Monitoring Corangamite's waterways

Refer to Statewide section (Teacher sheet 21: Monitoring with Waterwatch) for general overview information and instructions on water quality monitoring.

Key Learning Outcomes

As for Teacher sheet 21: Monitoring with Waterwatch, in Statewide section.

Aims

As for Teacher sheet 21, in Statewide section.

Materials

Waterwatch equipment kit.

A Community Water Quality Monitoring Manual for Victoria.

Completed Site Description, Habitat and Physical and Chemical Tests Record Sheets from your *Waterwatch Monitoring Records Book.*

Student sheet 22: Water quality results summary in Statewide section.

Blackline master 7: Water quality ratings for Corangamite.

Advanced preparation

1. Familiarise your students with the equipment, waterways and water quality by conducting the activities described in earlier pages of this Kit. Make sure the students practise using the equipment and taking readings *before* they commence water monitoring in the field.

Additional references

Barwon Water Internet site address
http://www.barwonwater.vic.gov.au/

Activity instructions

1. Using maps supplied, map your monitoring site's catchment and identify the source(s) of the water that flows into it.

   [*Refer to Teacher sheet 18, Statewide section.*]

2. Monitor your local wetland/waterway as part of the Waterwatch program (use the Waterwatch Kit, Waterwatch Manual and Monitoring Book supplied to you). Conduct the tests as described on the instruction sheets in the equipment kit.

3. Record your results in the Waterwatch Monitoring Results Book.

   [*Refer to Teacher sheet 18: Monitoring with Waterwatch, Statewide section.*]

4. As soon as possible after monitoring, send a copy of each completed record page from your Monitoring Results Book to:

   Corangamite Waterwatch Scientific Co-ordinator
   Barwon Water Laboratory
   40-44 Lonsdale St
   South Geelong, 3220

5. **Sample data**

   Complete the example data exercise(s).

   [*Example data - Statewide section, Teacher and Student sheets 5: Interpreting sample data, and Corangamite Region, Teacher and Student sheets 5: Barwon and Moorabool River sample data*].

6. **Present your results**

   a) After each monitoring session at your site:

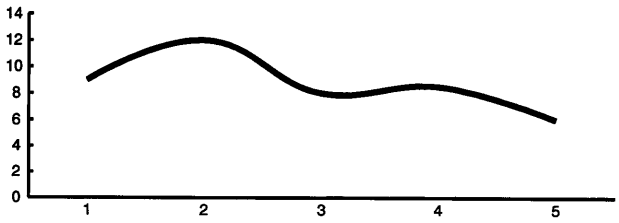
   Distribute Student sheet 22 and Blackline master 7: Water quality ratings for Corangamite.

   Students collate the results for all the tests conducted at that time onto Student sheet 22. Students use Blackline master 7 to rate the water quality at the site. Do the readings show that water quality at your monitoring site is Excellent, Good, Fair, Poor or Degraded?

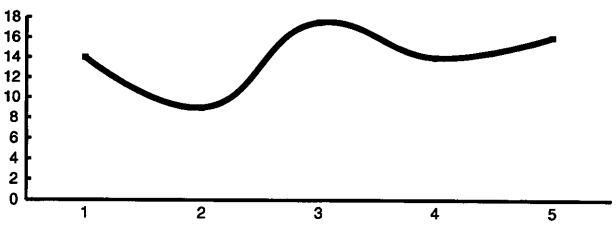
   b) After the second monitoring trip:

   To help interpret their results over the year, students also prepare a graph for each of the parameters tested. The graphs will build up a picture of what happens over the year(s).

Dissolved Oxygen

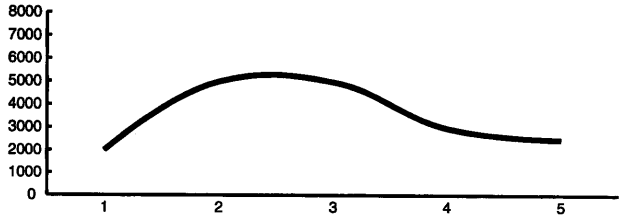


Temperature



Monitoring Corangamite's waterways

Conductivity



7. **Analyse and interpret your results**

   [Follow points 6 and 7 on Teacher sheet 22: Monitoring with Waterwatch, Statewide section of this kit.]

   Do your results for any of the parameters change much from one monitoring time to the next?

