



Campaspe River near confluence with River Murray. Courtesy Alison Pouliot

North Central Region

Dominated by the forested slopes of the Great Dividing Range in the south and flat, alluvial plains in the north toward the River Murray, the North Central region is distinguished by a large number of lakes, swamps and reservoirs, and diverse agricultural land use, from broad acre cropping in the west to irrigated farming in the east.

Four river basins form the region - the Campaspe (basin 6), the Loddon (basin 7), part of the Avoca (basin 8) and the Avon-Richardson system of the Wimmera (basin 15).

Of the major rivers, the Campaspe and Loddon flow into the River Murray, the Avon-Richardson terminates at Lake Buloke and the Avoca discharges into the Avoca Marshes and Lake Boga - the Avoca River regularly ceases to flow for many months of the year.

Water storages within the region include lakes Buloke, Batyo Catyo, Boort, Meran and Boga as well as Lake Eppalock and the Upper Coliban, Lauriston, Malmsbury, Hepburn Lagoon, Newlyn, Cairn Curran, Tullaroop and Laanecoorie reservoirs. In addition, the region includes ecologically and culturally significant naturally occurring wetlands, notably Kow Swamp and the Gunbower Island Forest which is made up of small lakes, wetlands, sand hills and magnificent stands of Red Gums, Black Box and Grey Box trees.

Water resources within the North Central region occur as surface water and groundwater systems. In the north, the shallow groundwater table and shallow sands of the River Murray plain account for the significant salinity issue.

The Campaspe basin was the only basin in the region to have any stream length in good or excellent condition, with 7% of stream length being in good condition. The majority of stream length in the Campaspe, Loddon and Avoca basins was in moderate condition (29%, 41% and 74% respectively). More than half (56%) of stream length in the Avon – Richardson river system (part of the Wimmera basin) included in the North Central region was in poor condition.

Water Quality

Water quality was monitored at 28 reaches across the North Central region. Results ranged from excellent to very poor, with the majority of reaches in moderate condition (43%) followed by 32% in poor condition, 17% in good condition and 4% each in excellent and in poor condition.

Ten of the Campaspe basin's 25 reaches were assessed. Reach 14, located on a cleared tract of the Mclvor Creek scored very poorly, with elevated phosphorus, salinity and turbidity levels. In contrast, reach 5, located on the Campaspe River downstream of Lake Eppalock in an area of patchy forest cover, was the only reach across the entire region to show close to unmodified water quality. The majority of sites showed elevated levels of phosphorus and salinity, which is attributed to dryland and irrigation farming practices.

Water quality was assessed for a quarter of the reaches in the Loddon basin. Results across the basin ranged from very poor to good. The poorest reach, reach 18 on McCallum Creek, is located in a cleared agricultural area. Reach 6 on the Loddon River had good water quality, although there was evidence of elevated levels of salinity.

Four of Avoca's 23 reaches were assessed. All reaches had poor to moderate water quality, attributed to elevated phosphorus and salinity levels.

Hydrology

All reaches in the North Central region had modified hydrology, ranging from those most altered in the Loddon basin to a small number of streams with near natural flows in the Campaspe and Avoca basins.

Environmental water were available in both the Loddon and Campaspe basins in 2011-12. In the Loddon, 7,601 ML was available from the Loddon Weir to water reaches 1-8 on the Loddon River below Cairn Curren Reservoir and reach 18 on Tullaroop Creek, below Tullaroop Reservoir. One out of three (33% compliance) priority watering actions were met with spring and summer freshes only partially achieved as flow rates were below target.

In the Campaspe basin, 13,684 ML of water was available from Lake Eppalock for environmental water in 2011-12 for five reaches (reaches 1 – 5 on the Campaspe River below Lake Eppalock). Reaches 3-5 met both priority watering actions, however, reaches 1 and 2 only met one out of four, priority watering actions. Priority watering actions were not met as the summer low flows were exceeded, only one of three summer freshes were provided and the winter high flow was less than recommended.

