

SECTION 2: WATER QUALITY CONDITION

Water Quality Monitoring Program

Environment ACT manages a monitoring program for the ACT's water resources that includes the collection of water quality, streamflow and biological data. The monitoring program is based on regular sampling of lakes and rivers. Such information is used to determine whether waters in the ACT are of appropriate quality and if the management strategies used to achieve or maintain such water quality are adequate. The information is not intended to identify specific pollution incidents but rather provide information about changes to water quality over time.

Water quality data is collected by other government agencies, research institutions and authorised dischargers such as ACTEW (Lower Molonglo Water Quality Control Centre, Water Supply Reservoirs) and the Queanbeyan City Council (Queanbeyan Sewage Treatment Plant). Although the EPA may use such data for assessing compliance with licence conditions and the Environment Protection Regulations 1997, the data collected by those organisations is not reported in this document.

Sampling Sites

Sites are located so as to be representative of stream and lake conditions in the ACT (Figure 8). It is not possible to monitor all sites and all parameters of interest, consequently those considered most representative of environmental conditions are selected with the intention of generalising to similar areas.

Lakes

The major urban lakes (with the exception of Lake Burley Griffin — a Commonwealth responsibility) are sampled eight months of the year during August, October to March, and May. The ACT Government also monitors Burrinjuck Reservoir as the ACT's impact on the Murrumbidgee River is not identifiable downstream of Burrinjuck Reservoir as a result of the Reservoir's size and the residence time of water in it. Monitoring of blue-green algae in Canberra's lakes is undertaken during the summer months by Environment ACT's Environment Protection Officers and encompasses the recreation zones of the lakes. The ACT Health Protection Service undertakes bacterial monitoring of lake recreation areas during peak use times.

Rivers

Streamflow is measured at a number of sites throughout the ACT at hydrographic stations operated by Ecowise Environmental. This information is valuable for interpreting water quality data. Most of the pollutants that wash off the land do so during rainfall events. In conjunction with water quality monitoring, streamflow allows for the calculation of pollutant loads in our lakes and rivers.

A flow based sampling process has been adopted for the stream water quality monitoring program. This method is a more cost effective characterisation of water quality than time based monitoring, because streamflow is the major determinant of quality. Samples are collected within four flow percentile groupings (see Table 4). The 5th percentile flow is the flow exceeded only 5% of the time and represents very high flow; conversely the 90th percentile flow indicates very low flow.

Rivers were sampled five times during this reporting period. In addition to the requirement to sample within flow percentile groups, there is a requirement to ensure there is a reasonable time period between each sample. The aim of this strategy is to provide a fully representative assessment of river health over time by taking account of the impact of flow on water quality. As in the previous reporting year, the full range of samples, as scheduled in Table 4, were not taken as the flow was not adequate to enable all high flow percentile samples (Figure 5).

Table 4: Flow Percentiles for River Sampling

Flow Percentile Group	Number of Samples
5-29	2
30-49	2
50-69	2
70-89	2

Biological Assessment of Ecosystem Condition

In addition to monitoring the physical and chemical condition of the ACT's waters an assessment of the status of the aquatic ecosystem is performed. Assessment of ecosystem health is based on the macro invertebrate monitoring undertaken using the AUSRIVAS protocol. It involves collecting samples from stream edge sites in the ACT region during Spring and Autumn. An AUSRIVAS predictive model, developed as part of the National River Health Program (NRHP) conducted under the Natural Heritage Trust, is used to assess these sites. The condition of the site, as determined by the model, provides a measure of a stream's biological health. Thirteen sites are sampled and are selected as either reference sites or test sites. The selection of test sites was based on potential and known impacts from rural degradation, urban runoff, discharge of treated sewage effluent, trace metal contamination, habitat degradation, sedimentation and river regulation. The three reference sites were selected from those sampled during development of the ACT component of the NRHP. The ten test sites and three reference sites were sampled in October 2004 and April 2005.

Condition of ACT Waters 2004-2005

The water quality condition history in the ACT generally has been good. In recent years rivers and streams have been stressed by the extreme events of drought and fire. The urban water quality in particular has deteriorated because of drought conditions, as pollutants are not diluted.

Sites in urban areas appear to be faring worse than the fire affected non-urban sites, as many non-urban waterways are displaying greater resilience to rainfall events and the pulses of sediment that these events bring. Such a comparison indicates that the drought impacts on urban streams are exacerbated by the human impacts such as altered flow regimes, nutrient enrichment, weed infestation and increased pollutants.

The condition of water quality at the monitoring sites can be assessed by comparison of actual concentrations with concentrations listed in the water quality standards.

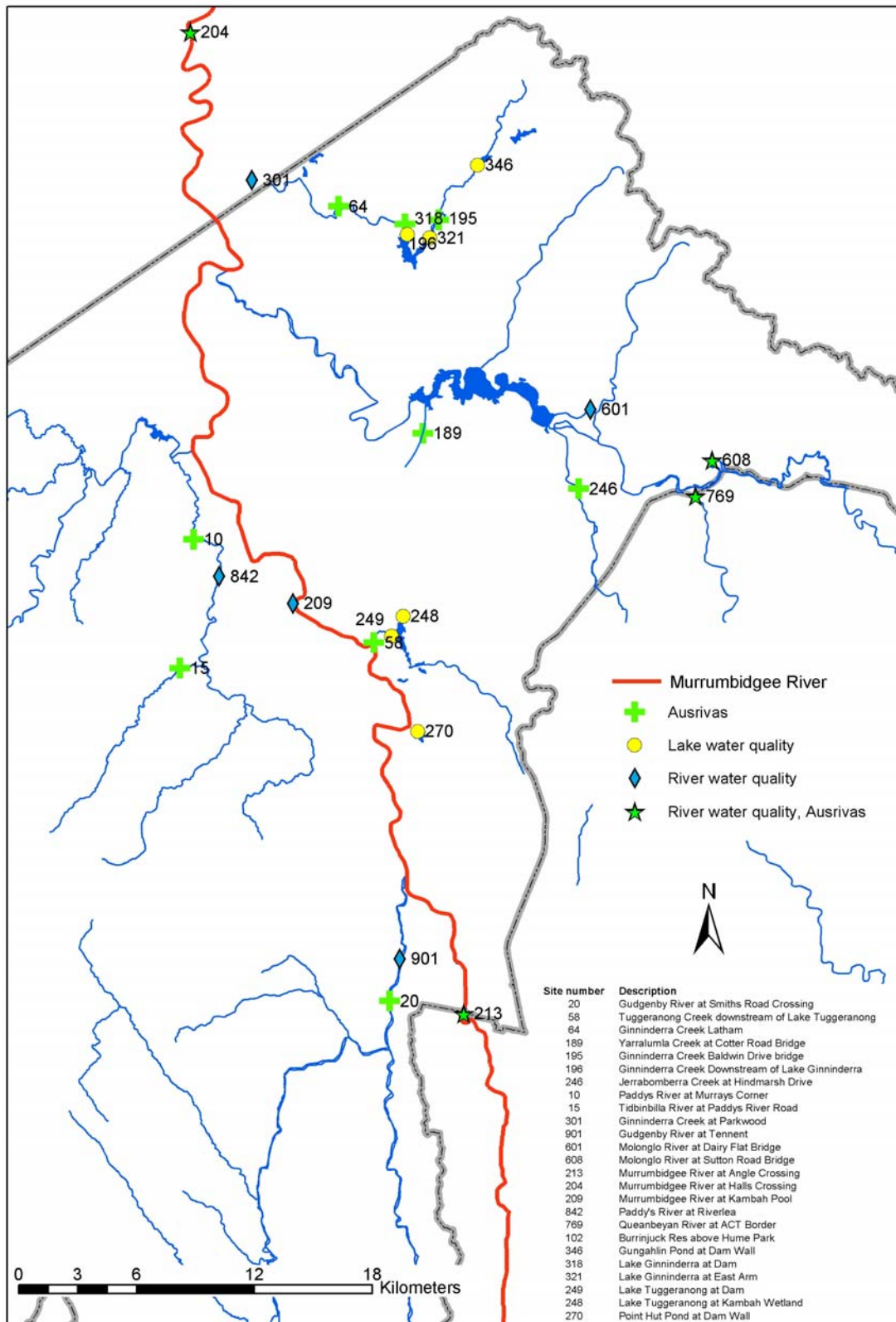


Figure 7: Locations of Water Quality and Biological (AUSRIVAS) Sampling Sites in the ACT Water Quality Monitoring Program

Indicators

Nutrient Levels (Phosphorus and Nitrogen)

Nutrients are a natural component of all water bodies, but increases in their supply often have undesirable effects, including the eutrophication of aquatic ecosystems. Eutrophication is the presence of an abnormally high quantity of plant nutrients and can lead to excess algal growth including toxic algal blooms. This can also produce other unwanted side effects e.g. low dissolved oxygen levels in the water. The two most important plant nutrients for aquatic ecosystems are phosphorus and nitrogen.