   Compare the summary sheets and graphs of your results over the course of the year.

   Has the reading for that particular factor increased or decreased over time? If so, ask students to suggest what might be some reasons for the change in the reading? Could it be a natural change with the season? [*e.g. temperature increase of the water in summer, decrease in water flow in summer*] If it is not likely to be a natural change, ask students to suggest possible reasons for the increase/decrease in the reading.

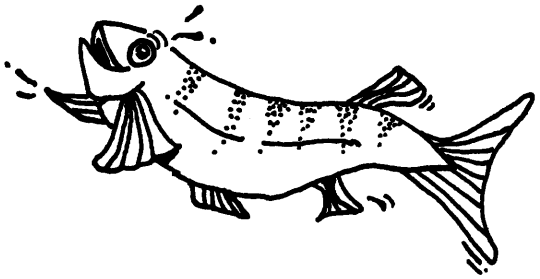
8. To develop an understanding of water quality in your catchment review any other data collected by groups further upstream or downstream of your waterway. Use data provided by your local Waterwatch Co-ordinator, or from Barwon Water's Waterwatch Internet site.

   a) If results are available, prepare graphs or compile a map and tables to show sites along the length of the river. Suggest possible reasons for any changes in water quality readings at different sites along the river.

9. Prepare a Catchment Condition Report each year (see Teacher and Student sheet 6).

Extension

Compare your data with other Waterwatch data in other regions of Victoria, Australia or the world. Interpret their results. What is the condition of these waterways? What are people doing to look after their waterway? From your comparisons with other groups and sites, list the ideas it gives you about what to do to help look after waterways and water quality.



Water quality ratings for Corangamite

Corangamite Catchment Region

Water quality scientists have developed rating guidelines for each chemical test to judge the quality (Excellent to Degraded) of your water sample. Use the tables below to check fresh water quality in the Corangamite Catchment region. But remember these figures are guidelines only.

Turbidity
Suspended solids (NTU)

Excellent	Good	Fair	Poor	Degraded
10 or less	More than 10 but less than 20	More than 20 but less than 30	More than 30 but less than 50	More than 50
				

Conductivity
(ms/cm)

Excellent	Good	Fair	Poor	Degraded
0 - 400	More than 400 but less than 800	More than 800 but less than 2000	More than 2000 but less than 5000	More than 5000
				

Water quality ratings for Corangamite

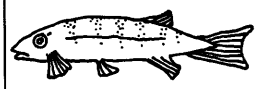
pH

Excellent	Good	Fair	Poor	Degraded
Between 6.5 and 7.5	Between 6.0 and 6.5 or between 7.5 and 8.0	Between 5.5 and 6.0 or between 8.0 and 8.5	Between 5.0 and 5.5 or between 8.5 and 9.0	Less than 5.0 or more than 9.0
				

Dissolved oxygen (%)

Excellent	Good	Fair	Poor	Degraded
Between 80 and 110	Between 70 and 80 or between 110 and 130	Between 50 and 70 or between 130 and 150	Between 40 and 50 or between 150 and 160	More than 160
				

Phosphorus (mg/L)

Excellent	Good	Fair	Poor	Degraded
Less than 0.01	Between 0.01 and 0.025	Between 0.026 and 0.05	Between 0.06 and 0.1	More than 0.1
				

Teacher sheet 5

Corangamite region sample data

Key Learning Outcomes

Level 4 Science: Living together
Identify living and non-living things that affect the survival of organisms in an ecosystem.

Level 4 SOSE: Natural & social systems
Describe responses of different elements (including people) to change in natural systems.

Level 5 Science: Living together
Explain the effects of various environmental changes on living things in ecosystems.

Level 5 SOSE: Place and space
Compare natural and human environments and describe factors affecting them.

Maths

Aims:

- to develop understandings of the main factors that affect water quality
- to understand how pollutants get into waterways
- to understand how waterways and water quality can be improved

Materials

Student sheets 5: Corangamite Region sample data.

Information sheet 4: Corangamite Catchment Region.

Blackline master 1: Map 1 of Corangamite Region, and others as required.

Blackline master 7: Water quality ratings for Corangamite.

Advanced preparation

Duplicate required number of Student sheets 5.

Prepare overheads of the maps.