Drought had a heavy impact across the entire region, with the Campaspe basins amongst the most affected by drought in the State. Reaches most heavily impacted included Axe Creek (reach 12), Sheepwash Creek (reach 13), Mclvor Creek (reach 14) and Myrtle Creek (reach 17) in the Campaspe basin; Joyces Creek (reach 25) and Pyramid Creek (reach 51) in the Loddon basin; and the Avoca River (reaches 1, 7, and 8) and Glenlogie Creek (reach 20) in the Avoca basin.

Water management arrangements increased stress on the majority of reaches affected by drought, notably reach 6 in the Campaspe basin, reach 51 in the Loddon basin and reach 1 in the Avoca basin. However, water management arrangements did decrease flow stress on some reaches including reaches 6 and 52 on the Loddon River.



Campaspe River. Courtesy NCCMA

Of the 40 reaches assessed in the Loddon basin, 20 had flow stress scores of two or less, indicating high levels of flow alteration. Streams with the most altered hydrology included reaches 11, 33-34 and 51 on the Serpentine, Bullock and Pyramid Creeks respectively. Large water storages in the upper catchment, particularly Cairn Curran Reservoir on the Loddon River, control flows to meet irrigation demands and therefore alter natural flow regimes. Nearly all reaches in the Loddon catchment exhibited summer stress and extended periods of low flow and zero flows during summer.

Within the Campaspe basin, the headwaters of the Campaspe River (reach 7) and Mt. Pleasant Creek (reaches 8-9) had near natural flow regimes. All other reaches had significantly altered flow regimes, most notably Axe Creek (reach 12), Sheepwash Creek (reach 13) and Little Coliban Creek (reach 20).

Like the Campaspe basin, hydrology varied in the Avoca basin from reaches with near natural flow regimes, notably reaches 13-15 on Fentons Creek, to those in a highly altered state. A considerable length of the Avoca River (reaches 1-4) and its anabranch, Mosquito Creek (reach 9), had heavily modified flow regimes, attributed to the operation of numerous weirs along the length of the river. Reaches 10-17 had moderate to minimal variations to natural flow regimes. In contrast, reaches along the lower Avoca River demonstrated extended periods of low and zero flows during summer.