Total Phosphorus

Total phosphorus is the sum of dissolved and particulate phosphorus in the water. The standard is 0.1 mg/L for both aquatic health and recreational use. In ACT water bodies phosphorus is the nutrient that commonly determines the amount of algae that can occur.

Nutrients such as phosphorus are bound within soil/sediment particles and the movement of phosphorus through the landscape and waterways is closely linked to soil erosion and sediment transport dynamics.

Many of the rivers experienced high phosphorus levels indicating that there is still transport of nutrient rich sediments into streams during rainfall events following the vegetation removal and general soil destabilisation caused by the 2003 bushfire.

Table 5: Summary of Total Phosphorus (mg/L) Measurements for Lake and River Water Quality Sampling Sites in the ACT 2004-2005

Site number	Site name	Minimum	Maximum	Mean 04-05	Standard Deviation	Regulation limits
102	Burrinjuck Reservoir above Hume Park	0.02	0.10	0.05	0.03	0.10
248	Lake Tuggeranong at Kambah Wetland	0.04	0.11	0.08	0.02	0.10
249	Lake Tuggeranong at Dam	0.01	0.11	0.07	0.04	0.10
270	Point Hut Pond at Dam Wall	0.03	0.12	0.07	0.03	0.10
318	Lake Ginninderra at Dam	0.01	0.04	0.03	0.01	0.10
321	Lake Ginninderra at East Arm	0.01	0.06	0.03	0.02	0.10
346	Gungahlin Pond at Dam Wall	0.01	0.04	0.03	0.01	0.10
601	Molonglo River at Dairy Flat Bridge	0.02	0.04	0.03	0.01	0.10
608	Molonglo River at Sutton Road Bridge	0.03	0.38	0.15	0.15	0.10
769	Queanbeyan River at ACT Border	0.03	0.06	0.05	0.02	0.10
842	Paddy's River at Riverlea	0.04	0.09	0.05	0.02	0.10
901	Gudgenby River at Tennent	0.05	0.23	0.10	0.07	0.10
204	Murrumbidgee River at Halls Crossing	0.04	0.20	0.09	0.06	0.10
209	Murrumbidgee River at Kambah Pool	0.03	0.22	0.08	0.08	0.10
213	Murrumbidgee River at Angle Crossing	0.01	0.12	0.04	0.04	0.10
301	Ginninderra Creek at Parkwood	0.05	0.07	0.06	0.01	0.10

Total Nitrogen

There is no regulation limit for total nitrogen for the ACT. Nitrogen is not generally a limiting factor in algal growth in regional waters and it is non-toxic to organisms. Nitrogen values are consistently highest at sampling sites (601 and 204), which are downstream of the Queanbeyan and Canberra sewerage treatment plants. These high levels generally decrease rapidly along the stream. In situations where nitrogen is limiting, research indicates a potential for the growth of nitrogen fixing blue-green (scum and toxicant forming) algae. In these situations, the discharge of nitrogen in sewage effluent could discourage the growth of nitrogen fixing blue-green algae. In addition, the discharge of nitrogen can have a beneficial effect by restricting the release of phosphorus from lake or reservoir sediments. In this context, management and discharge authorisation arrangements in the ACT concentrate on minimising the input of phosphorus to waterways as a priority, with nitrogen reduction encouraged as a second priority.

Elevated levels of nitrogen (relative to other sites in the ACT) were apparent for sites 601 and 204 that were downstream of sewerage treatment plants. Also Burrinjuck reservoir (site 102) which acts as a vast nutrient and sediment sink had large fluctuations in nitrogen measurements throughout the year.

Table 6: Summary of Total Nitrogen (mg/L) Measurements for Lake and River Water Quality Sampling Sites in the ACT 2004-2005

Site number	Site name	Minimum	Maximum	Mean 04-05	Standard Deviation	Regulation limits
102	Burrinjuck Reservoir above Hume Park	1.5	10.4	4.0	3.0	N/A
248	Lake Tuggeranong at Kambah Wetland	0.4	0.9	0.7	0.2	N/A
249	Lake Tuggeranong at Dam	0.5	1.1	0.7	0.2	N/A
270	Point Hut Pond at Dam Wall	0.6	1.4	0.9	0.3	N/A
318	Lake Ginninderra at Dam	0.4	0.6	0.5	0.1	N/A
321	Lake Ginninderra at East Arm	0.4	0.6	0.5	0.1	N/A
346	Gungahlin Pond at Dam Wall	0.4	0.9	0.6	0.1	N/A
601	Molonglo River at Dairy Flat Bridge	0.5	5.1	2.4	1.7	N/A
608	Molonglo River at Sutton Road Bridge	0.4	1.0	0.7	0.3	N/A
769	Queanbeyan River at ACT Border	0.4	0.8	0.6	0.1	N/A
842	Paddy's River at Riverlea	0.3	0.7	0.4	0.2	N/A
901	Gudgenby River at Tennent	0.3	1.0	0.5	0.3	N/A
204	Murrumbidgee River at Halls Crossing	1.3	4.6	2.7	1.2	N/A
209	Murrumbidgee River at Kambah Pool	0.4	0.8	0.5	0.2	N/A
213	Murrumbidgee River at Angle Crossing	0.2	0.7	0.4	0.2	N/A
301	Ginninderra Creek at Parkwood	0.6	0.8	0.7	0.1	N/A

Suspended Solids

All streams and rivers naturally carry some suspended material as organic and inorganic particles of varying sizes. Most land uses and activities have the potential to increase suspended solids concentrations in streams. An increase in the concentration of suspended solids can have two major impacts on aquatic ecosystems. Firstly, higher concentrations of suspended solids reduce the light penetration of water, slowing plant growth and changing the type of algae present. Secondly, increases in suspended solids concentrations ultimately result in increased sedimentation in streams and lakes, choking habitats for bottom dwelling organisms with sediment.

High levels of suspended solids occurred in the river sampling sites especially those in the fire affected catchments. This indicates that some sediments are still being transported through the landscape and into the streams despite the vegetation reestablishment that has occurred since the bushfires.

Lake Ginninderra and Lake Tuggeranong continue to be effective in reducing high suspended solids concentrations coming from upstream development with a noticeable reduction in suspended solids measurements between the inflow sampling point (321 Lake Ginninderra, 248 Lake Tuggeranong) and the outflow at the dam walls.

Table 7: Summary of Suspended Solids (mg/L) Measurements for Lake and River Water Quality Sampling Sites in the ACT 2004-2005

Site number	Site name	Minimum	Maximum	Mean 04-05	Standard Deviation	Regulation limits
102	Burrinjuck Reservoir above Hume Park	9.4	146.4	46.1	46.8	25
248	Lake Tuggeranong at Kambah Wetland	6.2	27.6	14.1	7.5	25
249	Lake Tuggeranong at Dam	3.0	14.4	8.6	3.8	25
270	Point Hut Pond at Dam Wall	9.6	62.8	20.9	18.0	25
318	Lake Ginninderra at Dam	0.8	8.0	4.1	2.6	25
321	Lake Ginninderra at East Arm	0.8	25.8	12.3	8.1	25
346	Gungahlin Pond at Dam Wall	0.6	12.4	6.7	5.0	25
601	Molonglo River at Dairy Flat Bridge	5.0	12.0	6.6	3.0	25
608	Molonglo River at Sutton Road Bridge	2.0	140.0	46.6	56.9	25
769	Queanbeyan River at ACT Border	2.0	12.0	7.6	4.7	25
842	Paddy's River at Riverlea	4.0	43.0	18.4	16.7	25
901	Gudgenby River at Tennent	4.0	89.0	30.6	35.2	25
204	Murrumbidgee River at Halls Crossing	10.0	88.0	32.4	32.4	25
209	Murrumbidgee River at Kambah Pool	7.0	84.0	27.6	31.8	25
213	Murrumbidgee River at Angle Crossing	7.0	50.0	18.6	18.1	25
301	Ginninderra Creek at Parkwood	12.0	31.0	18.4	7.3	25

Turbidity

Turbidity, or opacity of a water body is related to the suspended solids concentration but also includes colouration. A stream may have very low levels of suspended material but be strongly coloured, for example the tannin rich streams in Namadgi National Park. Turbidity has an important ecological effect in determining the depth to which light penetrates the water, affecting plant growth and changing the type of algae present.