Activity

1. Distribute the student sheet and map(s) for small group work.
2. Interpreting the readings in the table:

   [*In the Barwon River nutrient levels keep increasing from site 1 in the upper catchment to site 4 in the middle catchment, then reduce slightly through the lower catchment. pH and EC increase from the headwaters to the boat ramp at Ocean Grove. The highest values for turbidity are at Wilsons Road access to the river.*]

Water quality data collected along the Barwon River

	SITE 1 upper catchment of East Branch	SITE 2 upper catchment of West Branch	SITE 3 middle catchment	SITE 4 middle catchment Pollocksford	SITE 5 lower catchment	SITE 6 lower catchment; estuary
Phosphates mg/L	0.024 Good	0.034 Fair	0.040 Fair	0.220 Degraded	0.110 Degraded	0.043 Fair
Water temp	11	11	15	15	16	18
D.O. mg/L	10	8.75	9.75	10	9.6	10
pH	6.9 Excellent	6.6 Excellent	7.6 Good	7.9 Good	7.9 Good	8.4 Fair
EC µS/cm	160 Excellent	240 Excellent	1400 Fair	1900 Fair	1700 Fair	41000 Estuarine water
Turbidity mg/L	5.7 Excellent	5.4 Excellent	14 Good	18 Excellent	9.6 Good	8.2 Excellent

Source of data: *Barwon River and Lake Colac System Nutrient Study Monitoring Program.* Report prepared for Southern Rural Water. Oct 1996. WES Report No 105/96. Water EcoScience. Page 8.

Corangamite region sample data

3. When interpreting water quality readings it is useful to know what type of landform, landuse and climate conditions occur in the vicinity of the waterway as all of these factors influence the condition of the water. Use the regional maps provided as overheads or handouts for students to map any influencing features onto the river map provided.

   [*E.g. upper catchments will be steeper and usually have cooler water; estuaries will be naturally high in salt (high Conductivity readings).*]

Water quality data collected along the Moorabool River

	Lal Lal upper catchment	**Morrisons** middle catchment	**Batesford Site** middle catchment
Discharge (ML/Day)	25 Lower discharge because in upper catchment and above the Bungal Dam.	125	108
Stream temperature (°C)	12	13	14
pH	7.6 Good	7.7 Good	7.6 Good
D.O. (mg/L)	9.7 (= 92%) Excellent	9.5 (=95%) Excellent	8.7 (= 85%) Excellent
Turbidity (NTU)	11.3 Good	7.3 Excellent	8.6 Excellent
Conductivity (µs)	387 Excellent	634 Good	1421 Fair Increase due to land use practices and influence of tributaries, e.g. Sutherland Ck.
Phosphorus soluble (mg/L)	0.041 Fair Slight increase in P levels may be due to land clearance on the West Moorabool.	0.017 Good Lower levels could be due to the East and West Moorabool meeting at this site, and the East Moorabool having slightly lower P levels.	0.042 Fair Nutrient levels increase may be caused by human influence, e.g. storm water drains from towns.

Note

The above results for the Barwon and Moorabool Rivers are the cumulative, *median* values [*see Introduction section, page 4*] for all the readings taken between 1975 to 1994 on each river. The median rather than the average of all the figures is used because if there are occasional atypically high or low readings, the average of all the figures is too high or low to be an accurate representative figure.

