/L	mg/L	NTU
		Schedule 15 limit or target		0.1	260	0.026	0.444	5
6	*	Blackcleugh Burn at Rongahere Road	Excellent	0.0025	38	0.019	0.060	0.49
10		Catlins at Houipapa	Good	0.012	235	0.015	0.448	3.97
11	N	Clutha at Balclutha (NIWA)	Excellent	0.0044	85	0.002	0.09	4.20
16		Crookston Burn at Kelso Road	Poor	0.0344	1499	0.043	1.401	5.41
24		Heriot Burn at Park Hill Road	Poor	0.0321	1330	0.046	1.496	5.31
28		Kaikorai Stream at Brighton Road	Poor	0.0165	1990	0.014	0.471	8.13
44		Leith at Dundas Street Bridge	Poor	0.0141	1174	0.030	0.553	2.28
47		Lindsays Creek at North Road Bridge	Fair	0.02	589.2	0.026	0.753	2.53
48		Lovells Creek at Station Road	Fair	0.0163	603.9	0.018	0.645	3.09
50	*	Maclennan at Kahuiku School Road	Good	0.0144	479.2	0.012	0.031	2.17
62		Owaka at Katea Road	Fair	0.0111	451.5	0.021	1.212	2.62
65		Pomahaka at Burkes Ford	Good	0.0172	145	0.014	0.534	3.81
80	*	Tahakopa at Tahakopa	Fair	0.0097	1221	0.008	0.386	7.27
92		Tokomairiro at Blackbridge	Fair	0.0274	1780	0.029	0.311	4.87
93	*	Tokomairiro at Lisnatunny	Good	0.0215	500	0.023	0.245	4.15
94		Tokomairiro at West Branch Bridge	Good	0.0167	296	0.014	0.261	2.77
96		Tuapeka at 700m u/s bridge	Fair	0.0145	283	0.028	0.110	3.25
108		Waipahi at Cairns Peak	Poor	0.0321	729	0.018	0.641	7.42
109		Waipahi at Waipahi	Good	0.0149	239	0.024	0.872	2.49
11		Wairuna at Millar Road	Poor	0.0512	906	0.107	1.020	14.4
112		Waitahuna at Tweeds Bridge	Good	0.016	505	0.018	0.149	4
113	*	Waitati at Mt Cargill Road	Excellent	0.01	154	0.01	0.019	1.15
114		Waiwera at Maws Farm	Poor	0.0192	348	0.036	0.924	2.96

Table 4: Group 2 sites showing water quality results. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets. Sites with an ‘*’ have been monitored for less than five years, therefore the grade is interim. Sites monitored by NIWA are shown with an ‘N’.

Site #		Receiving Water Group 2		NH4-N	E.coli	DRP	NNN	Turb
				mg/L	cfu/100ml	mg/L	mg/L	NTU
		Schedule 15 limit or target		0.1	260	0.01	0.075	5
1	*	Akatore Creek at Akatore Creek Road	Poor	0.003	547	0.007	0.454	16.8
2	*	Arrow at Morven Ferry Road	Fair	0.005	309	0.003	0.111	4.27
3		Awamoko at SH83	Poor	0.019	744	0.106	0.632	1.32
4		Bannockburn at Lake Dunstan	Excellent	0.011	144	0.007	0.003	4
5		Benger burn at SH8	Poor	0.015	397	0.017	0.297	1.49
12	N	Clutha at Luggate (NIWA)	Excellent	0.004	5.2	0.001	0.043	1.01
9		Cardrona at Mt Barker	Good	0.010	171	0.004	0.087	2.21
13	N	Clutha at Millers Flat (NIWA)	Excellent	0.004	37	0.001	0.042	2.95
14		Contour Channel at No. 4 Bridge	Poor	0.070	899	0.040	0.333	6.94
18		Deep Stream at SH87	Excellent	0.005	201	0.003	0.01	0.94
20		Dunstan Creek at Beattie Road	Good	0.007	153	0.005	0.085	0.89
21	*	Fraser at Old Man Range	Excellent	0.003	14	0.002	0.007	0.50
23		Hawea at Camphill Bridge	Excellent	0.006	10	0.003	0.020	0.58
25	*	Hills Creek at SH85	Fair	0.003	604	0.004	0.142	1.26
29	*	Kakaho Creek at SH1	Fair	0.041	457	0.046	0.201	2.94
30		Kakanui at Clifton Falls Bridge	Good	0.006	431	0.003	0.040	0.40
31		Kakanui at McCones	Good	0.013	202	0.005	0.371	0.63
32		Kauru at Ewings	Excellent	0.007	211	0.003	0.028	0.42
34		Kye Burn at SH85 Bridge	Good	0.007	181	0.006	0.085	1.57
45		Lindis at Ardgour Road	Good	0.009	134	0.004	0.096	1.44
46		Lindis at Lindis Peak	Excellent	0.006	89	0.004	0.020	1.75
49		Luggate Creek at SH6 Bridge	Good	0.009	220	0.012	0.004	1.61
52		Manuherikia at Galloway	Fair	0.007	267	0.018	0.047	2.76
53		Manuherikia at Ophir	Poor	0.017	357	0.031	0.109	2.87
54	*	Manuherikia downstream of Fork	Excellent	0.003	62	0.006	0.008	0.48