Canberra has soils with very fine clay particles that can cause high turbidity levels even though the actual amount of material suspended in the water column is not large. Also the small clay particles remain floating in the water long after the heavier sediments have settled on the bottom. A comparison of turbidity with suspended solids in the urban lakes shows how a lake can experience high turbidity even though it is performing well in reducing overall levels of material suspended in the water column.

Rivers often experience pulses of high turbidity related to rainfall events that wash soil into the waterway. Turbidity events this year in the rivers draining fire affected catchments have not been as severe as in 2003 because of the establishment of groundcover after the bushfires.

Table 8: Summary of Turbidity (NTU) Measurements for Lake and River Water Quality Sampling Sites in the ACT 2004-2005

Site number	Site name	Minimum	Maximum	Mean 04-05	Standard Deviation	Regulation limits
102	Burrinjuck Reservoir above Hume Park	20.0	156.0	68.3	43.6	30
248	Lake Tuggeranong at Kambah Wetland	12.8	63.3	36.4	21.5	30
249	Lake Tuggeranong at Dam	12.9	74.9	41.6	25.0	30
270	Point Hut Pond at Dam Wall	22.8	181.0	90.7	66.1	30
318	Lake Ginninderra at Dam	2.9	44.4	16.6	16.5	30
321	Lake Ginninderra at East Arm	6.3	37.0	19.3	10.4	30
346	Gungahlin Pond at Dam Wall	4.5	40.0	19.5	14.0	30
601	Molonglo River at Dairy Flat Bridge	2.2	9.6	4.8	2.9	10
608	Molonglo River at Sutton Road Bridge	1.9	240.0	77.2	97.6	10
769	Queanbeyan River at ACT Border	2.2	13.0	6.0	5.0	10
842	Paddy's River at Riverlea	6.0	26.0	14.0	7.3	10
901	Gudgenby River at Tennent	4.2	64.0	21.0	24.4	10
204	Murrumbidgee River at Halls Crossing	9.1	95.0	34.6	34.8	10
209	Murrumbidgee River at Kambah Pool	6.7	110.0	32.3	43.6	10
213	Murrumbidgee River at Angle Crossing	3.9	39.0	13.9	14.3	10
301	Ginninderra Creek at Parkwood	9.8	22.0	16.2	5.0	10

Faecal Coliforms

Bacteria occur naturally in all waterbodies. The presence of faecal coliforms in a water sample may be an indication that human or animal faeces have contaminated the water and that harmful, less easily detectable pathogens such as *Cryptosporidium* or *Giardia* may be present. High levels of faecal coliforms are not necessarily a problem for aquatic ecosystems. Faecal coliforms generally do not infect aquatic organisms, and may serve as a food source.

The presence of high numbers of faecal coliforms is a problem for some human uses of water bodies, particularly water supply and recreation involving bodily contact. This report looks at bacterial levels in water used for primary and secondary contact recreational use, but does not deal with the quality of drinking water.

Results are expressed as colony forming units (cfu) per 100 mL. The standard for water based recreation—swimming is 150 cfu/100 mL and for boating and secondary contact is 1000 cfu/100ml. These standards apply to individual sites depending on their classification in the Territory Plan.

Faecal coliform levels generally compared favourably with the standard designated under in the Environment Protection Regulations. This provides some indication that land use planning and the quality of the ACT's sewage system are protecting recreational opportunities. There were exceedence incidents at the Molonglo River, Paddy's River and lower Ginninderra Creek, however, these sites would experience inputs such as livestock faeces from the surrounding rural landuse.

Table 9: Summary of Faecal Coliforms (cfu/100mL) Measurements for Lake and River Water Quality Sampling Sites in the ACT 2004-2005

Site number	Site name	Minimum	Maximum	Mean 04-05	Standard Deviation	Regulation limits
102	Burrinjuck Res above Hume Park	6.0	23.0	16.9	4.8	150/1000
248	Lake Tuggeranong at Kambah Wetland	3.0	13.0	8.6	3.7	150/1000
249	Lake Tuggeranong at Dam	1.0	16.0	10.1	4.7	150/1000
270	Point Hut Pond at Dam Wall	4.5	48.0	15.1	14.6	150/1000
318	Lake Ginninderra at Dam	9.5	60.0	32.6	17.4	150/1000
321	Lake Ginninderra at East Arm	9.0	45.0	22.1	11.9	150/1000
346	Gungahlin Pond at Dam Wall	9.0	33.0	17.9	7.5	150/1000
601	Molonglo River at Dairy Flat Bridge	4.0	80.0	28.0	31.0	150/1000
608	Molonglo River at Sutton Road Bridge	52.0	1700.0	676.4	804.9	150/1000
769	Queanbeyan River at ACT Border	50.0	690.0	316.0	289.5	150/1000
842	Paddy's River at Riverlea	120.0	1200.0	500.0	424.3	150/1000
901	Gudgenby River at Tennent	190.0	400.0	316.0	86.2	150/1000
204	Murrumbidgee River at Halls Crossing	10.0	470.0	220.0	205.1	150/1000
209	Murrumbidgee River at Kambah Pool	6.0	380.0	124.4	148.6	150/1000
213	Murrumbidgee River at Angle Crossing	2.0	190.0	78.0	79.9	150/1000
301	Ginninderra Creek at Parkwood	140.0	1100.0	508.0	362.9	150/1000

Conductivity

Conductivity, that is the ability of electricity to pass through water, is a measure of the salts and ions present in the water body. Pure de-ionised water does not conduct electricity; organic compounds like oil, alcohol, charcoal are poor conductors; salts (sodium, potassium, calcium), metals (aluminium iron) and acids (carbonic) conduct electricity well. Unless there is an unusual occurrence, conductivity measures are a good indicator of the amount of salt in the water. Urban runoff can be high in salts as many cleaning agents, fertilisers and surfaces (paint, concrete, roads) contain salts and these salts are washed into streams during rainfall. In the majority of lake sites and some sites on the Murrumbidgee River there has been a long-term downward trend in conductivity. The highest readings this period were recorded at the sites downstream of the urban industrial region of Queanbeyan and also Burrinjuck Reservoir which captures runoff from the highly salinised area of the Yass River catchment.

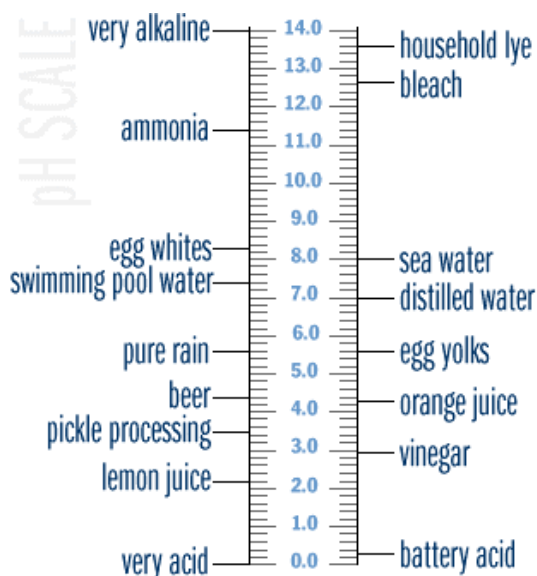
Table 10: Summary of Conductivity (uS/cm) Measurements for Lake and River Water Quality Sampling Sites in the ACT 2004-2005

Site number	Site name	Minimum	Maximum	Mean 04-05	Standard Deviation	Regulation limits
102	Burrinjuck Reservoir above Hume Park	51.0	433.0	252.6	123.2	N/A
248	Lake Tuggeranong at Kambah Wetland	65.0	169.0	114.2	35.5	N/A
249	Lake Tuggeranong at Dam	60.0	160.0	115.8	39.7	N/A
270	Point Hut Pond at Dam Wall	135.3	250.0	172.3	38.4	N/A
318	Lake Ginninderra at Dam	184.0	274.0	226.2	33.9	N/A
321	Lake Ginninderra at East Arm	187.0	261.0	223.2	31.2	N/A
346	Gungahlin Pond at Dam Wall	219.0	369.0	274.2	47.9	N/A
601	Molonglo River at Dairy Flat Bridge	440.0	610.0	516.0	72.3	N/A
608	Molonglo River at Sutton Road Bridge	220.0	370.0	266.0	60.2	N/A
769	Queanbeyan River at ACT Border	190.0	490.0	294.0	123.8	N/A
842	Paddy's River at Riverlea	64.0	94.0	79.2	10.9	N/A
901	Gudgenby River at Tennent	83.0	110.0	94.6	10.6	N/A
204	Murrumbidgee River at Halls Crossing	89.0	270.0	217.8	73.0	N/A
209	Murrumbidgee River at Kambah Pool	99.0	140.0	119.8	19.0	N/A
213	Murrumbidgee River at Angle Crossing	68.0	130.0	100.2	22.7	N/A
301	Ginninderra Creek at Parkwood	250.0	280.0	270.0	12.2	N/A

pH (Acidity)

The pH refers to the degree of acidity or alkalinity of the water. A pH of 7 is neutral. A value above 7 indicates that the water is alkaline and a pH below 7 indicates acidic conditions (see figure to right).