Vegetation

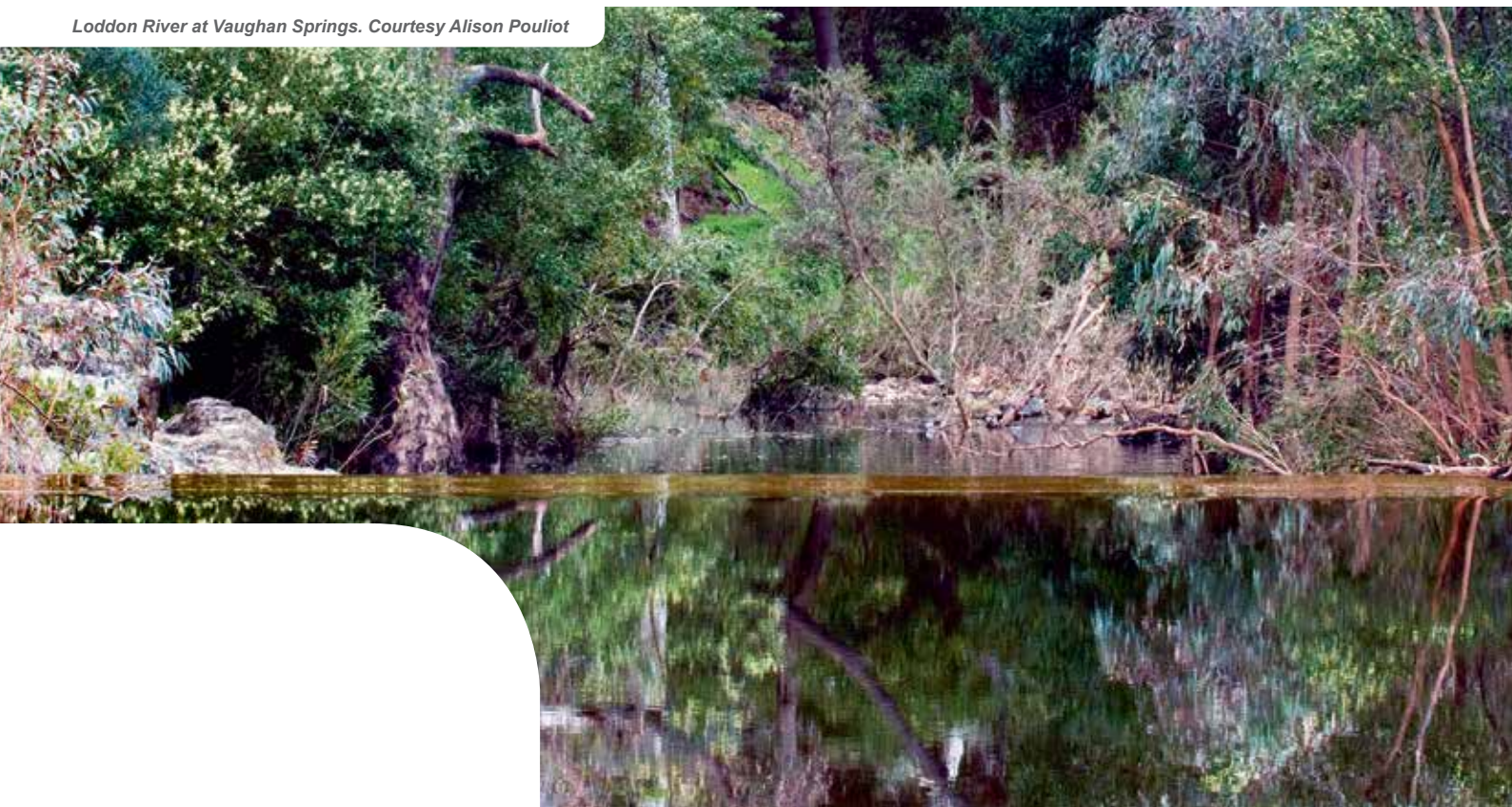
The majority of streamside vegetation in the North Central region was found to be in moderate condition (58% or 64 of the 111 reaches assessed). The remaining reaches ranged from poor (13% or 15 reaches) to good (25% or 28 reaches) or excellent (4%, or reaches).

In the Campaspe basin, 52% (13 of the 25 reaches assessed) of streamside vegetation was in moderate condition and a further 40% (10 reaches) was in good condition. Reaches in moderate condition had generally good but variable results for vegetation diversity, were highly fragmented and had poor results for vegetation width, a reflection of the fact that much of the native riparian vegetation has been cleared for agriculture and urban development.

Only one reach in the Campaspe basin (reach 22 at the headwaters of the Coliban River above the Upper Coliban Reservoir) was in near reference condition. Equally, only one reach was in poor condition - reach 25 on Jews Harp Creek, which scored poorly for all parameters with the exception of vegetation overhang and numbers of invasive willows, of which there were few.

In the Loddon basin, more than half of the reaches (53% or 28 of the 53 assessed) were found to be in moderate condition. Of the remainder, 11 reaches (20%) were in poor condition, 12 (23%) were in good condition and two (4%) were in excellent condition.

Loddon River at Vaughan Springs. Courtesy Alison Pouliot



Reach 48 at the headwaters of the Loddon River was in reference condition and reach 28 at Jim Crow Creek was in near reference condition. Of the reaches that scored poorly, those in the poorest condition (reaches 19, 24, 32 and 45) are all located in areas that have been extensively cleared of vegetation.

Only one reach of the 23 assessed for vegetation in the Avoca basin was found to be in excellent condition - reach 3 on the Avoca River. In contrast, three reaches (19, 20 and 27) scored poorly, where vegetation was found to be highly fragmented and lacking diversity. The majority of the Avoca catchment was in either moderate or good condition - 65% (15 reaches) and 18% (four reaches) respectively. Moderate scores were attributed to fragmentation and a lack of diversity.

