



Goulburn River. Courtesy Alison Pouliot

Goulburn Broken Region

At the heart of Victoria's 'food bowl' is the Goulburn Broken region. In the south of the region, the high country of the Great Dividing Range dominates the landscape - native forest, natural mountain plains and the headwaters of the Goulburn, Big and Broken Rivers.

Two river basins form the region - the Broken (basin 4) and Goulburn (basin 5).

The mountain country gives way to highly productive irrigated valleys and the rich, flat River Murray plain in the north. Much of the northern and central parts of the region, particularly the Broken basin, has been cleared of native vegetation for agriculture - predominantly grazing, cereal, intensive horticultural, dairy and livestock production. While in the northern area of the Goulburn basin, intensive irrigation agriculture dominates.

There are a number of major water storages, notably Lake Eildon and the Goulburn Weir in the Goulburn basin and Lake Nillahcootie in the Broken basin. The region is vitally important to the wider Murray-Darling Basin area - although the region is only 2% of the Murray-Darling Basin's land area, the Goulburn and Broken basins generate 11% of the Murray-Darling Basin's water resources.

The majority of river length in both the Broken (69%) and Goulburn (59%) basins was in moderate condition. However, the Goulburn basin had considerably more river length in good and excellent condition (20%) compared with the Broken basin (4%).

Water Quality

Water quality was monitored at 54 reaches across the Goulburn Broken region. The majority of reaches were in moderate condition (41%), followed by 20% in poor condition, 17% in excellent condition, 17% in good, and 5% in very poor condition.

Water quality was assessed at 20 of the 36 reaches in the Broken basin. Of these, half were in moderate condition, three were in good condition (reaches 6, 14 and 23) and five were in poor condition (reaches 5, 18, 24-26). One reach, reach 19 on Watchbox Creek, was in excellent condition and one reach, reach 22 on Broken Creek, was in very poor condition. All reaches tested had elevated levels of phosphorus (except reach 19) and high levels of turbidity, with the exception of reaches in the upper part of the basin. The generally moderate to poor water quality reflects the highly modified natural environment.

Results in the Goulburn basin varied from excellent to poor. Thirty-three of the basin's 69 reaches were assessed. Three reaches were in reference condition - reaches 6 and 8 on the Goulburn River and reach 70 on the upper Howqua River. A further five reaches were in excellent condition - reach 9 and 14 on the Goulburn River and reaches 59, 68 and 71 on the Murrindindi, Big and Delatite Rivers respectively. The lowest scoring reaches, rated as very poor, were located on Ford Creek (reach 73) and Kurkuruc Creek (reach 78). Both showed elevated levels of phosphorus and turbidity and reach 78 also had high levels of salinity. Both reaches are located in cleared areas of the basin.

Many reaches within the Goulburn basin showed elevated phosphorus levels, and to a lesser extent, turbidity. Again, these results are associated with reaches located in areas of cleared agricultural land.

Hydrology

Flow stress scores varied widely across the Goulburn Broken region with some streams under extreme flow stress and others with natural, or near natural, flow regimes.

Goulburn Weir and Lake Eildon provided 195,110 ML of environmental water to the Goulburn basin in 2011-12. Four (of seven) priority watering actions were met for reaches 1-14 on the Goulburn River below Eildon, achieving a 57% compliance. Target flow rates were not met for all days for the autumn/winter base flow, winter/spring base flow and the winter fresh.

The Murray system and Goulburn Weir provided 10,418 ML of environmental water to the Broken basin in 2011-12. None of the six priority watering actions were fully met for the Broken Creek (reaches 21-24) and Nine Mile Creeks (reach 28). This was due to fluctuations in the flow rates being outside those recommended.

Drought had a major impact on streams across most of the region, with the greatest impact on flows in Hughes (reaches 37-39), Whitehead (reach 40), Ford (reach 73) and Cornella Creeks (reach 33) in the Goulburn basin.

Water delivery arrangements compounded climate stress on more than half of the streams monitored in the Goulburn basin, notably at reach 1 on the Goulburn River where the river meets the Murray and reach 73 on Ford Creek, upstream of Lake Eildon. In contrast, water delivery arrangements eased flow stress on a number of streams including, Sawpit (reach 11), Boosey (reaches 32-33) and Sandy Creeks (reach 35) in the Broken basin.