If the pH of the water is altered substantially then there can be changes to chemical processes which could release nutrients or toxic metals that were previously bound safely in lake or river sediments. All sites had pH within an acceptable range throughout the year.



<http://waterontheweb.org/under/waterquality/pH.html>

Table 11: Summary of pH Measurements for Lake and River Water Quality Sampling Sites in the ACT 2004-2005

Site number	Site name	Minimum	Maximum	Mean 04-05	Standard Deviation	Regulation limits
102	Burrinjuck Reservoir above Hume Park	7.1	8.9	7.9	0.6	6-9
248	Lake Tuggeranong at Kambah Wetland	7.0	8.3	7.6	0.5	6-9
249	Lake Tuggeranong at Dam	6.7	8.1	7.5	0.5	6-9
270	Point Hut Pond at Dam Wall	7.3	8.4	7.8	0.4	6-9
318	Lake Ginninderra at Dam	6.6	8.2	7.5	0.5	6-9
321	Lake Ginninderra at East Arm	7.5	8.7	8.0	0.4	6-9
346	Gungahlin Pond at Dam Wall	7.8	8.7	8.3	0.3	6-9
601	Molonglo River at Dairy Flat Bridge	7.4	7.7	7.5	0.1	6-9
608	Molonglo River at Sutton Road Bridge	7.0	7.2	7.0	0.1	6-9
769	Queanbeyan River at ACT Border	7.0	7.2	7.1	0.1	6-9
842	Paddy's River at Riverlea	7.2	8.2	7.6	0.4	6-9
901	Gudgenby River at Tennent	7.3	7.8	7.6	0.2	6-9
204	Murrumbidgee River at Halls Crossing	7.5	8.7	8.1	0.5	6-9
209	Murrumbidgee River at Kambah Pool	7.4	7.8	7.6	0.1	6-9
213	Murrumbidgee River at Angle Crossing	7.3	7.9	7.5	0.2	6-9
301	Ginninderra Creek at Parkwood	7.3	7.6	7.5	0.1	6-9

Dissolved Oxygen

Dissolved oxygen (DO) is a measure of the oxygen in the water available to aquatic organisms. It is important for the maintenance of aquatic organisms as changes in DO can affect the species present. Low levels of DO can stress fish, which can lead to fungal infections and disease or result directly in fish kills. Levels of DO are affected by turbulence, temperature (colder water can hold more dissolved oxygen), photosynthesis (during periods of sunlight algae and other water plants produce oxygen, while in darkness they consume oxygen) and the level of biochemical oxygen demand.

DO was measured down through a depth profile in the lakes and at times the deeper sections of the water column had low DO concentrations (i.e. see minimum value for Lake Tuggeranong). This can be a natural occurrence, related to temperature gradients, and does not pose an issue unless the difference between the top layer of water and deeper layers remains pronounced for a long time. Wind or thermal induced mixing usually keeps DO concentrations at acceptable limits in Canberra's urban lakes.

Low flows in the rivers combined with other factors such as inputs of sediment and organic material can cause DO concentrations to fall to life threatening levels. In the Queanbeyan and Molonglo rivers near the ACT border there was a period this year when low DO may have made the rivers unfit for survival of aquatic life. Other streams throughout the ACT were in the healthy range for DO concentrations.

Table 12: Summary of DO (mg/L) Measurements for Lake and River Water Quality Sampling Sites in the ACT 2004-2005

Site number	Site name	Minimum	Maximum	Mean 04-05	Standard Deviation	Regulation limits
102	Burrinjuck Reservoir above Hume Park	7.6	13.7	10.1	1.8	> 4
248	Lake Tuggeranong at Kambah Wetland	2.1	10.9	7.7	2.0	> 4
249	Lake Tuggeranong at Dam	0.4	13.5	7.1	2.8	> 4
270	Point Hut Pond at Dam Wall	5.0	70.8	10.6	13.6	> 4
318	Lake Ginninderra at Dam	3.2	11.2	7.0	2.2	> 4
321	Lake Ginninderra at East Arm	3.1	11.0	7.8	1.7	> 4
346	Gungahlin Pond at Dam Wall	5.0	12.0	8.4	1.9	> 4
601	Molonglo River at Dairy Flat Bridge	4.0	9.8	7.0	2.2	> 4
608	Molonglo River at Sutton Road Bridge	2.0	6.5	4.7	1.8	> 4
769	Queanbeyan River at ACT Border	2.4	7.4	4.6	2.0	> 4
842	Paddy's River at Riverlea	8.7	12.3	10.6	1.5	> 4
901	Gudgenby River at Tennent	8.7	12.9	10.5	1.9	> 4
204	Murrumbidgee River at Halls Crossing	8.1	12.6	10.4	1.7	> 4
209	Murrumbidgee River at Kambah Pool	7.1	12.0	9.4	2.0	> 4
213	Murrumbidgee River at Angle Crossing	7.7	12.0	10.1	1.9	> 4
301	Ginninderra Creek at Parkwood	6.5	10.4	8.4	1.9	> 4

Chlorophyll 'a' (C₅₅H₇₂O₅N₄Mg)

Chlorophyll 'a' is the plant pigment that gives algae their green colour, and is commonly used as a measure of the quantity of algae present (algal biomass). This measure can therefore serve as a useful indicator of the extent to which an ecosystem has been affected by nutrient inputs. There is no standard for streams and rivers in the ACT while a standard of less than 10 µg/L applies for urban lakes and ponds.

Chlorophyll 'a' is measured in micrograms per litre (µg/L). To provide a sense of scale, water with a chlorophyll 'a' concentration of 1 µg/L will be clear, a concentration of 20 µg/L will be slightly green, and 100 µg/L very green and possibly with algal scums on the surface.

A number of sites, including all lake sites, showed increased median values of Chlorophyll 'a' concentrations, since the last reporting period. The chlorophyll 'a' levels exceeded the regulation limit numerous times in Lake Tuggeranong, and one or two times at other sites.

Table 13: Summary of Chlorophyll-a (µg/L) Measurements for Lake and River Water Quality Sampling Sites in the ACT 2004-2005

Site number	Site name	Minimum	Maximum	Mean 04-05	Standard Deviation	Regulation limits
102	Burrinjuck Reservoir above Hume Park	2.3	36.6	13.6	11.7	10
248	Lake Tuggeranong at Kambah Wetland	3.4	39.2	16.5	14.6	10
249	Lake Tuggeranong at Dam	2.4	25.1	12.3	9.5	10
270	Point Hut Pond at Dam Wall	1.0	17.0	8.7	6.6	10
318	Lake Ginninderra at Dam	0.8	3.8	2.2	0.9	10
321	Lake Ginninderra at East Arm	2.1	12.6	5.5	3.6	10
346	Gungahlin Pond at Dam Wall	1.2	13.2	5.0	3.9	10
601	Molonglo River at Dairy Flat Bridge	4.3	29.0	11.4	10.5	N/A
608	Molonglo River at Sutton Road Bridge	2.6	6.4	4.0	1.5	N/A
769	Queanbeyan River at ACT Border	1.3	17.0	8.3	6.6	N/A
842	Paddy's River at Riverlea	0.6	3.5	1.6	1.1	N/A
901	Gudgenby River at Tennent	0.4	8.7	3.0	3.3	N/A
204	Murrumbidgee River at Halls Crossing	14.0	24.0	16.8	4.1	N/A
209	Murrumbidgee River at Kambah Pool	4.5	12.0	8.6	2.7	N/A
213	Murrumbidgee River at Angle Crossing	3.3	12.0	7.2	3.4	N/A
301	Ginninderra Creek at Parkwood	2.0	34.0	10.9	13.1	N/A

Algae Monitoring of Lake Recreation Areas

Algae are simple microscopic plants that live either in water or damp areas. Algae blooms (dense growths of algae) can impact on water quality by causing bad smells and forming thick scums. Rotting algae will use up oxygen in the water and with severe blooms fish may die as a result. A certain class of algae, 'blue-green algae' in some situations can generate toxins which are poisonous to people, and animals.