Ten reaches in the Avon – Richardson river system were assessed as part of the North Central region. Of these, eight were in moderate condition (with predominantly moderate vegetation width, fragmented streamside vegetation and very few willows) and two were in good condition (reach 78 on the Richardson River and reach 81 on the Avon River).

Physical Form

The physical condition of 111 reaches in the North Central region was assessed. The majority of reaches were in good condition (41% or 45 reaches), followed equally by 30 reaches in excellent condition and 30 reaches in moderate condition (representing 27% each), and six reaches (5%) in poor condition.

Reaches in the Avoca basin were in the best physical condition. Of the 23 reaches assessed, almost half (11 reaches or 48%) were in excellent condition with a further nine reaches (39%) in good condition and three (13%) in moderate condition. Of the reaches rated excellent, all were in near reference condition, predominantly due to the lack of downstream major barriers to fish passage. The poorest reach, reach 8 on the Avoca River, scored poor to moderate results for all parameters.

Twenty-five reaches were assessed in the Campaspe basin, with the majority in either moderate or good condition (40% or ten reaches and 48% or 12 reaches respectively). One reach, reach 15 on Mclvor Creek, was in poor condition, scoring moderately for bank stability but very poorly for instream woody habitat and fish barriers. Two reaches - reaches 10 and 11 on Forest Creek - were in near reference condition. Notably, within the Campaspe basin, all but one reach (reach 1 on the Campaspe River) assessed were impacted by major barriers to fish passage.

In the Loddon basin, the majority of the 53 reaches assessed were in good condition (36% or 19 reaches), with a further 28% (15 reaches) in excellent condition and 26% (14 reaches) in moderate condition. Five reaches in the Loddon basin were assessed as poor - reaches 9, 16, 22, 23 and 44. The poor scores were attributed to downstream fish barriers, bank instability and low levels of instream woody habitat. In contrast, five reaches (1-3, 40 and 41) were in reference condition.

Of the ten reaches (reaches 77-86) in the Avon – Richardson river system, three were in moderate condition, five were in good condition and two were in excellent condition with the Richardson River (reach 77) in reference condition.

Aquatic Life

Ninety-five (85%) reaches were assessed for aquatic life in the North Central region. Of these, 70% were in moderate or poor condition (41% and 29% respectively) and 12% in very poor condition. Only two reaches (2%) were assessed as excellent.

Results varied significantly between basins. Overall, the Avoca basin rated poorly for aquatic life with four of the 19 reaches tested in very poor condition and eight in poor condition. The remainder were in moderate condition with the highest scoring sites located at the headwaters of the Avoca River and Glenlogie and Rutherford Creeks. Interestingly, the poorest rating reach, reach 18 located on Number Two Creek, is also located in the basin headwaters and in a relatively dense tract of forest.

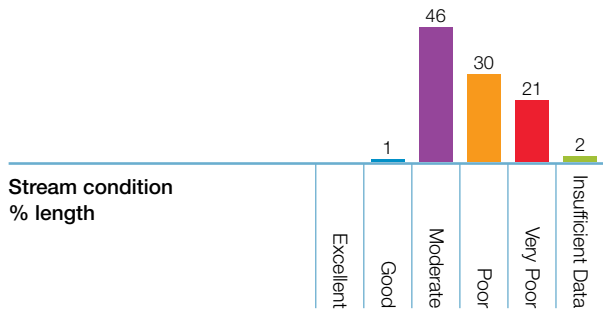
In contrast, the Loddon basin had the highest percentage of reaches in good or excellent condition (21% and 5% respectively) and more than half in moderate condition (51%). The highest scoring reaches (reaches 18 and 19) are both located on Tullaroop Creek, in the south of the basin near forested highlands.

All reaches in the Campaspe basin were assessed for aquatic life. The majority of reaches were in poor or moderate condition (36% and 40% respectively) and no reaches were assessed as excellent. The generally lower scores in the Campaspe basin could be attributed to the highly modified hydrology and environment.