In the Broken basin, flow regimes ranged from the highly modified at reaches 1 and 2 on the lower Broken River to very minor modifications at reaches 16 and 17 on Ryans Creek. In the Goulburn basin, flow regimes of streams below Lake Eildon were significantly modified compared with those reaches in the upper catchment. Upstream of Lake Eildon, reaches 15 and 16 on the Goulburn River, reaches 67 and 68 on the Big River and reaches 69 and 70 on the Howqua River had natural or near natural flow regimes.

The majority of streams across the region had significantly altered hydrological patterns with low flows and summer stress attributed to diversions for irrigation and domestic use. A number of ephemeral streams experienced extended periods of low flow or zero flow during summer, specifically reaches 25-27 on Broken Creek and reaches 32-34 on Boosey Creek in the Broken basin, and reaches 25 and 26 on Castle Creek, and reaches 58 and 59 on the Murrindindi River in the Goulburn basin.

A small number of streams experienced winter flow stress, which can be attributed to reduced run-off reaching streams, caused by the filling of off-stream farm dams. Key examples include Broken Creek (reaches 21-24), Nine Mile Creek (reaches 28-29) and Pine Lodge Creek (reaches 30-31) in the Broken basin.

Vegetation

Results for the condition of vegetation in the streamside zone across the region ranged from reaches in reference condition to those in poor condition. Reflecting land use, reaches in reference condition were located in the densely vegetated south of the region and those in poorer condition were predominantly located in areas where land had been cleared. Overall, the majority of reaches (62% in both the Broken and Goulburn basins) were in good or excellent condition.

Sixteen of the 117 reaches assessed across the region were in excellent condition, with the majority of these located in the Goulburn basin. Notably, reaches 63, 66 and 67-68 (on the Acheron, Rubicon and Big Rivers respectively) in the heavily vegetated highlands of the Goulburn basin were in reference condition. The lowest and upper reaches of the Goulburn, Dabyminga, Yea, Murrindindi, Taggerty, Howqua and Delatite Rivers were in near reference condition (reaches 1, 15-16, 50, 57, 59, 64, 70 and 72 respectively). These reaches scored excellent results for all parameters with the exception of a small percentage of streams having willows present (generally less than 1%).

Reaches in near reference condition in the Broken basin included Five Mile, Lima East, Holland and Ryans Creeks (reaches 8, 10, 15 and 17 respectively), all located in the vegetated southern highlands of the basin.

Willows were not wide spread, with only 14 reaches recording significant amounts of willows. In the Goulburn basin this included the Goulburn River (reaches 12-16), upper Howqua River (reach 70), Brankeet Creek (reach 74), Kurkuruc Creek (reach 78), Honeysuckle Creek (reach 23) and Castle Creek (reach 25). In the Broken basin this included the Broken River (reach 1) and the Lima East Creek (reach 10).

Physical Form

Results for physical form in the Goulburn Broken region ranged predominantly from good to moderate. Of the 117 reaches assessed, 35 reaches (30%) were in moderate condition and 68 reaches (58%) were in good condition. Of the remainder, four reaches (3%) were in poor physical condition and ten reaches (9%) were in excellent condition.

Thirty-six reaches were assessed in the Broken basin. Three reaches were in near reference condition - reaches 8, 20 and 36 on Five Mile, Winton and Tullah Creeks respectively. Reach 8 had stable banks and a good quantity of instream woody habitat however a downstream weir hampered fish passage. In contrast, reaches 20 and 36 had no major downstream barriers to fish passage and high quantities of instream woody habitat, however, minor bank instability was observed. The majority (69% or 25 reaches) of reaches in the Broken basin were assessed as having good physical form.

Broken Creek near confluence with the River Murray. Courtesy Alison Pouliot



Like the Broken basin, the majority of reaches in the Goulburn basin (53% or 42 reaches of the 80 assessed for physical form) were in good condition, with a further 35% (28 reaches) in moderate condition. While most streams had minor downstream barriers to fish migration and moderate to low levels of instream woody habitat, most had stable banks.

Reach 33 on Goborup Creek in the north-west of the Goulburn basin was in reference condition and a further six reaches (20, 21, 50, 57, 63 and 66) were in near reference condition, with scores affected by downstream barriers to fish passage.

Two reaches, 8 (Goulburn River) and 81 (Yea River), in the Goulburn basin scored poorly. Both had low levels of instream woody habitat, unstable banks and major downstream barriers to fish passage.