Blue-green algae occur naturally in most ACT water bodies, but usually in low numbers mixed in with other algae. However, given the right environmental conditions, which, includes warm weather, low rainfall and the right mix of nutrient levels, blue-green algae may multiply rapidly to high levels, dominate all other algae and pose a health risk.

Weekly monitoring, of visible algae conditions, is performed by Environment Protection Officers and actions on alerts, warnings or lake closures are determined when certain levels of blue-green algae are present (Table 14).

Warm weather combined with other environmental conditions, such as low flows, resulted in high algal levels in the Molonglo River, necessitating the water ski area being closed for some of the summer period. Lake Tuggeranong was closed for a short time during summer and warnings were posted at the other urban lakes.

Table 14: Algae Alert Levels for ACT Urban Lakes

Low Level	At this alert level, there is generally no major health risk. Algal counts are between 5,000 to 20,000 cells per millilitre of lake water. The EPA increases monitoring and erects WARNING signs.
Medium Level	At this level, there is a greater risk of potential health problems. Algal counts are above 20,000 cells per millilitre and scumming is evident. There can also be a slight milky discolouration of the water and bright green surface scums. The EPA issues media warnings; erects WARNING signs; alerts sporting groups such as yachting, rowing and swimming clubs, as well as organisers of water sport events; and notifies the Water Police.
High Level	At this level there is a real risk of health problems. Algal counts are above 20,000 cells per millilitre, extensive scums have formed and environmental conditions suggest that algal numbers are likely to escalate quickly and become widespread throughout the water. The EPA may close recreational areas and the lakes. If the EPA closes a lake because of the severity of the blue-green algal bloom, it will place LAKE CLOSED signs around the lake; issue a media release; continue intensive monitoring until algal counts decrease to levels below 20,000 cells per millilitre of lake water; provide the community with regular reports about the condition of the lake or river recreation area; and communicate re-opening of the lake or waterbody by a media release.

AUSRIVAS (Biological assessment using benthic macroinvertebrates)

Whilst water chemistry analysis such as pH, total phosphorus and dissolved oxygen provide a snapshot of the water quality at the time when the sample is taken. Biological assessment, in this case the sampling of waterbugs (benthic macroinvertebrates), can indicate much about the water quality over time and show what type of environment the water and waterway is to live in.

Macroinvertebrate biological assessment is where the tally of the type of waterbugs sampled at a site are processed by a predictive model. The bugs that the model predicts should be at the site are compared with the bugs actually sampled from the site and a rating (band) is generated from the comparison. A brief summary of the bands and what they mean is presented below. A full explanation of the AUSRIVAS biological assessment method for the ACT is available from <http://ausrivas.canberra.edu.au> and the full biological assessment reports are available on request from Water Resources.



Seeing who's home....
Collecting waterbugs to assess water quality and habitat conditions

Table 15: AUSRIVAS Bands and their O/E Taxa Scores for the ACT Autumn Edge Model and Some Interpretations for Reporting (Ball *et al.* 2001)

Band	Condition	Taxa Interpretations
X	MORE BIOLOGICALLY DIVERSE THAN REFERENCE	More families found than expected. Potential biodiversity 'hot-spot' or mild organic enrichment. Continuous irrigation flow in a normally intermittent stream. Differential loss of pollution-tolerant taxa (potential impact unrelated to water quality).
A	SIMILAR TO REFERENCE	Expected number of families within the range found at 80% of the reference sites.
B	SIGNIFICANTLY IMPAIRED	Fewer families than expected. Potential impact either on water and/or habitat resulting in a loss of families.
C	SEVERELY IMPAIRED	Many fewer families than expected. Loss of families from substantial impairment of expected biota caused by water and/or habitat quality.
D	EXTREMELY IMPAIRED	Few of the expected families and only the hardy, pollution tolerant families remain. Severe impairment.

Table 16: Summary of AUSRIVAS Band Scores for Sites in the ACT from Autumn 2002 to Autumn 2005

Site number	Site name	Regulation limit	Autumn 02	Spring 02	Autumn 03	Spring 03	Autumn 04	Spring 04	Autumn 05
213	Murrumbidgee River at Angle Crossing	N/A	B	A	B	C	B	B	B
204	Murrumbidgee River at Halls Crossing	N/A	B	A	B	C	A	C	C
58	Tuggeranong Creek D/S of Lake	N/A	A	C	A	C	B	B	C
64	Ginninderra Creek at Latham	N/A	B	C	C	C	B	B	C
195	Ginninderra Creek Baldwin Drive	N/A	B	C	C	D	C	C	B
196	Ginninderra Creek D/S of Lake	N/A	B	D	C	C	C	C	C
769	Queanbeyan River at ACT border	N/A	A	C	C	C	C	D	C
608	Molonglo River at Sutton Road	N/A	B	D	C	B	C	C	C
246	Jerrabomberra Creek at Hindmarsh Drive	N/A	B	D	B	C	B	B	C
189	Yarralumla Creek at Cotter Road bridge	N/A	C	D	C	D	C	C	C
10	Paddys River at Murray's corner	N/A	A	A	B	B	B	A	B
15	Tidbinbilla River at Paddys River Road	N/A	A	A	B	A	A	A	A
20	Gudgenby River at Smiths Road	N/A	A	X	B	A	A	A	A

The onset of the drought (winter 2002) saw the biological condition of many urban sites degrade further from reference condition. Reference sites (20, 15 and 40) degraded immediately after the 2003 bushfires but most reference sites recovered within a year. The biological communities in urban sites are under considerable stress from habitat degradation, altered flow regimes, pollutant inputs, pest species and thus are not as resilient to natural stresses such as drought compared with reference sites.

Lakes

Lake Tuggeranong

Two sites are monitored in Lake Tuggeranong, one at the Kambah Wetland (Site 248), which is near the northern inflow to the lake, and the other at the dam wall (Site 249).

Data collected since 1992 has indicated decreasing trends in nitrogen, phosphorus and conductivity at both sites. High turbidity readings typical for Lake Tuggeranong have continued. Although suspended solids were generally below the guideline value and the long-term average. There were high levels of Chlorophyll 'a' in summer, which matches with when the lake was closed because of high levels of Blue-Green Algae observed in the recreation areas.

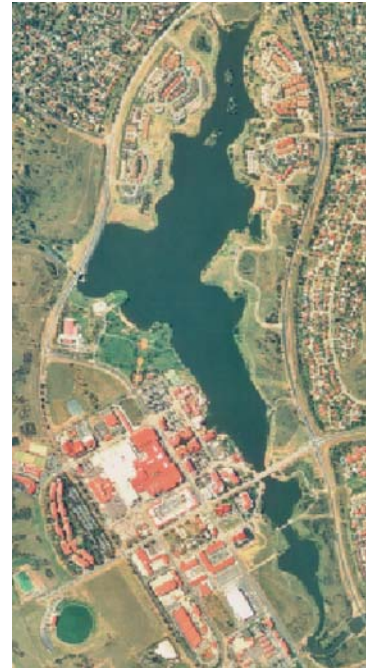


Table 17: Site 248 Lake Tuggeranong Kambah Wetland

Indicator	Units	Regulation limits	Long term average	Average 2004-2005	Aug 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	May 05
Acidity	pH	6-9	7.7	7.6	8.3	7.9	7.3	7.0	7.8	7.4	7.0	8.2
Chlorophyll 'a'	ug/L	10	11.2	16.5	5.1	37.6	16.4	7.7	3.4	39.2	17.7	4.6
Conductivity	us/cm	N/A	199.0	114.2	169.0	148.0	82.5	82.0	65.0	120.0	120.0	127.0
Dissolved Oxygen	mg/L	>4	7.3	7.7	10.6	8.1	10.9	7.0	8.1	7.3	5.7	7.6
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	1698.4	8.6	3.0	6.0	12.0	10.0	5.0	12.0	13.0	8.0
Suspended Solids	mg/L	25	22.7	14.1	6.2	16.6	6.8	27.6	11.4	12.4	22.0	9.4
Total Nitrogen	mg/L N	N/A	1.1	0.7	0.5	0.7	0.6	0.9	0.8	0.4	0.6	0.7
Total Phosphorus	mg/L P	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Turbidity	NTU	30	36.5	36.4	63.3	15.9	15.4	45.0	12.8	62.0	52.0	25.0

Table 18: Site 249 Lake Tuggeranong Dam Wall

Indicator	Units	Regulation limits	Long term average	Average 2004-2005	Aug 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	May 05
Acidity	pH	6-9	7.7	7.5	8.1	7.8	7.4	7.0	7.5	7.4	6.7	8.0
Chlorophyll 'a'	ug/L	10	8.8	12.3	6.8	25.1	13.7	4.0	2.4	24.3	19.1	3.3
Conductivity	us/cm	N/A	190.3	115.8	160.0	137.0	79.2	70.0	60.0	137.0	129.0	154.0
Dissolved Oxygen	mg/L	>4	7.2	7.1	9.4	13.4	10.8	6.4	7.4	9.1	5.2	7.5
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	184.0	10.1	12.0	9.0	6.0	12.0	1.0	12.0	12.5	16.0
Suspended Solids	mg/L	25	18.6	8.6	3.0	10.0	5.6	14.4	5.2	8.2	11.4	11.0
Total Nitrogen	mg/L N	N/A	1.1	0.7	0.6	0.6	0.5	0.9	1.1	0.7	0.7	0.7
Total Phosphorus	mg/L P	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Turbidity	NTU	30	38.7	41.6	74.9	15.6	14.3	36.0	12.9	62.0	57.0	60.0

Point Hut Pond

Water quality in Point Hut Pond (Site 270) has been historically poor compared with the standards set for its designated uses in the Territory Plan and compared with other lake sites in the ACT. However, intensive residential construction is nearing an end and quality should continue to improve over time as sediment and pollutant inputs decrease.