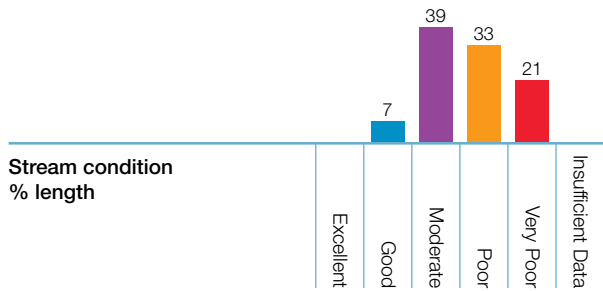


Campaspe River. Courtesy NCCMA

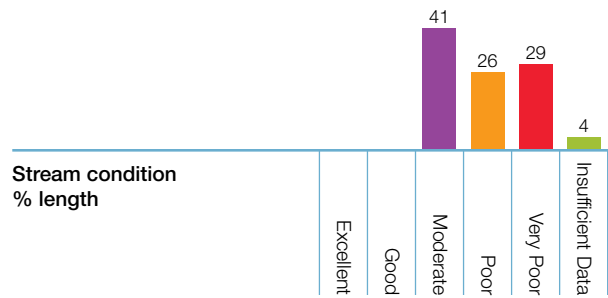
/ North Central Region



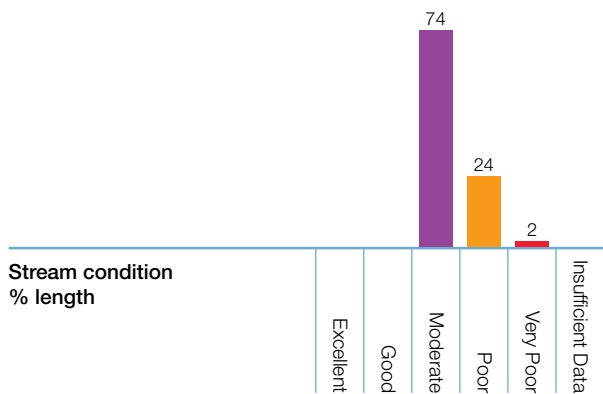
/ Campaspe



/ Loddon



/ Avoca



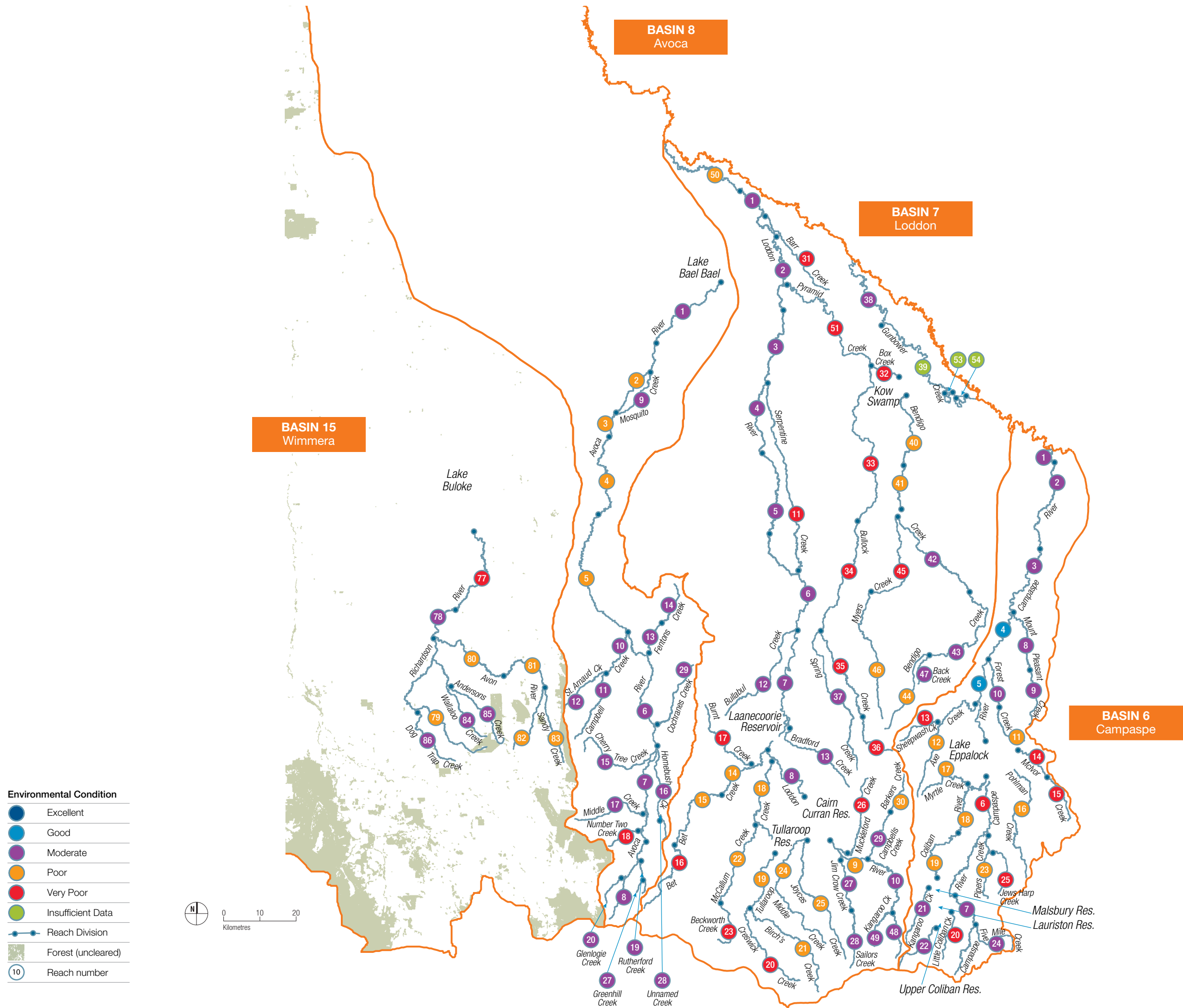
Environmental Condition



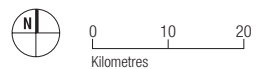


North Central

- / Campaspe – basin 6
- / Loddon – basin 7
- / Avoca – basin 8 (part)
- / Wimmera – basin 15 (part)



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



Index of Stream Condition

/ Campaspe Basin

Basin	Reach	Reach Length (Km)	River	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life	ISC Score	Condition
6	1	10.6	Campaspe River ²	6	7	7	5	5	28	Moderate
6	2	44.8	Campaspe River ²	6	6	7	8	6	31	Moderate
6	3	36.3	Campaspe River ^{2,3}	10	7	7	6	7	34	Moderate
6	4	24.0	Campaspe River ²	10	8	6		7	36	Good
6	5	30.1	Campaspe River ²	10	7	6	10	7	36	Good
