Environment Protection Authority
EPA Aquatic Ecosystem Condition Reports

Reporting on the health of South Australia's creeks and lakes

Monitoring water quality and reporting on the condition of our inland waters is an important part of the EPA's work as South Australia's leading independent environmental regulator. Major findings and trends are reported every five years in a State of the Environment Report. Following a review in 2009, the EPA has also decided to publish findings more frequently through a new series of Aquatic Ecosystem Condition Reports.

These reports represent a breakthrough in the way water quality and the condition of aquatic environments is measured and reported in this State. They bring together a broader range of information to create a more comprehensive picture of what is happening at particular sites, and they present the findings in a format that is easier to read. The reports also set a benchmark for future monitoring, which will enable us to track progress in limiting further degradation, and potentially improving the condition of our precious water resources.

Released in 2011, the first reports focus mainly on creeks and rivers in the Adelaide and Mt Lofty Ranges, SA Murray-Darling Basin, South East, Kangaroo Island, Northern and Yorke Peninsula and Eyre Peninsula NRM regions; and lakes in the lower reaches of the River Murray. Other regions in the State will be covered in coming years.

In the future, reports will be prepared for each region at least once every five years, covering data collected during autumn and spring of the previous year.

How we assess each creek and lake

The Aquatic Ecosystem Condition Reports are based on the findings of a specialist team of EPA scientists and technical advisers who collect a wide variety of measurements relating to the ecological condition of each sampled site. This information is then assessed using a range of science-based approaches and models that capture the biological, chemical and physical changes occurring in our streams and lakes, and describe the major disturbances and stressors affecting them.

The process starts with a review of research and information already available about land uses in the upper catchment of each selected stream, or within a kilometre of each lake site sampled, and the risks they might pose. For example, creeks flowing through well-vegetated areas receive less nutrients and sediment than streams passing through areas cleared for agriculture or rural living. In urban areas, high volumes of stormwater carrying pollutants and sediment are often flushed into creeks after heavy rainfall.

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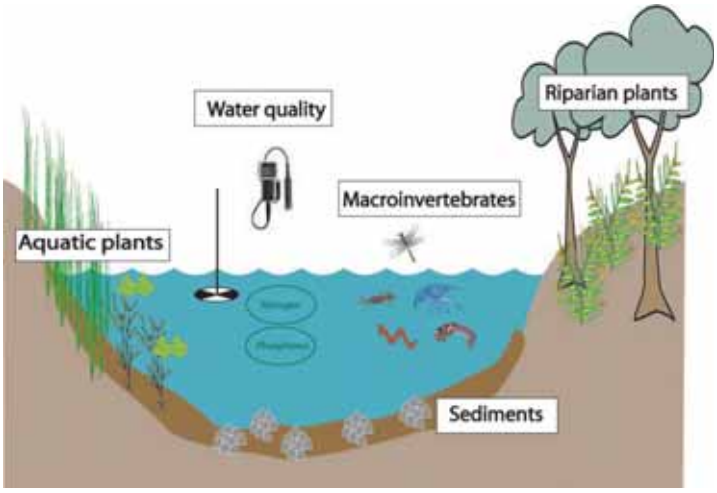

The next part of the assessment involves field visits to collect data about the condition of the creek or lake, and the major stressors affecting its condition. This work allows us to develop a more complete picture of the relationship between the biological components of the ecosystem (the animal and plant life), and the physical and chemical environment in which they live, such as the water itself, the climate, geology, and surrounding land uses.

Assessing the condition of our creeks and lakes primarily involves considering two key areas of biological, or living, evidence:

- The number, diversity and structure and the macroinvertebrate community found in the water, and
- The amount and type of plants found in the water and its riparian zone (the strip of land alongside the creek or lake).