Table 4 continued. Group 2 sites showing water quality results. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets. Sites with '*' have been monitored for less than five years, therefore the grade is interim. Sites monitored by NIWA are shown with an 'N'. Sites with '***' were originally monitored by NIWA before ORC took on the sampling responsibility.

Site #		Receiving Water Group 2		NH4-N	E.coli	DRP	NNN	Turb
				mg/L	cfu/100ml	mg/L	mg/L	NTU
		Schedule 15 limit or target		0.1	260	0.01	0.075	5.0
56	*	Meggat Burn at Berwick Road	Fair	0.01	461	0.010	0.133	4.39
57		Mill Creek at Fish Trap	Fair	0.013	300	0.007	0.42	4.26
59		Nenthorn at Mt Stoker Road	Good	0.011	140	0.017	0.010	1.50
60		Nevis at Wentworth Station	Excellent	0.008	50	0.005	0.004	0.73
61	*	Oamaru Creek at SH1	Fair	0.024	1948	0.351	0.991	4.63
64	*	Pleasant at Patterson Road Ford	Good	0.008	84.9	0.003	0.034	5.81
65		Pomahaka at Glenken	Good	0.010	325	0.010	0.089	2.98
67	*	Poolburn at Cob Cottage	Fair	0.011	385	0.057	0.115	2.54
70	*	Quartz Reef Creek at SH8	Excellent	0.003	166	0.003	0.013	3.76
72	*	Roaring Meg at SH6	Excellent	0.003	89	0.007	0.024	1.58
74		Shag at Craig Road	Good	0.006	142	0.005	0.152	0.81
75		Shag at Goodwood Pump	Good	0.010	200	0.007	0.283	0.74
76	N	Shotover at Bowens Peak (NIWA)	Excellent	0.003	6	0.001	0.010	4.72
77		Silverstream at Taieri Depot	Good	0.018	307	0.007	0.709	2.16
78	*	Silverstream at Three Mile Hill Road	Excellent	0.005	32.2	0.003	0.020	0.43
79	***	Sutton Stream at SH87	Good	0.003	516	0.009	0.011	1.16
81		Taieri at Allanton Bridge	Fair	0.017	289	0.013	0.063	4.23
82		Taieri at Linnburn Runs Road	Fair	0.008	300	0.005	0.100	1.50
83	***	Taieri at Outram	Good	0.008	100	0.010	0.040	1.69
84		Taieri at Stonehenge	Excellent	0.009	155	0.008	0.012	1.64
85		Taieri at Sutton	Fair	0.010	395	0.014	0.053	3.10
86	***	Taieri at Tiroiti	Good	0.008	173	0.022	0.036	3.90
87		Taieri at Waipiata	Good	0.014	231	0.038	0.040	3.44
88	*	Teviot at Bridge Huts Road	Excellent	0.006	184	0.002	0.006	4.57
90		Thomsons Creek at SH85	Poor	0.022	1362	0.100	0.304	7.13
95		Trotters Creek at Mathesons	Good	0.02	210	0.006	0.440	2.04
100	*	Upper Cardrona at Tuohys Gully Road	Excellent	0.003	165	0.002	0.027	1.64
101	*	Upper Pomahaka at Aitchison Runs Road	Excellent	0.003	92	0.005	0.020	0.98
102	*	Upper Shag at SH85 Culvert	Excellent	0.008	130	0.002	0.041	0.34
103		Waianakarua at Browns	Good	0.010	220	0.003	0.318	0.45
104	*	Waianakarua at South Branch SH1	Good	0.005	218	0.002	0.587	0.43
105		Waiareka Creek at Taipo Road	Poor	0.032	581	0.265	0.640	1.97
107		Waikouaiti at Confluence d/s	Excellent	0.009	68	0.004	0.025	1.18
110		Waipori at Waipori Falls Reserve	Excellent	0.006	36	0.003	0.040	1.79
115	*	Whare Creek at Whare Flat Road	Excellent	0.003	15	0.003	0.051	0.61