6	6	61.1	Campaspe River	2	6	5	4	5	19	VPoor
6	7	46.9	Campaspe River	8	6	5		5	28	Moderate
6	8	34.6	Mount Pleasant Creek	8	8	7		3	29	Moderate
6	9	22.2	Mount Pleasant Creek	8	8	6		3	27	Moderate
6	10	22.0	Forest Creek	4	9	7		4	26	Moderate
6	11	22.8	Forest Creek	4	9	6		3	23	Poor
6	12	55.9	Axe Creek	1	7	7	6	4	20	Poor
6	13	21.3	Sheepwash Creek ³	1	7	7	5	2	16	VPoor
6	14	15.9	Mcivor Creek	2	5	6	3	4	17	VPoor
6	15	18.0	Mcivor Creek	2	4	6		5	18	VPoor
6	16	54.5	Pohlman Creek	2	5	6	6	5	21	Poor
6	17	27.2	Myrtle Creek	4	5	6		4	22	Poor
6	18	35.3	Coliban River	3	6	5		6	23	Poor
6	19	25.8	Coliban River ³	3	5	7	4	8	23	Poor
6	20	19.5	Little Coliban Creek	1	5	5		5	17	VPoor
6	21	24.4	Kangaroo Creek	3	7	8		5	25	Moderate
6	22	28.2	Coliban River	3	7	9		8	30	Moderate
6	23	27.0	Pipers Creek	4	7	5		4	23	Poor
6	24	24.0	Five Mile Creek	6	7	7		4	28	Moderate
6	25	20.2	Jews Harp Creek	4	5	3		5	19	VPoor