Macroinvertebrates and what they tell us

Macroinvertebrates are aquatic animals without backbones that are large enough to be seen with the naked eye. They include yabbies and shrimp (crustaceans), snails, worms, mites and insects such as mayflies, stoneflies, dragonflies, waterbugs, beetles and midges. They are often used in water monitoring because they are found in most inland waterways, and they are easy to sample and identify accurately. Most importantly, they respond predictably to changes in their environment, which tells us a great deal about the condition of a creek or lake.

Macroinvertebrates are assessed in terms of their diversity and abundance. The range of macroinvertebrates present can indicate the likelihood of stressors in the ecosystem. For example, some species of stoneflies and mayflies are very sensitive to high nutrient loads. If none of these macroinvertebrates are found where they should naturally occur, it is a strong indication the ecological condition of the waterway has been affected, at least in part, by nutrient inputs such as nitrogen and phosphorus.

On the other hand, some species of worms, midges and snails thrive in nutrient-enriched water. If they dominate the macroinvertebrates found in a creek or lake and are present in large numbers it is another indication nutrient levels are likely to be unnaturally high.

Plant life and what it tells us

Plants provide food, habitat and refuge for many aquatic organisms. The number and type of plants present in the water and in the riparian zone also provide an indication about the condition of a waterway.

Our approach is to observe the presence and extent of all major plant types (e.g. trees, shrubs, understorey species, water plants, algal growths) and whether they are native or introduced species. This provides a measure of the naturalness of the vegetation and whether it has been significantly disturbed or affected by human activities such as land clearing, urban development and farming practices, or some other more natural process such as bushfires.

For example, in areas where the natural vegetation remains largely unchanged by human settlement, the riparian plants would include the expected native plant types and no introduced or exotic species. However, in severely disturbed areas riparian vegetation tends to be either entirely absent or consists of a few very tolerant, weedy species or other introduced plants.

Important stress indicators

There are several ‘stressors’ that affect the condition of a creek or lake system. These are chemical and/or physical phenomena which occur naturally, but when they are present in excessive amounts or changed significantly, they can cause the aquatic ecosystem to become unbalanced.

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In broad terms, the important stressors relate to water quality, sediments and the hydrology. These three stresses are often intertwined but we assess them as discrete characteristics.

Water quality

- In the laboratory, we measure the amount of nutrients in the water, in particular nitrogen, phosphorus and organic carbon. High nutrient levels lead to too much plant growth (often algae) which chokes the waterway and shifts the balance in the macroinvertebrate community.

- In the field, we measure the clarity of the water, and the concentrations of salinity and oxygen. Salinity levels above 1000mg/L can place direct stress on many macroinvertebrates and plants. Low water clarity means light cannot penetrate the water, so submerged plants cannot grow properly. Low concentrations of dissolved oxygen levels occur naturally over night, although they can also indicate that too much organic matter is decomposing in the system. Extremely high concentrations of dissolved oxygen (i.e. above 100% saturation) indicate excessive algal growth.

Sediments

- Sediments found on a creekbed or lakebed should be relatively low in organic content. If sediments become overloaded with organic matter their oxygen levels can be depleted which reduces the type and number of macroinvertebrates that can live in and around this important micro-habitat. Several characteristics indicate if the sediments contain too much organic matter, such as them becoming dark or blackened in colour, a strong smell, or the presence of sulfide.

- We also assess the type and depth of sediments that dominate the creek or lake bed, such as rocks, sand and silt. Too much fine sediment or silt, for example, is likely to smother plant and animal communities.

Hydrology

- The hydrology of a waterway is described in terms of water levels and/or the way the water flows. While most South Australian creeks are ephemeral, meaning they only flow occasionally, if the flows are too low plant and animal communities can become very isolated and stressed. We evaluate whether the flow is low due to drought conditions and/or human activity such as dams being built in the catchment. Similarly, we assess whether the creek flow is too high due to urbanisation and stormwater entering the creek after rainfall events. High flows can erode the banks and scour out the sediments, which destabilises the plant and animal communities.