Table 5. Group 3 sites showing water quality results. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets. Sites with an ‘*’ have been monitored for less than five years, therefore the grade is interim. Sites monitored by NIWA are shown with an ‘N’.

Site #		Receiving Water Group 3		NH4-N	E.coli	DRP	NNN	Turb
				mg/L	cfu/100ml	mg/L	mg/L	NTU
		Schedule 15 limit or target		0.01	50	0.005	0.075	3
98	*	12 Mile Creek at Glenorchy Queenstown Road	Excellent	0.006	6	0.002	0.006	0.30
99	*	25 Mile Creek at Glenorchy Queenstown Road	Excellent	0.005	29	0.002	0.009	0.5
7	*	Buckler Burn at Glenorchy Queenstown Road	Good	0.003	9.2	0.002	0.031	4.46
8	*	Bullock Creek at Dunmore Street Footbridge	Fair	0.003	579	0.002	0.775	0.52
15	*	Craig Burn at SH6	Good	0.003	55	0.002	0.009	0.90
17		Dart at The Hillocks	Fair	0.014	10	0.003	0.036	15.4
19	*	Dundas Creek at Mill Flat	Excellent	0.003	3.8	0.002	0.042	0.35
22	*	Greenstone at Greenstone Station Road	Excellent	0.003	22	0.002	0.022	0.34
26	*	Horn Creek at Queenstown Bay	Poor	0.013	363	0.008	0.172	3.98
27	*	Invincible Creek at Rees Valley Road	Excellent	0.003	2.7	0.002	0.013	2.02
33	N	Kawarau at Chards Road	Excellent	0.022	27	0.002	0.030	3.81
43	*	Leaping Burn at Wanaka Mt Aspiring Road	Good	0.003	196	0.002	0.030	0.62
51	*	Makarora at Makarora	Excellent	0.003	20	0.002	0.061	1.65
55		Matukituki at West Wanaka	Good	0.010	24	0.004	0.080	1.79
58	*	Motatapu at Wanaka Mt Aspiring Road	Excellent	0.003	25	0.002	0.042	0.82
63	*	Ox Burn at Rees Valley Road	Good	0.003	9	0.002	0.020	7.01
68	*	Precipice Creek at Glenorchy Paradise Road	Excellent	0.003	23	0.002	0.010	0.65
69	*	Quartz Creek at Maungawera Valley Road	Good	0.003	47	0.002	0.082	0.51
71	*	Rees at Glenorchy Paradise Road Bridge	Good	0.003	13	0.002	0.017	10.1
73	*	Scott Creek at Routeburn Road	Excellent	0.004	20	0.002	0.029	0.52
89	*	The Neck Creek at Meads Road	Excellent	0.003	18	0.002	0.007	0.42
91	*	Timaru at Peter Muir Bridge	Fair	0.003	6	0.006	0.015	20.6
97	*	Turner Creek at Kinloch Road	Excellent	0.003	8	0.002	0.054	0.37

Table 6. Group 4 sites showing water quality results. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets.