Table 19: Site 270 Point Hut Pond

Indicator	Units	Regulation limits	Long term average	Average 2004-2005	Aug 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	May 05
Acidity	pH	6-9	7.96	7.79	8.4	8.1	7.6	7.4	7.6	7.7	7.3	8.2
Chlorophyll 'a'	ug/L	10	10.83	8.68	15	16.8	5.34	8.1	1	3.1	17	3.1
Conductivity	us/cm	N/A	242.72	172.29	250	201	135.3	136	168	145	170	173
Dissolved Oxygen	mg/L	>4	7.88	8.68	9.5	10	10.7	6.6	8	6.4	6.4	6.9
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	151.91	15.06	6	15	8	23	7	9	4.5	48
Suspended Solids	mg/L	25	32.76	20.93	15	12.8	14.4	29.4	10	9.6	13.4	62.8
Total Nitrogen	mg/L N	N/A	1.19	0.91	0.67	0.78	0.74	0.58	1.44	1.1	1.03	0.93
Total Phosphorus	mg/L P	0.1	0.07	0.07	0.03	0.08	0.05	0.03	0.12	0.08	0.08	0.07
Turbidity	NTU	30	79.96	90.73	22.8	33	45	52	69	181	148	175

Gungahlin Pond

Water quality in Gungahlin Pond (Site 346) is fair with a downward trend in turbidity. There were exceedences of the standard in both turbidity and chlorophyll 'a'. There is still a significant level of development occurring further upstream of this pond, which could adversely affect water quality. However, development controls and sediment retention ponds upstream of Gungahlin Pond should contribute to the improving water quality. The reduction in suspended solids concentrations is expected to continue as the immediate catchment area stabilises after extensive development during previous years.

Table 20: Site 246 Gungahlin Pond

Indicator	Units	Regulation limits	Long term average	Average 2004-2005	Aug 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	May 05
Acidity	pH	6-9	8.10	8.31	8.6	8.4	8.2	8.7	7.8	8.2	8.1	8.5
Chlorophyll 'a'	ug/L	10	5.45	4.96	2.3	2	1.17	4.4	6	13.2	7.3	3.3
Conductivity	us/cm	N/A	323.26	274.16	369	297	247.3	234	219	265	259	303
Dissolved Oxygen	mg/L	>4	7.77	8.36	9.5	9.4	11.4	9.4	7.2	9	6.1	6.5
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	21.04	17.94	16	12	13	19	9	22	19.5	33
Suspended Solids	mg/L	25	18.98	6.70	0.6	3.6	1	3.6	11.8	12.4	10.8	9.8
Total Nitrogen	mg/L N	N/A	1.08	0.64	0.4	0.86	0.72	0.58	0.77	0.57	0.6	0.65
Total Phosphorus	mg/L P	0.1	0.04	0.03	0.01	0.03	0.04	0.01	0.04	0.04	0.03	0.02
Turbidity	NTU	30	33.98	19.48	31.8	6	6	4.5	14.5	40	20	33

Lake Ginninderra

Two sites are monitored in Lake Ginninderra, one near the inflow in the East Arm (Site 321) and the other at the outflow dam wall, or West Arm (Site 318). Water quality in the lake was good and generally better than the other lakes monitored.

There were occasions when turbidity values were measured above the standards at both sites. Given the low values of the other indicators those occurrences may have been related to a localised runoff event caused by a thunderstorm.



A quiet winter's day at the swimming area on Lake Ginninderra's foreshore

Table 21: Site 318 Lake Ginninderra East Arm

Indicator	Units	Regulation limits	Long term average	Average 2004-2005	Aug 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	May 05
Acidity	pH	6-9	7.92	7.54	7.9	7.8	7.4	7.8	6.6	7.4	7.2	8.2
Chlorophyll 'a'	ug/L	10	5.38	2.21	3.8	2.5	2.94	1.9	0.8	2.3	1.3	2.1
Conductivity	us/cm	N/A	283.42	226.23	254	244	190.8	184	189	236	238	274
Dissolved Oxygen	mg/L	>4	7.09	7.03	11.2	8.9	10.8	8.3	7	5.2	3.7	6.2
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	106.85	32.56	41	51	32	60	29	15	9.5	23
Suspended Solids	mg/L	25	12.51	4.08	3	2.8	0.8	1.8	3.2	8	5.6	7.4
Total Nitrogen	mg/L N	N/A	0.76	0.55	0.48	0.61	0.57	0.54	0.52	0.4	0.64	0.63
Total Phosphorus	mg/L P	0.1	0.04	0.03	0.02	0.03	0.02	0.01	0.03	0.04	0.03	0.03
Turbidity	NTU	30	14.55	16.56	44.4	4.4	4.8	4	2.9	16	17	39

Table 22: Site 321 Lake Ginninderra Dam Wall

Indicator	Units	Regulation limits	Long term average	Average 2004-2005	Aug 04	Oct 04	Nov 04	Dec 04	Jan 05	Feb 05	Mar 05	May 05
Acidity	pH	6-9	8.00	8.04	8.2	8.2	7.5	8.2	7.9	8.1	7.5	8.7
Chlorophyll 'a'	ug/L	10	9.53	5.51	6.3	7.6	2.78	6.9	3.6	12.6	2.2	2.1
Conductivity	us/cm	N/A	299.20	223.23	261	253	189.8	191	187	219	231	254
Dissolved Oxygen	mg/L	>4	7.81	7.76	9.7	7.8	10.9	7.8	8.2	7.9	6	7.1
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	321.56	22.06	10	28	27	45	19	25	13.5	9
Suspended Solids	mg/L	25	22.29	12.33	13	7.6	0.8	25.8	21.4	8.2	7.8	14
Total Nitrogen	mg/L N	N/A	0.80	0.51	0.37	0.51	0.45	0.53	0.61	0.57	0.57	0.5
Total Phosphorus	mg/L P	0.1	0.05	0.03	0.01	0.03	0.03	0.03	0.06	0.04	0.02	0.02
Turbidity	NTU	30	27.05	19.26	20.8	7	6.3	28	24	15	16	37

Rivers

Ginninderra Creek

Ginninderra Creek runs through a highly urbanised catchment with intensive development occurring in the parts above Gungahlin. The monitoring site for water quality in Ginninderra Creek is at Parkwood (Site 301) below the confluence with Gooromon Ponds Creek downstream of the lake. The biological monitoring sites in Ginninderra Creek are Baldwin Drive bridge (Site 195), downstream of Lake Ginninderra (Site 196) and Latham (Site 64).

In both spring 2004 and autumn 2005 the sites were showing below reference or impoverished levels in the macroinvertebrate sampling. This is a reflection of the low flows and degraded habitat conditions in the area. It is hoped that recent willow removal and other habitat restoration work along Ginninderra Creek will help improve the biological health of the creek. Improvements in condition will probably be seen after some time of higher creek flows.