Aquatic Life

Almost every reach in the Goulburn Broken region was assessed for aquatic life (105 out of 117 reaches tested). The majority of the reaches were found to be in good or excellent condition (39% and 16% respectively). Of the remainder, 15% were in poor condition and 30% were in moderate condition. No reaches in the Goulburn Broken region were assessed as very poor.

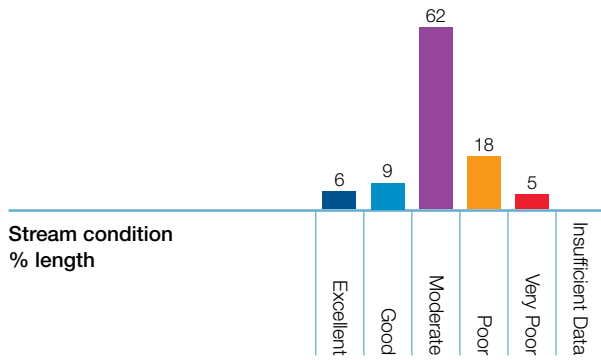
Overall, the results for the individual Goulburn and Broken basins were comparable, with the exception of reaches assessed as in excellent condition. Within the Broken basin, where land has been predominantly cleared for agriculture, only two reaches (reaches 8 and 9) of the 36 tested were found to be in excellent condition - both reaches were located in the upper catchment where tracts of forest remain.

In contrast, 14 of the 69 reaches assessed in the Goulburn catchment were classed in excellent condition and of these, seven reaches were considered in reference condition. Reaches classed as excellent were clustered in the densely vegetated southern highlands at the headwaters of the Big, Acheron and Murrindindi Rivers and on King Parrot Creek.