Corangamite region sample data

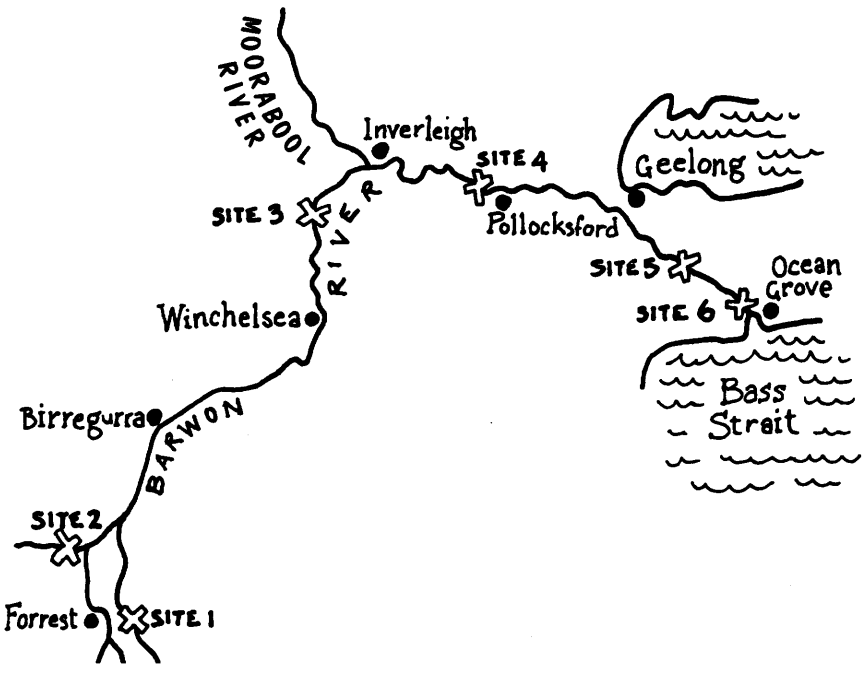
Activity instructions

1. Scientists have measured water quality at sites along the Barwon River since 1974. The following table shows their results (the median value for readings from 1975 to 1994).

Table 1: Water quality data collected along the Barwon River

	SITE 1 upper catchment of East Branch	**SITE 2** upper catchment of West Branch	**SITE 3** middle catchment	**SITE 4** middle catchment Pollocksford	**SITE 5** lower catchment	**SITE 6** lower catchment estuary
Phosphates mg/L	0.024	0.034	0.040	0.220	0.110	0.043
Water temp °	11	11	15	15	16	18
D.O. mg/L	10	8.75	9.75	10	9.6	10
pH	6.9	6.6	7.6	7.9	7.9	8.4
EC µS/cm	160	240	1400	1900	1700	41000
Turbidity mg/L	5.7	5.4	14	9.6	18	8.2

Source of data: *Barwon River and Lake Colac System Nutrient Study Monitoring Program.* Report prepared for Southern Rural Water. Oct 1996. WES Report No 105/96. Water EcoScience.



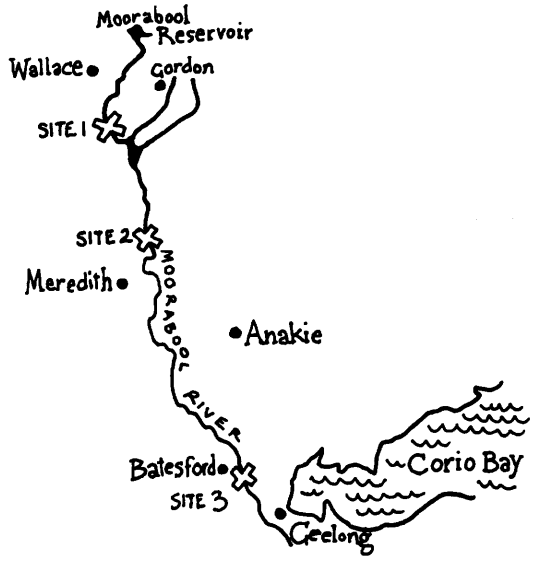
Corangamite region sample data cont.

2. Scientists have measured water quality at the 3 sites along the Moorabool River since 1974. The table below shows their results.

Table 2: Water quality data collected along the Moorabool River

	Lal Lal upper catchment	**Morrisons** middle catchment	**Batesford Site** middle catchment
Discharge (ML/Day)	25	125	108
Stream temperature (°C)	12	13	14
pH	7.6	7.7	7.6
D.O. (mg/L)	9.7	9.5	8.7
Turbidity (NTU)	11.3	7.3	8.6
Conductivity (µs)	387	634	1421
Phosphorus (mg/L)	0.041	0.017	0.042

VWQM Network Annual Report 1994.



3. Interpreting the results

Below each figure in Table 1 and 2, write in whether the reading is Excellent, Good, Fair, Poor, or Degraded. (Refer to the Water quality ratings for Corangamite tables.)

For each river, write a sentence to explain how the readings for each test changed along the river from its upper catchment to its estuary.

Using the supplied maps, draw onto each location map to show the type of landform and landuse along the length of the river.

Suggest possible reasons for the water quality readings along the length of these rivers.

Catchment condition report

Complete a Catchment condition report at least once a year after undertaking water monitoring at your site and preparing a map of your catchment.

Key Learning Outcomes

Level 4 Science: Living together
Identify living and non-living things that affect the survival of organisms in an ecosystem.

Level 4 SOSE: Natural & social systems
Describe responses of different elements (including people) to change in natural systems.