Table 23: Values of Indicators Sampled at Sites 301, 195, 196 and 64 Along Ginninderra Creek 2004-2005

Indicator	Units	Regulation limits	Long term average	Average 04-05	Sep 04	Oct 04	Dec 04	Mar 05	Jun 05
Acidity	pH	6-9	7.8	7.5	7.5	7.6	7.3	7.4	7.5
Chlorophyll 'a'	ug/L	10	14.7	10.9	5.1	5.3	8.0	34.0	2.0
Conductivity	us/cm	N/A	415.4	270.0	270.0	280.0	270.0	280.0	250.0
Dissolved Oxygen	mg/L	>4	8.2	8.4	10.4	8.2	6.5	6.6	10.4
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	1307.5	508.0	140.0	1100.0	540.0	320.0	440.0
Suspended Solids	mg/L	25	15.9	18.4	31.0	16.0	17.0	12.0	16.0
Total Nitrogen	mg/L N	N/A	1.2	0.7	0.8	0.6	0.7	0.6	0.6
Total Phosphorus	mg/L P	0.1	1.0	0.1	0.1	0.1	0.1	0.1	0.0
Turbidity	NTU	30	12.0	16.2	22.0	13.0	16.0	9.8	20.0
AUSRIVAS score (195)		N/A			C			B	
AUSRIVAS score (196)		N/A			C			C	
AUSRIVAS score (64)		N/A			B			C	



Ginninderra Creek is constrained as it flows through urban areas. Substantial modification of instream habitat results in poor AUSRIVAS scores even when water quality is good

Paddy's River (842)

Paddy's River catchment is a combination of rural, forestry and conservation land uses. It was affected directly by the January bushfires. This was reflected in the AUSRIVAS data at Murray's Corner (Site 10), which was below reference for some time after the bushfires.

However, for this year, although on occasion some indicators had high values, the site had good water quality and the biological condition had recovered to reference or just below reference condition.

Table 24: Values of Indicators Sampled on Sites 842 and 10 Along Paddys River 2004-2005

Indicator	Units	Regulation limits	Long term average	Average 04-05	Sep 04	Oct 04	Dec 04	Mar 05	Jun 05
Acidity	pH	6-9	7.6	7.6	7.2	7.6	7.3	8.2	7.7
Chlorophyll 'a'	ug/L	10	2.2	1.6	3.5	0.9	0.6	1.4	1.4
Conductivity	us/cm	N/A	81.2	79.2	64.0	83.0	79.0	94.0	76.0
Dissolved Oxygen	mg/L	>4	10.6	10.6	12.1	10.0	8.7	10.0	12.3
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	402.5	500.0	380.0	1200.0	560.0	120.0	240.0
Suspended Solids	mg/L	25	9.8	18.4	28.0	6.0	43.0	4.0	11.0
Total Nitrogen	mg/L N	N/A	0.4	0.4	0.7	0.3	0.5	0.3	0.3
Total Phosphorus	mg/L P	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.0
Turbidity	NTU	30	12.3	14.0	26.0	6.0	13.0	12.0	13.0
AUSRIVAS score (site 10)		N/A			A			B	

Gudgenby River (901)

The Gudgenby River drains a rural catchment dominated by native forest, and is a fire affected site. The biological condition of the site at Smiths Road Crossing (20) was similar to reference condition in both spring and autumn, indicating good river health.

Table 25: Values of Indicators Sampled on Sites 901 and 20 Along the Gudgenby River 2004-2005

Indicator	Units	Regulation limits	Long term average	Average 04-05	Sep 04	Oct 04	Dec 04	Mar 05	Jun 05
Acidity	pH	6-9	7.7	7.6	7.3	7.8	7.4	7.7	7.6
Chlorophyll 'a'	ug/L	10	1.9	3.0	8.7	1.8	0.4	1.8	2.3
Conductivity	us/cm	N/A	100.6	94.6	83.0	100.0	92.0	110.0	88.0
Dissolved Oxygen	mg/L	>4	9.9	10.5	12.0	10.0	8.9	8.7	12.9
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	272.7	316.0	270.0	340.0	190.0	400.0	380.0
Suspended Solids	mg/L	25	8.7	30.6	89.0	8.0	38.0	4.0	14.0
Total Nitrogen	mg/L N	N/A	0.4	0.5	1.0	0.4	0.6	0.4	0.3
Total Phosphorus	mg/L P	0.1	0.0	0.1	0.2	0.1	0.1	0.1	0.1
Turbidity	NTU	30	10.5	21.0	64.0	8.6	14.0	4.2	14.0
AUSRIVAS score (site 20)		N/A			A			A	

Murrumbidgee River

The Murrumbidgee River flows through the ACT entering at Angle Crossing (213) in the south and is sampled at a number of locations including Kambah Pool (209), and Halls Crossing (204), which is in NSW, downstream of the ACT. As the main river in the ACT, the Murrumbidgee is on the receiving end of most material transported throughout ACT waterways. Inputs into streams are still higher than average with some ACT catchments still recovering after the bushfires and, combined with urban runoff, there is some degradation of the condition of the Murrumbidgee River as it flows through the ACT.

Table 26: Values of Indicators Sampled on Site 213 on the Murrumbidgee River at Angle Crossing 2004-2005

Indicator	Units	Regulation limits	Long term average	Average 04-05	Sep 04	Oct 04	Dec 04	Mar 05	Jun 05
Acidity	pH	6-9	7.8	7.5	7.5	7.4	7.3	7.6	7.9
Chlorophyll 'a'	ug/L	10	3.8	7.2	5.8	9.3	12.0	5.5	3.3
Conductivity	us/cm	N/A	128.5	100.2	99.0	68.0	94.0	110.0	130.0
Dissolved Oxygen	mg/L	>4	9.3	10.1	11.1	11.1	8.5	7.7	12.0
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	112.7	78.0	160.0	70.0	190.0	50.0	2.0
Suspended Solids	mg/L	25	9.0	18.6	7.0	18.0	50.0	9.0	9.0
Total Nitrogen	mg/L N	N/A	0.3	0.4	0.2	0.3	0.7	0.3	0.2
Total Phosphorus	mg/L P	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Turbidity	NTU	30	8.9	13.9	6.5	12.0	39.0	8.1	3.9
AUSRIVAS score		N/A			B			B	

Table 27: Values of Indicators Sampled on Site 209 on the Murrumbidgee River at Kambah Pool 2004-2005

Indicator	Units	Regulation limits	Long term average	Average 04-05	Sep 04	Oct 04	Dec 04	Mar 05	Jun 05
Acidity	pH	6-9	8.0	7.6	7.6	7.6	7.4	7.7	7.8
Chlorophyll 'a'	ug/L	10	5.7	8.6	12.0	8.9	4.5	9.2	8.6
Conductivity	us/cm	N/A	140.3	119.8	140.0	99.0	100.0	130.0	130.0
Dissolved Oxygen	mg/L	>4	9.4	9.4	10.8	8.6	8.4	7.1	12.0
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	192.5	124.4	66.0	50.0	380.0	6.0	120.0
Suspended Solids	mg/L	25	13.2	27.6	16.0	17.0	84.0	7.0	14.0
Total Nitrogen	mg/L N	N/A	0.5	0.5	0.5	0.4	0.8	0.4	0.5
Total Phosphorus	mg/L P	0.1	0.0	0.1	0.1	0.1	0.2	0.0	0.0
Turbidity	NTU	30	12.9	32.3	16.0	15.0	110.0	6.7	14.0

Table 28: Values of Indicators Sampled on Site 204 on the Murrumbidgee River at Halls Crossing 2004-2005

Indicator	Units	Regulation limits	Long term average	Average 04-05	Sep 04	Oct 04	Dec 04	Mar 05	Jun 05
Acidity	pH	6-9	8.3	8.1	7.9	8.5	7.5	8.7	8.1
Chlorophyll 'a'	ug/L	10	14.7	16.8	24.0	15.0	14.0	16.0	15.0
Conductivity	us/cm	N/A	196.3	217.8	240.0	240.0	89.0	250.0	270.0
Dissolved Oxygen	mg/L	>4	10.1	10.4	11.2	10.6	8.1	9.4	12.6
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	421.9	220.0	160.0	60.0	470.0	10.0	400.0
Suspended Solids	mg/L	25	16.3	32.4	34.0	13.0	88.0	10.0	17.0
Total Nitrogen	mg/L N	N/A	3.6	2.7	2.7	2.0	1.3	4.6	3.0
Total Phosphorus	mg/L P	0.1	0.1	0.1	0.1	0.0	0.2	0.0	0.1
Turbidity	NTU	30	12.8	34.6	28.0	9.1	95.0	28.0	13.0
AUSRIVAS score		N/A			C			C	

Molonglo River

The Molonglo River is sampled at two sites above Lake Burley Griffin near where the river enters the ACT at Dairy Flat (Site 601) and Yass Road (Site 608). Additional sampling of the Molonglo River, near its confluence with the Murrumbidgee River, is carried out by ActewAGL as part of monitoring the impact of the Lower Molonglo Water Quality Control Centre (Canberra's main sewerage treatment plant) may have on downstream waters. During times of low flow (October 2004, March 2005, Table 30) the amount of Dissolved Oxygen in the river becomes a concern. When the Molonglo River enters the ACT it has flowed along the periphery of urban/industrial areas of Queanbeyan and continues through intensive landuse in the ACT. Both degraded habitat and the at times poor water quality contribute to the significantly impaired biological scores in the Molonglo River.