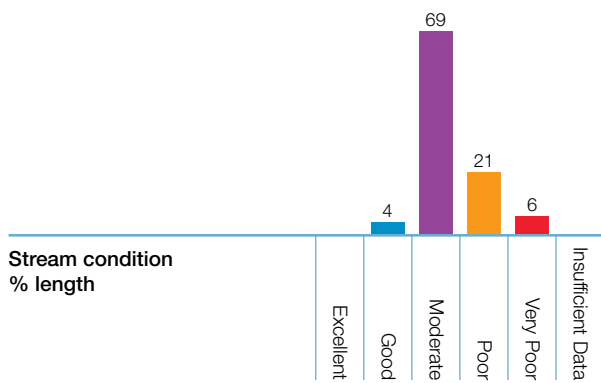


Big River. Courtesy Alison Pouliot

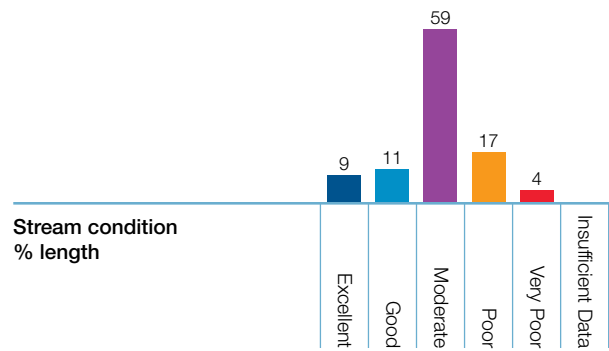
/ Goulburn Broken Region



/ Broken



/ Goulburn



Environmental Condition

● Excellent

● Good

● Moderate

● Poor

● Very Poor

● Insufficient Data

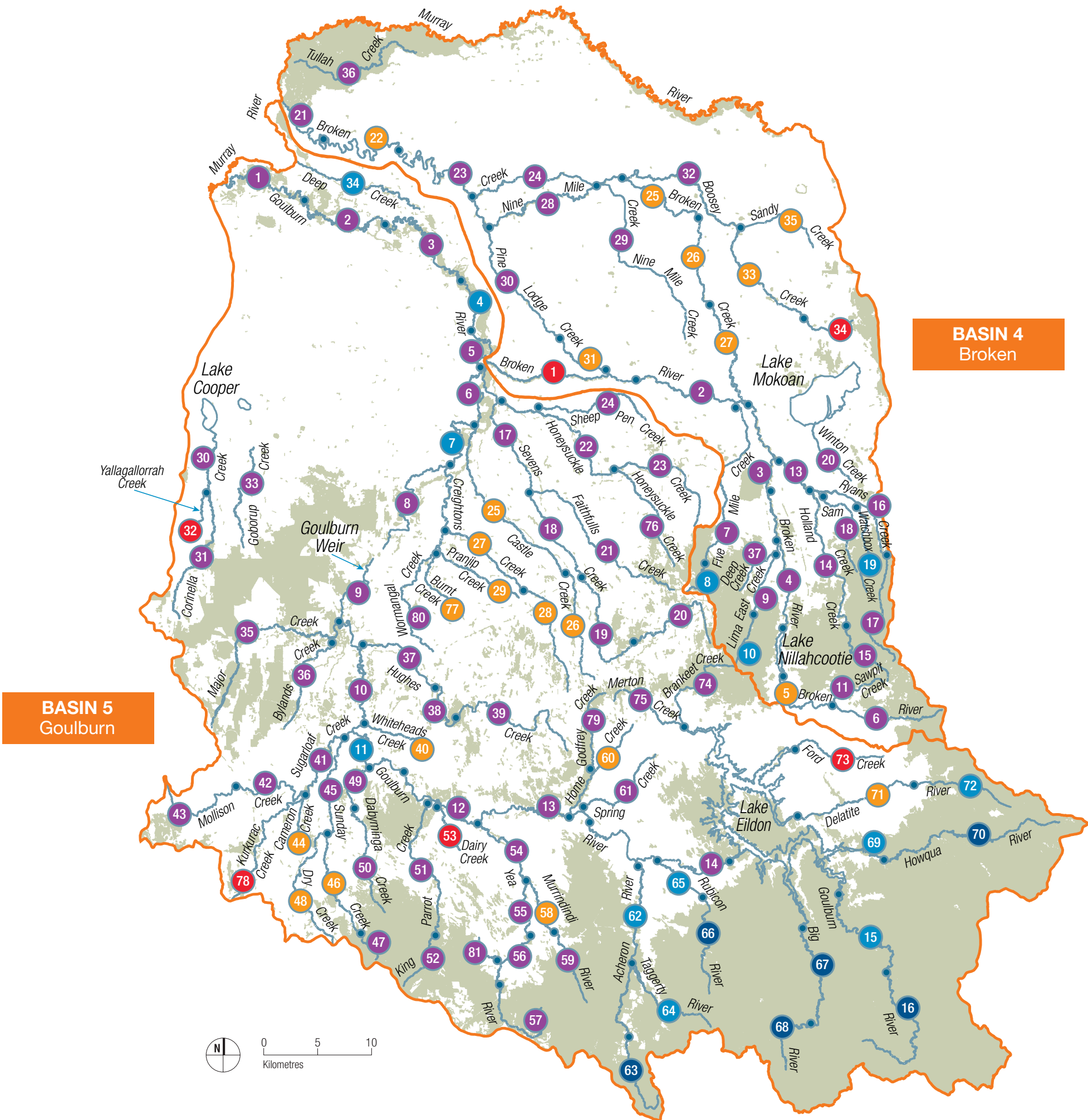


Goulburn Broken

/ Broken – basin 4

/ Goulburn – basin 5





BASIN 5
Goulburn

BASIN 4
Broken

- Environmental Condition**
- Excellent
 - Good
 - Moderate
 - Poor
 - Very Poor
 - Insufficient Data
 - Reach Division
 - Forest (uncleared)
 - 10 Reach number



Index of Stream Condition

/ Broken Basin

Basin	Reach	Reach Length (Km)	River	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life	ISC Score	Condition
4	1	42.9	Broken River	1	7	8	5	4	19	VPoor
4	2	34.4	Broken River	1	7	8		7	24	Moderate
4	3	25.7	Broken River	4	7	7	5	7	27	Moderate
4	4	35.7	Broken River ³	5	4	7	6	8	27	Moderate
4	5	22.1	Broken River ^{1,3}	7	4	4	3	8	22	Poor
4	6	27.7	Broken River ^{1,3}	7	5	6	7	8	31	Moderate
4	7	51.8	Five Mile Creek	6	8	6		7	32	Moderate
4	8	10	Five Mile Creek	6	9	9		9	39	Good
4	9	17.7	Lima East Creek ³	6	8	5	6	9	31	Moderate
4	10	12.1	Lima East Creek	6	8	9		8	37	Good
4	11	14.8	Sawpit Creek	5	5	7		5	26	Moderate
4	13	15.3	Holland Creek	4	6	7	5	7	26	Moderate
4	14	41.3	Holland Creek	4	7	7	8	7	30	Moderate
4	15	20.7	Holland Creek	4	6	9		8	30	Moderate
4	16	29.9	Ryans Creek ³	9	8	6	6	8	34	Moderate
4	17	30.2	Ryans Creek	9	5	9		6	32	Moderate
4	18	26.8	Sam Creek	5	8	6	4	6	26	Moderate
4	19	23.4	Watchbox Creek ³	7	8	8	9	6	36	Good
4	20	24.1	Winton Creek	7	9	6		7	34	Moderate
4	21	24.4	Broken Creek ²	4	8	7		4	25	Moderate
4	22	37	Broken Creek ²	4	7		2	5	21	Poor
4	23	43.4	Broken Creek ^{2,3}	4	7	7	7	5	27	Moderate
4	24	40.1	Broken Creek ^{2,3}	4	7	7	4	5	24	Moderate
4	25	25.6	Broken Creek	2	7	6	4	6	21	Poor
4	26	24.1	Broken Creek ³	2	7	7	4	6	22	Poor
4	27	40.3	Broken Creek ³	2	7	6	5	6	22	Poor
4	28	44	Nine Mile Creek ²	4	7	8		5	27	Moderate
4	29	46.2	Nine Mile Creek	6	7	6		5	29	Moderate
4	30	41.3	Pine Lodge Creek	6	7	5	5	4	25	Moderate