² Hydrology score based on 2011 environmental watering objectives ³ Only 1 year water quality data available

/ Loddon Basin

Basin	Reach	Reach Length (Km)	River	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life	ISC Score	Condition
7	1	38.9	Loddon River ²	6	10	6		5	30	Moderate
7	2	48.0	Loddon River ²	6	10	6	5	6	30	Moderate
7	3	40.2	Loddon River ²	6	10	6		6	32	Moderate
7	4	56.2	Loddon River ²	6	9	7		6	32	Moderate
7	5	53.9	Loddon River ²	6	7	6		4	27	Moderate
7	6	57.5	Loddon River ²	6	7	6	8	6	31	Moderate
7	7	46.7	Loddon River ²	6	8	6	6	8	32	Moderate
7	8	30.1	Loddon River ²	6	6	6		8	31	Moderate
7	9	15.4	Loddon River	4	4	5		5	22	Poor
7	10	35.8	Loddon River	4	6	8		6	27	Moderate
7	11	95.7	Serpentine Creek		7	6		6	19	VPoor
7	12	49.9	Bullabul Creek	6	7	6		4	27	Moderate
7	13	42.7	Bradford Creek	5	8	6		5	28	Moderate
7	14	27.7	Bet Bet Creek ³	2	7	7		5	22	Poor
7	15	35.6	Bet Bet Creek	2	5	6	6	6	22	Poor
7	16	32.3	Bet Bet Creek	2	4	4		5	17	VPoor
7	17	39.6	Burnt Creek ³	2	7	7	3		19	VPoor
7	18	38.4	Tullaroop Creek ^{2,3}	6	5	5	2	9	22	Poor
7	19	25.2	Tullaroop Creek	3	5	3		9	20	Poor
7	20	40.2	Creswick Creek	2	6	5	5	4	19	VPoor
7	21	51.0	Birch's Creek	3	6	4		7	22	Poor
7	22	35.2	Mccallum Creek	3	4	5		7	21	Poor
7	23	22.2	Beckworth Creek	3	4	4		6	19	VPoor
7	24	55.3	Middle Creek	6	5	3		6	23	Poor
7	25	52.9	Joyces Creek	2	5	6		7	21	Poor
7	26	37.0	Muckleford Creek	3	5	6		3	18	VPoor
7	27	23.1	Jim Crow Creek	3	5	5	7	8	24	Moderate
7	28	24.9	Sailors Creek	3	7	9			27	Moderate
7	29	19.3	Campbells Creek ³	4	6	7	4	6	24	Moderate

² Hydrology score based on 2011 environmental watering objectives ³ Only 1 year water quality data available