Table 29: Values of Indicators Sampled on Site 601 on the Molonglo River at Dairy Flat Bridge 2004-2005

Indicator	Units	Regulation limits	Long term average	Average 04-05	Sep 04	Oct 04	Dec 04	Mar 05	Jun 05
Acidity	pH	6-9	7.6	7.5	7.7	7.4	7.5	7.4	7.6
Chlorophyll 'a'	ug/L	10	13.5	11.4	4.3	4.9	29.0	13.0	5.7
Conductivity	us/cm	N/A	241.1	516.0	610.0	500.0	440.0	460.0	570.0
Dissolved Oxygen	mg/L	>4	7.5	7.0	9.8	5.7	7.1	4.0	8.3
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	98.5	28.0	4.0	20.0	30.0	6.0	80.0
Suspended Solids	mg/L	25	12.0	6.6	5.0	5.0	12.0	5.0	6.0
Total Nitrogen	mg/L N	N/A	1.3	2.4	5.1	2.8	1.7	0.5	2.1
Total Phosphorus	mg/L P	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Turbidity	NTU	30	12.3	4.8	4.6	2.2	9.6	2.6	5.0

Table 30: Values Indicators Sampled on Site 608 on the Molonglo River at Sutton Road 2004-2005

Indicator	Units	Regulation limits	Long term average	Average 04-05	Sep 04	Oct 04	Dec 04	Mar 05	Jun 05
Acidity	pH	6-9	7.3	7.0	7.0	7.0	7.0	7.0	7.2
Chlorophyll 'a'	ug/L	10	4.2	4.0	6.4	3.4	3.0	4.6	2.6
Conductivity	us/cm	N/A	356.7	266.0	250.0	230.0	220.0	260.0	370.0
Dissolved Oxygen	mg/L	>4	7.0	4.7	6.5	3.8	5.8	2.0	5.3
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	378.2	676.4	1400.0	110.0	120.0	52.0	1700.0
Suspended Solids	mg/L	25	12.7	46.6	140.0	19.0	11.0	2.0	61.0
Total Nitrogen	mg/L N	N/A	0.4	0.7	1.0	0.4	0.8	0.4	0.8
Total Phosphorus	mg/L P	0.1	0.0	0.1	0.4	0.1	0.1	0.0	0.2
Turbidity	NTU	30	20.4	77.2	240.0	30.0	19.0	1.9	95.0
AUSRIVAS score		N/A			C			C	

Queanbeyan River (769)

The Queanbeyan River is sampled at the ACT border. Although most indicators for water quality at this section in the river are quite acceptable there are concerns with low dissolved oxygen during low flow, suggesting impacts from urban runoff. This, along with issues related to urban habitat degradation, result in poor instream conditions for water bugs to live in, as shown by the low AUSRIVAS scores.

Table 31: Values Indicators Sampled on Site 769 on the Queanbeyan River at the ACT Border 2004-2005

Indicator	Units	Regulation limits	Long term average	Average 04-05	Sep 04	Oct 04	Dec 04	Mar 05	Jun 05
Acidity	pH	6-9	7.4	7.1	7.1	7.2	7.0	7.2	7.1
Chlorophyll 'a'	ug/L	10	6.7	8.3	13.0	1.3	3.1	17.0	7.1
Conductivity	us/cm	N/A	201.9	294.0	210.0	490.0	240.0	340.0	190.0
Dissolved Oxygen	mg/L	>4	7.9	4.6	7.4	5.1	2.9	2.4	5.3
Faecal Coliforms - Confirmed	cfu/100mL	150/1000	530.8	316.0	180.0	50.0	690.0	100.0	560.0
Suspended Solids	mg/L	25	8.1	7.6	10.0	2.0	3.0	12.0	11.0
Total Nitrogen	mg/L N	N/A	0.5	0.6	0.7	0.4	0.5	0.5	0.8
Total Phosphorus	mg/L P	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.1
Turbidity	NTU	30	6.7	6.0	9.4	2.2	2.4	2.8	13.0
AUSRIVAS score		N/A			D			C	

Tidbinbilla River (15)

The Tidbinbilla River is only sampled using the AUSRIVAS macroinvertebrate rapid bioassessment protocol in spring and autumn. Water quality results presented for this site are those sampled in conjunction with the macroinvertebrate sampling. Tidbinbilla River is largely in the Tidbinbilla Nature Reserve and the 'equivalent to reference condition' AUSRIVAS score reflects how this protected area has recovered from the effect of the 2003 fire.

Table 32: Values Indicators Sampled on Site 15 on the Tidbinbilla River 2004-2005

Indicator	Units	Regulation limits	September 04	March 05
Conductivity	($\mu\text{S}/\text{cm}^1$)	N/A	58.4	65.02
Acidity	pH	6.5-9	7.74	7.1
Alkalinity	(mg/L CaCO_3)	N/A	26	24
Dissolved Oxygen	(mg/L ¹)	>4	11.7	8.9
Turbidity	(NTU)	<10	3.2	2.1
AUSRIVAS score		N/A	A	A

Jerrabomberra Creek (246)

Site 246 (Figure 8) on Jerrabomberra Creek is only sampled using the AUSRIVAS macroinvertebrate rapid bioassessment protocol in spring and autumn. Water quality results presented for this site are those sampled in conjunction with the macroinvertebrate sampling. Jerrabomberra Creek drains through industrial, rural and urban settings and generally instream habitat conditions are poor.



Extensive reed growth choking instream habitat along Jerrabomberra Creek

Table 33: Values of Indicators Sampled on Site 246 on Jerrabomberra Creek near Hindmarsh Drive 2004-2005

Indicator	Units	Regulation limits	September 04	March 05
Conductivity	($\mu\text{S}/\text{cm}^1$)	N/A	427	595.2
Acidity	pH	6.5-9	7.49	7.2
Alkalinity	(mg/L CaCO_3)	N/A	127	91
Dissolved Oxygen	(mg/L ¹)	>4	9.62	9.81
Turbidity	(NTU)	<10	10.7	11.3
AUSRIVAS score		N/A	B	C

Yarralumla Creek (189)

Site 189 (Figure 8) on Yarralumla Creek is only sampled using the AUSRIVAS macroinvertebrate rapid bioassessment protocol in spring and autumn. Water quality results presented for this site are those sampled in conjunction with the macroinvertebrate sampling. This creek is mostly a concrete lined drain meandering through the urban areas of Phillip and Woden. The poor AUSRIVAS score for this site reflects the highly modified nature of the creek.

Table 34: Values of Indicators Sampled on Site 769 on Yarralumla Creek Downstream Curtain 2004-2005

Indicator	Units	Regulation limits	September 04	March 05
Conductivity	($\mu\text{S}/\text{cm}^1$)	N/A	593	489
Acidity	pH	6.5-9	8.35	8.2
Alkalinity	(mg/L CaCO_3)	N/A	152	81
Dissolved Oxygen	(mg/L ¹)	>4	10.6	9.5
Turbidity	(NTU)	<10	3.5	4
AUSRIVAS score		N/A	C	C

Tuggeranong Creek (58)

Site 58 (Figure 8) on Tuggeranong Creek is only sampled using the AUSRIVAS macroinvertebrate rapid bioassessment protocol in spring and autumn. Water quality results presented for this site are those sampled in conjunction with the macroinvertebrate sampling. This site is in the creek downstream of Lake Tuggeranong. Although Lake Tuggeranong helps prevent sediments and pollutants from reaching this section of the creek habitat, the surrounding landuse of grazing and the disturbance by bushfires means this site is susceptible to degradation. Low flows in leading into Autumn may have contributed to a deterioration from its spring condition.

Table 35. Values of Indicators Sampled on Site 58 on Tuggeranong Creek downstream of lake Tuggeranong 2004-2005

Indicator	Units	Regulation limits	September 04	March 05
Conductivity	($\mu\text{S}/\text{cm}^1$)	N/A	171.9	134.2
Acidity	pH	6.5-9	8.3	7.1
Alkalinity	(mg/L CaCO_3)	N/A	39	21
Dissolved Oxygen	(mg/L ¹)	>4	9.2	8.01
Turbidity	(NTU)	<10	18.2	12.1
AUSRIVAS score	units	N/A	B	C