¹ Used hydrology result from 2004 ISC ² Hydrology score based on 2011 environmental watering objectives ³ Only 1 year water quality data available

Basin	Reach	Reach Length (Km)	River	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life	ISC Score	Condition
4	31	18.1	Pine Lodge Creek	6	7	4		4	23	Poor
4	32	48.4	Boosey Creek ³	3	8	6	5	6	24	Moderate
4	33	33.9	Boosey Creek	2	7	7		5	22	Poor
4	34	17.3	Boosey Creek	2	7	6		3	19	VPoor
4	35	21.3	Sandy Creek	5	6	5		3	22	Poor
4	36	39.1	Tullah Creek	1	9	8		6	24	Moderate
4	37	12.4	Deep Creek ³	6	7	7	6	8	32	Moderate

/ Goulburn Basin

Basin	Reach	Reach Length (Km)	River	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life	ISC Score	Condition
5	1	43.2	Goulburn River ^{2,3}	7	7	9	7	5	32	Moderate
5	2	39.6	Goulburn River ²	7	7	8	5	3	26	Moderate
5	3	53.3	Goulburn River ²	7	8	7		5	32	Moderate
5	4	19.6	Goulburn River ²	7	8	8		8	38	Good
5	5	16.4	Goulburn River ²	7	7	8	7	6	34	Moderate
5	6	21.3	Goulburn River ^{2,3}	7	7	7	10	5	33	Moderate
5	7	20.1	Goulburn River ²	7	7	8		8	37	Good
5	8	34.8	Goulburn River ²	7	4	8	10	6	30	Moderate
5	9	31.2	Goulburn River ^{2,3}	7	7	7	9	4	31	Moderate
5	10	22.3	Goulburn River ²	7	5	7		5	28	Moderate
5	11	25.8	Goulburn River ²	7	7	7	7		35	Good
5	12	25.6	Goulburn River ²	7	6	6			30	Moderate
5	13	38.6	Goulburn River ²	7	5	7		3	25	Moderate
5	14	51.3	Goulburn River ²	7	5	6	9	8	32	Moderate
5	15	39.4	Goulburn River ⁴	9	6	9	6	8	35	Good
5	16	51.8	Goulburn River	9	7	9		9	42	Excellent
5	17	40.7	Seven Creeks ³	4	6	7	5	8	27	Moderate
5	18	27.5	Seven Creeks	4	5	7	6	7	26	Moderate
5	19	31	Seven Creeks	4	7	6	6	8	28	Moderate

² Hydrology score based on 2011 environmental watering objectives ³ Only 1 year water quality data available ⁴ No instream woody habitat score available