Level 5 Science: Living together
Explain the effects of various environmental changes on living things in ecosystems.

Level 5 SOSE: Place and space
Compare natural and human environments and describe factors affecting them.

Maths

Aims:

- to develop understandings of the main factors that affect water quality
- to understand how pollutants get into waterways
- to understand how waterways and water quality can be improved

Materials

Student sheet 6: Catchment condition report.

Teacher information sheet 4: Corangamite Catchment Region.

Corangamite Maps 1 - 6.

Completed Student sheet 22: Water quality results summary, and prepared tables and graphs [see Teacher sheet 4: Monitoring Corangamite's waterways.]

Completed local catchment map [Teacher sheet 18: Mapping your catchment, Statewide section].

Advanced preparation

1. Get together all the summaries of the water quality tests you conducted at your site.
2. Prepare an overhead of a completed catchment map of your monitoring site.
3. Duplicate the required number of Student sheet 6.
4. Duplicate any required sections of Information sheet 4: Corangamite Catchment Region.
5. If you need more information (e.g. soil type, landuse, catchment boundaries), contact your local Waterwatch Co-ordinator and local Council.

Activity instructions

1. In their small groups, students review their water quality Results Summary sheets for the year.
2. Show the overhead map of your catchment and ask students to point out any major influences on your monitoring site.
3. Explain median compared to average figures.
4. Students complete Q1a - c of the Catchment condition report. Which tests, if any, consistently indicated 'Degraded' results at your site?
5. Summarise and discuss the results as a class.
   - Do any of the results vary much throughout the year? Might there be some natural causes for this?

   [*E.g. Does the rainfall graph explain any results (e.g. storm events)? If your site has high salinity levels, can you see any link between rainfall and salinity at your site? Does the temperature graph explain any results (e.g. unusually high or low temperatures)?]*
   - Does your site have high salinity or phosphorus levels? If so, where might the excess salt or nutrients come from? Was there any visual evidence at your site of high nutrient levels, i.e. excess algal growth or high salinity levels, i.e. dieback of salt sensitive plants?
   - Can they see any relationships between any of the test results (e.g. high temperatures and low D.O.; high turbidity and high salinity levels)

   [*Refer to Information sheets 4-8, Statewide section .*]
   - Could there be any major errors in your results caused by faulty equipment or operator errors?
   - Which test result indicates the cause of greatest concern for water quality at your site?
   - Compare your site's results with the average result for you catchment.
6. Students complete the remainder of their Catchment Condition Report. Review these as a class and prepare one Catchment Condition Report for your local Waterwatch Co-ordinator.
7. Discuss and decide on a course of action to help improve or maintain the water quality at your site

   [*See Teacher sheets 23 and 24: Local action, in Statewide section*]
8. If you have previous year's results, identify and celebrate any improvements in water quality from previous results. Discuss what may have led to these improvements. Similarly, identify any decreases in water quality and discuss what may have caused these.

Catchment condition report

Prepare your report using these headings.

1. Water monitoring results

Name of your waterway and site: _____

Name of your monitoring group: _____

Date: _____

1a. Site description

Briefly describe your monitoring site. (e.g. type of waterway, its location in the catchment, it's upstream tributaries.)

Describe any special visual observations at your site (e.g. upstream storm water drains, eroded banks, excessive algal growth.)

1b. Water quality results

Record the median result for each test you conducted over the year. Using this median result, tick the relevant water quality rating for each test you conducted.

Results for (name of site) for (year)

Date: _____	Median reading	Excellent	Good	Fair	Poor	Degraded
Stream habitat						
Macro-invertebrates						
Conductivity						
pH						
Turbidity						
Dissolved oxygen						
Phosphorus						

Using information from the table, write a paragraph to explain your conclusions from the tests.
(e.g. list any tests which indicate an Excellent/Good water quality rating, and list

Catchment condition report

2. Catchment condition

2a. Catchment description

Briefly describe your waterway's catchment (e.g. sub-region, local climate, soil or landform influences.)

2b. Landuse and industry

List the major upstream and adjoining landuses and industries in your local catchment. In what ways may these affect water quality at your site?

Landuse or industry	Influence on water quality

2c. Conservation values

List any special or significant aquatic or riverside plants or animals that live in or around in your waterway or monitoring site.

List any cultural heritage sites in or near your monitoring site.