/ Loddon Basin

Basin	Reach	Reach Length (Km)	River	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life	ISC Score	Condition
7	30	15.2	Barkers Creek	4	5	5		5	23	Poor
7	31	38.4	Barr Creek	1	9	4	4	3	15	VPoor
7	32	10.1	Box Creek	3	7	3		4	18	VPoor
7	33	69.4	Bullock Creek		9	4		2	12	VPoor
7	34	46.7	Bullock Creek		7	4		5	15	VPoor
7	35	50.5	Bullock Creek	2	6	7		3	19	VPoor
7	36	23.2	Bullock Creek	2	7	7		3	19	VPoor
7	37	62.3	Spring Creek	6	9	6		3	26	Moderate
7	38	56.6	Gunbower Creek		9	7	6		34	Moderate
7	39	84.6	Gunbower Creek		9	6				Insufficient Data
7	40	32.2	Bendigo Creek	1	10	5		6	22	Poor
7	41	17.1	Bendigo Creek	1	10	6	7	5	22	Poor
7	42	52.7	Bendigo Creek	2	9	7		5	24	Moderate
7	43	53.0	Bendigo Creek	4	7	7	7	6	29	Moderate
7	44	28.1	Bendigo Creek ³	4	4	6	3	8	21	Poor
7	45	35.4	Myers Creek	2	7	3			16	VPoor
7	46	53.0	Myers Creek	2	7	7			22	Poor
7	47	12.2	Back Creek	4	9	6			28	Moderate
7	48	21.8	Loddon River	4	8	10			32	Moderate
7	49	18.4	Kangaroo Creek	4	7	8		8	31	Moderate
7	50	57.7	Little Murray River	7	8	6		7	23	Poor
7	51	59.4	Pyramid Creek		8	5		5	18	VPoor
7	53	0.8	Gunbower Creek		9	4				Insufficient Data
7	54	1.8	Gunbower Creek		9	5				Insufficient Data

³ Only 1 year water quality data available

/ Avoca Basin

Basin	Reach	Reach Length (Km)	River	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life	ISC Score	Condition
8	1	41.5	Avoca River	2	9	7			25	Moderate
8	2	36.2	Avoca River	2	9	7		3	20	Poor
8	3	19.3	Avoca River	2	7	9		3	20	Poor
8	4	46.7	Avoca River ³	2	7	7	6	3	20	Poor
8	5	63.2	Avoca River	5	9	7	3	4	23	Poor
8	6	53.2	Avoca River ³	5	9	6	4	5	25	Moderate
8	7	40.1	Avoca River	3	6	6		6	24	Moderate
8	8	33.8	Avoca River	5	5	6	5	6	26	Moderate
8	9	25.8	Mosquito Creek	2	9	6			24	Moderate
8	10	25.6	Campbell Creek	7	7	6		2	24	Moderate
8	11	38.4	Campbell Creek	7	9	5		2	24	Moderate
8	12	24.0	St Arnaud Creek	7	9	6		2	25	Moderate
8	13	15.0	Fentons Creek	7	7	6		3	26	Moderate
8	14	20.3	Fentons Creek	8	9	6		3	28	Moderate
8	15	46.6	Cherry Tree Creek	8	7	6		3	26	Moderate
8	16	33.6	Homebush Creek	7	9	5		3	25	Moderate
8	17	36.5	Middle Creek	7	7	6		5	29	Moderate
8	18	16.0	Number Two Creek	3	9	6		1	18	VPoor
8	19	16.6	Rutherford Creek	5	7	4		6	26	Moderate
8	20	15.9	Glenlogie Creek	6	7	4		6	27	Moderate
8	27	7.2	Greenhill Creek	5	6	4		6	24	Moderate
8	28	1.3	Unnamed Creek	7	9	6			34	Moderate
8	29	39.9	Cochranes Creek	6	8	6			32	Moderate

³ Only 1 year water quality data available

/ Wimmera Basin

Basin	Reach	Reach Length (Km)	River	Hydrology	Physical Form	Streamside Zone	Water Quality	Aquatic Life	ISC Score	Condition
15	77	46.0	Richardson River	3	10	5		1	17	VPoor
15	78	21.2	Richardson River	3	9	7		7	29	Moderate
15	79	85.3	Richardson River	3	7	6		4	22	Poor
15	80	50.9	Avon River	6	7	6		1	21	Poor
15	81	35.6	Avon River	6	6	7		2	22	Poor
15	82	32.7	Avon River	6	6	6		1	20	Poor
15	83	37.0	Sandy Creek	8	7	6		1	23	Poor
15	84	43.1	Wallaloo Creek	8	7	6		3	26	Moderate
15	85	42.0	Andersons Creek	8	6	6			32	Moderate
15	86	37.7	Dog Trap Creek	8	7	6			34	Moderate

Avon River. Courtesy NCCMA



Campaspe River near confluence with River Murray. Courtesy Alison Pouliot