/ Goulburn Basin

Basin	Reach	Reach Length (Km)	River	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life	ISC Score	Condition
5	20	38	Seven Creeks	4	9	8		7	31	Moderate
5	21	53.7	Faithfulls Creek	6	9	6		7	33	Moderate
5	22	56	Honeysuckle Creek ³	5	6	7	5	6	27	Moderate
5	23	39.7	Honeysuckle Creek	5	7	7		5	28	Moderate
5	24	35	Sheep Pen Creek	5	8	5		4	25	Moderate
5	25	71.6	Castle Creek	2	7	7			22	Poor
5	26	30.4	Castle Creek	2	5	6		5	20	Poor
5	27	59.4	Creightons Creek	1	8	7		5	21	Poor
5	28	30.3	Creightons Creek ³	1	7	6	6	8	23	Poor
5	29	40.7	Pranjip Creek	1	7	6		5	20	Poor
5	30	22.1	Cornella Creek	4	6	5			24	Moderate
5	31	50.3	Cornella Creek	4	5	7			24	Moderate
5	32	13.9	Yallagalorrah Creek	4	5	5			18	VPoor
5	33	34.9	Goborup Creek	6	10	6		3	26	Moderate
5	34	38.5	Deep Creek	9	8	6			37	Good
5	35	70.9	Major Creek	5	6	8		5	28	Moderate
5	36	38.6	Bylands Creek	6	7	8		5	31	Moderate
5	37	23.6	Hughes Creek ³	4	7	7	6	8	29	Moderate
5	38	16.3	Hughes Creek	4	7	8		9	31	Moderate
5	39	44.7	Hughes Creek	4	7	7		9	31	Moderate
5	40	22.9	Whiteheads Creek ³	3	5	7	5	3	20	Poor
5	41	23.1	Sugarloaf Creek	3	8	6	4	7	24	Moderate
5	42	25.7	Mollison Creek	3	6	6		7	25	Moderate
5	43	26.4	Mollison Creek	5	6	5			25	Moderate
5	44	12	Cameron Creek	3	7	6			23	Poor
5	45	33.2	Sunday Creek	4	6	7	3	8	24	Moderate
5	46	30.6	Sunday Creek ³	4	6	7	4		23	Poor
5	47	7.3	Sunday Creek	4	7	8		3	24	Moderate
5	48	40.4	Dry Creek ³	5	5	8	3	6	23	Poor
5	49	14.7	Dabyminga Creek	6	7	7		3	26	Moderate
5	50	30.8	Dabyminga Creek	6	9	9		3	29	Moderate

Basin	Reach	Reach Length (Km)	River	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life	ISC Score	Condition
5	51	45	King Parrot Creek	3	7	7	8	8	29	Moderate
5	52	17.9	King Parrot Creek	3	7	8		10	30	Moderate
5	53	17.9	Dairy Creek ³	1	7	6	4	6	19	VPoor
5	54	29	Yea River ³	4	6	8	6		27	Moderate
5	55	17.2	Yea River	4	6	8		10	30	Moderate
5	56	21.8	Yea River ³	4	7	7	8	8	31	Moderate
5	57	29.8	Burnt Creek	4	9	9		8	34	Moderate
5	58	18	Murrindindi River ³	2	7	6	5	8	23	Poor
5	59	20.2	Murrindindi River	2	7	9	9	10	31	Moderate
5	60	29.3	Home Creek ³	3	5	6	4	7	22	Poor
5	61	30.5	Spring Creek	4	5	5		7	24	Moderate
5	62	61.8	Acheron River	6	7	7	8	9	35	Good
5	63	24.7	Acheron River ⁴	6	9	10		10	41	Excellent
5	64	28	Taggerty River	6	8	9		9	38	Good
5	65	18.3	Rubicon River	8	7	6		10	36	Good
5	66	26	Rubicon River	8	9	10		9	44	Excellent
5	67	36	Big River ⁴	10	7	10		10	44	Excellent
5	68	26.8	Big River ⁴	10	7	10	9	10	44	Excellent
5	69	8.8	Howqua River	9	5	8		8	35	Good
5	70	57.7	Howqua River ^{3,4}	9	7	9	10	9	42	Excellent
5	71	33.6	Delatite River	1	5	6	9	7	22	Poor
5	72	24.8	Delatite River ⁴	6	7	9		9	36	Good
5	73	28.3	Ford Creek ³	3	5	4	2	4	16	VPoor
5	74	26.7	Brankeet Creek	7	5	8	6	8	31	Moderate
5	75	23.6	Merton Creek	4	5	6		7	26	Moderate
5	76	35.2	Honeysuckle Creek	6	7	6		5	29	Moderate
5	77	22.2	Burnt Creek	1	7	6		8	23	Poor
5	78	38.4	Kurkuruc Creek ³	2	6	5	2	7	17	VPoor
5	79	24	Godfrey Creek	6	7	5		7	29	Moderate
5	80	36.4	Wormangal Creek	5	7	6		8	31	Moderate
5	81	12.5	Yea River	5	4	6			24	Moderate

³ Only 1 year water quality data available⁴ No instream woody habitat score available