2d. Water quality issues

Identify and briefly describe any particular issues that affect your waterway.

e.g.
Erosion
Weeds
Pest animals
Conservation issues (e.g. threatened species)
New developments on or near your waterway
Others

3. Summary

Write a paragraph or two to summarise any particular water quality issues for your monitoring site (e.g. turbidity, salinity, nutrient increases).

4. Actions

Using the information in steps 1, 2 and 3, write a paragraph or two to suggest ways that water quality at your site could be improved.

Describe any waterway improvement actions that your class/school/community group have completed or plan to undertake.

Attach to this Catchment Condition Report your completed local catchment map. (show landuse and any other relevant influences on water quality at your monitoring

Local issues

Some current local issues are outlined below to provide ideas to discuss, debate or investigate further.

Stormwater

Litter (paper, cans, plastics, dog poo. etc.) from streets and nature strips is carried by rain into stormwater drains and is discharged into waterways. Some illegal discharges are made into stormwater drains. (Factories and industries are required to obtain licenses to discharge their wastes so that the quantities can be minimised to safe levels and monitored. Factory discharges are to be made into the sewerage system where the wastewater can be treated.) Stormwater is not treated before it flows into waterways.

Watersports Complex

This major development of the lower reaches of the Barwon River aims to provide a secure future for rowing and other water sports in Geelong.

This development could be used to discuss, debate or investigate issues including:

- financial
  - it will be costly and perhaps become a 'white elephant'
- aesthetic
  - a long straight channel which will be very visible from Moorabool Street Bridge
- effects on the natural environment
  - river flow slowed due to the new course
  - potentially increased levels of sedimentation
  - potentially increased occurrences of algal blooms
  - damage to migratory birds' habitat, especially that of Latham's Snipe
  - destruction of 6,000 trees for the facility
  - short and long term effects on Gheringot Wetlands
- effects on interest groups
  - relocation of Barwon Valley Golf Course
  - dog obedience club
  - Geelong Field Naturalist (Gheringot Wetlands' custodians)

Fish migration

The migration of native fish up the Barwon River system is impeded by man-made structures. A fish way was installed beside the lower breakwater in 1996. Fish can now migrate to the next impediment, Buckley's Falls/Baum's Weir.

Mining activities

Is mining increasing sedimentation in Moorabool River?

Forestry

Is the construction of access roads for forestry operations increasing sedimentation of waterways flowing from the Otways Coast catchment?

Blue-green algae

(see *The Water Cycle*, page 131-2)

Piggeries

The development of piggeries near waterways in the region is emerging as an issue. Intensive farming near waterways has the potential to pollute waterways with animal manure, leading to increased nutrient levels in waterways.

Sewage treatment

The Government is stipulating that country towns are to be sewered and septic tanks phased out. This requires the building of lagoons near each town to dispose of waste water, or the tertiary treatment of waste water and its disposal to inland waters. Concerns have also been raised about disposal of inadequately treated sewage out to sea by some coastal towns.

Recreation

In Geelong there is increasing pressure to balance the needs of recreationists with the maintenance the health of the river. The reeds and waterplants in the river are cut to allow for rowing, canoeing, waterskiing and commercial cruising. An effect of this weed cutting is that the weeds are no longer there to reduce the impacts of wave action on the river banks and this leads to bank collapse and the river widening. This in turn causes the river to slow and may increase the rate of sedimentation.

Flood plain management

Geelong's 1995 flood inundated some businesses and houses, leaving silt and rubbish and damaging trails and even bridges. Floods raise questions as to whom should pay to fix the damages they cause? Should flooded industries be compensated, and if so, by whom? Should money come from Council or Government? Should houses and industry be built on floodplains in the first place since by nature, these areas are occasionally flooded. What flood warning systems are in place? Unprotected industries can no longer obtain flood damage insurance. Godfrey Hirst Mills has since spent more than $1 million to erect a flood wall.

Reedy Lake rejuvenation

Reedy Lake is a shallow lake with surrounding marsh fed by the Barwon River. In the natural pattern of occasional droughts, the lake would have occasionally dried out and this drying out period allowed some of the aquatic and fringing plants to reproduce. However over recent decades the lake has not dried out; fringing vegetation has not reproduced and the lake became infested by European Carp, reducing its environmental value. The Geelong Field and Game Club installed water level controlling structures after convincing the Department of Natural Resources and Environment of the need. Reedy Lake subsequently dried out and the carp died. The Lake is now refilling.