In lakes, we assess whether the lakes are drying out too much compared with the natural cycle, and whether water levels are too low due to drought and/or dams being built in the catchment. This can reduce the availability of suitable habitat and increase salt concentrations, which causes stress in many plants and animals.

Where to from here?

While the EPA is not responsible for improving water quality, each report identifies the management responses that are planned or currently being implemented to improve the condition of our waterways.

As part of our monitoring program, the EPA is also carrying out more detailed scientific investigations to identify the specific causes of damage at individual sites, including how and where excess nutrients and sediments are entering the creeks and lakes. Further work is also being carried out to determine the overall effectiveness of the various measures taken so far to stop the decline and improve water quality.

The reports do not attempt to set priorities for future action, however they do provide useful information for the agencies and organisations at the front-line of managing our water resources and improving water quality. For example, they may help Natural Resources Management boards, local councils and communities set future priorities for investment in on-ground works.

While many people have been working hard for some time to protect our water resources and improve their condition, it is important to remember there are no quick fixes. It has taken more than 170 years of European settlement for our waterways to reach their current condition, and improving them significantly is a long-term challenge.

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Grade	Description
Excellent	Natural or unaffected by human activity, with extensive areas of remnant native vegetation in the catchment area. It is possible some creeks and lakes in remote areas of the State may be given an excellent rating, however the vast majority are likely to be affected by humans in some way.
Very Good	Minimal changes in ecological condition and the way the ecosystem functions as a result of human settlement. These sites continue to provide a healthy environment for a natural diversity of animal and plant life.
Good	Often the best we can expect given significant changes to the natural landscape after more than 170 years of European settlement. Although changes to the environment and its animal and plant life are likely to be relatively minor, there will be clear, emerging signs of human impact, which could lead to further decline.
Fair	Moderate changes to animal and plant life at the site, and some change to the way the ecosystem functions. The effects of nutrient enrichment are often evident. The condition of these creeks and lakes is unlikely to meet community expectations for a healthy aquatic ecosystem at least some of the time.
Poor	These creeks or lakes are degraded, with evidence of major changes in the animal community and plant life, and moderate changes to the way the ecosystem functions. These sites typically have little native vegetation remaining and very high nutrient levels. Their condition is unlikely to meet community expectations for a healthy aquatic ecosystem most of the time.
Very Poor	Major changes to both the animal and plant life are apparent with a significant breakdown in the way the ecosystem functions because of human impact. These creeks and lakes are unlikely to meet community expectations for a healthy aquatic ecosystem.

About the grading system

As part of the reporting process, the ecological condition of each site is given a grading. The grades cover six levels from Excellent to Very Poor, using a grading system that describes the ecological responses to the increasing effects of human disturbance. This 'biological (ecological) condition gradient' model was developed in the United States (Davies and Jackson 2006) to help scientists assess aquatic ecosystems more consistently and directly than in the past.

Aquatic ecology cannot always be assessed in definite numerical terms and the results are open to some variation in scientific opinion. To ensure a considered and consistent approach, an expert panel of aquatic biologists is engaged by the EPA to review all the information and confirm the findings.

The resulting grades enable the condition of a creek or lake to be reported more clearly than in the past and also identifies the potential for improvement, so this information can be used by water managers and the community to help decide what action needs to be taken.

Further reading

Davies SP and Jackson SK 2006, 'The biological condition gradient: a descriptive model for interpreting change in aquatic ecosystems', Ecological Applications Volume 16, p1251-1266.

More information

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To view the Aquatic Ecosystem Condition Reports

You can view report Aquatic Ecosystem Condition Reports on the web, accessing the information either via:

- An interactive map showing all the sites monitored via Water Connect
www.waterconnect.sa.gov.au
- A list, with links to the each report
www.epa.sa.gov.au/environmental_info/water_quality/aquatic_ecosystem_monitoring_evaluation_and_reporting

Regional summaries and more detailed findings are also available on the EPA website.

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