Site #		Receiving Water Group 4		NH4-N	E.coli	Turb	TP	TN
				mg/L	cfu/100ml	NTU	mg/L	mg/L
		Schedule 15 limit or target		0.1	126	5	0.033	0.55
37		Lake Hayes at Mid Lake 10m	Good	0.043	2	3	0.055	0.39
38		Lake Onslow at Boat Ramp	Excellent	0.009	8	4.8	0.028	0.29
39		Lake Tuakitoto at Outlet	Poor	0.077	125	8.6	0.147	1.44
40		Lake Waiholā at Waiholā Mid	Poor	0.027	225	11.9	0.058	0.69

Table 7. Group 5 sites showing water quality results. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets.

Site #		Receiving Water Group 5		NH4-N	E.coli	Turb	TP	TN
				mg/L	cfu/100ml	NTU	mg/L	mg/L
		Schedule 15 limit or target		0.01	10	3	0.005	0.1
35		Lake Dunstan at Dead Mans Point	Good	0.006	9	1.1	0.006	0.10
36		Lake Hawea South Open Water 10m	Excellent	0.003	1	1.0	0.002	0.04
41		Lake Wakatipu Open Water 10m	Excellent	0.003	1	0.8	0.002	0.06
42		Lake Wanaka Open Water 10m	Excellent	0.003	1	0.8	0.002	0.06

Water quality: Summary

The results in the table below show how sites and grades have varied over the years. In 2015-2020 more than half of the SoE sites are classified as having 'excellent' or 'good' water quality. Most the sites with 'excellent' river water quality were in Central Otago and the upper Clutha, where land-use tends to be low-intensity sheep farming and/or dominated by tussock lands. Poorer water quality was found in river catchments with higher-intensity farming or in streams draining urban environments. The number of water quality sites monitored in Otago increased by 43 river sites (from 63 to 106) in June 2018.

RIVERS GRADE	2009-14	2010-15	2011-16	2012-17	2013-18	2014-19	2015-20
Excellent	18	18	16	15	16	37	37
Good	18	18	23	24	20	32	34
Fair	10	13	11	13	15	18	20
Poor	8	13	13	11	12	19	15
TOTAL	54	62	63	63	63	106	106

LAKES GRADE	2009-14	2010-15	2011-16	2012-17	2013-18	2014-19	2015-20
Excellent	2	5	5	4	3	3	4
Good	2	1	1	1	2	2	2
Fair	1			1	1		
Poor	3	2	2	2	2	3	2
TOTAL	8	8	8	8	8	8	8

Compared to 2014-2019 water quality results, 84 sites retained the same grade, 19 sites improved by one grade and one site improved by two grades (Lake Hayes) nine sites degraded by one grade and one site degraded by two grades (Kaikorai Stream).

In Group 1, three sites (of 23) had 'excellent' water quality (Balclutha, Waitati and Blackcleugh Burn); seven had 'good' water quality (Catlins, Maclennan, Pomahaka at Burkes, Tokomairiro at Lisnatunny, Tokomairiro at West Branch Bridge, Waitahuna and Waipahi at Waipahi); six had 'fair' water quality; and the remaining 7 sites were classified as having 'poor' water quality. Schedule 15 limits were most often exceeded for *E. coli* and NNN. Most of the 'poor' sites were in south-west Otago.

For Group 2, 22 sites (out of 60) had 'excellent' water quality. Most of these were upper catchment sites in the Taieri and Clutha river catchments. 20 sites had 'good' water quality, *E.coli*, DRP and NNN were the parameters that most often exceeded the Schedule 15 limit in this category. Eleven sites had 'fair' water quality, while seven were classified as 'poor'.

Of the 23 sites in Group 3, 12 had 'excellent' water quality, seven had 'good' water quality, three sites had 'fair' water quality and one site had 'poor' water quality. Invincible Creek, Motatapu, Precipice Creek and The Neck Creek all improved a grade from 'good' to 'excellent'.

In Group 4, Lake Onslow 'excellent' water quality, Lake Hayes had 'good' water quality and Lake Tuakitoto and Lake Waihola both had 'poor' water quality. All but Onslow exceeded Schedule 15 limits for total phosphorus (TP). Lake Waihola was the only small lake to exceed the *E. coli* limit. All Group 5 sites had excellent water quality, except for Lake Dunstan which recorded total phosphorus as being just above the limit.