North Central Catchment Management Authority

Waterwatch

Field Manual

Victoria State Government | Environment, Land, Water and Planning

NORTH CENTRAL Catchment Management Authority
Connecting Rivers, Landscapes, People

WATERWATCH North Central
Communities Caring for Catchments

About the North Central Waterwatch Program

The North Central Catchment Management Authority's (CMA) Waterwatch Program increases the knowledge and skills of community, supporting them to become custodians of local waterways.

For more than 25 years, the program has empowered individuals to monitor river and wetland health and contribute to natural resource management in the North Central CMA region.

The long-term aim of the program is for 50% of sites in the North Central CMA region are being monitored and align with priority waterways by June 2020. This will ensure reliable and relevant waterway condition data is used by waterway managers who make decisions about activities to improve river and wetland health.

Acknowledgement of Country

The North Central CMA acknowledges Aboriginal Traditional Owners within the region, their rich culture and spiritual connection to Country. We also recognise and acknowledge the contribution and interest of Aboriginal people and organisations in land and natural resource management.

Contacts:

Contact the Waterwatch Coordinator at the North Central Catchment CMA:

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Thank you for being part of the Waterwatch community.

Step 1: Preparation for conducting monitoring activities

Equipment Checklist

- ❑ Water quality kit and instructions (manual, thermometer, pH meter, EC meter, phosphate test kit, turbidity tube).
- ❑ Waterbug testing equipment (net, bucket, trays, ice cube containers, spoons, pipettes and magnifying glasses).
- ❑ Recording folder.
- ❑ First-aid kit.
- ❑ Mobile phone - recommendation to download the NatureBlitz App.
- ❑ Camera or phone to photograph the site and other interesting observations.
- ❑ Completed risk assessment (see below).
- ❑ Hats, closed toe shoes, water for drinking and sunscreen.
- ❑ Check the weather forecast. Consider if past weather events have affected the site.

Environmental considerations

- Look at and photograph native animals and plants, but don’t harm or collect them.
- Collect all chemical waste used in testing in waste bottles and dispose in the mains sewer system (not septic).
- Take away more litter than you brought in. Bring gloves and bags to appropriately collect litter.
- Use paths and tracks.

Safety

- Always follow (your own) procedures when visiting the site.
- Complete a *Risk Assessment* prior to commencing activities (next page).
- Wear appropriate clothing and footwear.
- Let someone else know where you will be sampling and when you expect to return.
- Select a sampling site that is safe and easily accessible (not through plants, private property, steep banks etc.).
- Be aware of animals, holes and vegetation when going to and from and while testing at the site.
- Sample from a safe distance from the water’s edge.
- Wash your hands after being in the field and before eating.

Chemical

- Wear safety gloves and glasses when handling chemicals.
- Read the first aid and warning before using chemicals.
- Dispose of chemicals correctly (mains sewer system).
- Wash hands after using chemicals.

Step 2: Site risk assessment

The following information could be included in a risk assessment while considering individual requirements. It is recommended to visit the site to carry-out a risk assessment prior to each visit and acknowledge the visit on the data forms.

Activity	**Risk**	**Best Practice Management**
Field work	Bites and stings	• Wear long sleeves, long pants, sturdy footwear, thick socks • Use insect repellent • Look out for ant nests, stinging plants, bee hives, etc. and avoid working in the area
Field work	Exposure to heat/sun	• Have drinking water on hand • Work in shaded areas where possible • Do not monitor during hottest part of day • Wear long pants, long sleeves, broad brimmed hat and sun glasses • Use SPF 50 sunscreen on exposed skin • Select a suitable area to carry out sampling
Manual handling	Injury to body due to awkward position	• Ensure path is clear when carrying objects • Use a small bucket or sample bottle • Use correct techniques • Keep a straight back and don’t twist your body when lifting
Working near large trees	Branches/ limbs falling	• Avoid working under large trees, look for any dead or hanging limbs
Working near water	Falling in water	• Do not walk on steep, slippery or unstable banks • Do not enter the water when testing

		• Never drink water from the site • Be cautious during times of high flow • Always work with a partner
Working with chemicals	Eye or skin irritation	• Wear gloves and safety glasses • Always follow correct test procedures • Read and maintain relevant Material Safety Data Sheets (MSDS) • Store chemicals/water quality kit in a locked cupboard away from children
Working in snake habitat	Snake bite	• Assume snakes are present • Avoid long grass and high-risk areas • Do a heavy walk through the area before commencing monitoring • Train in and regularly revise snakebite first aid • Have an emergency response plan ready • If a snake is observed, stay clear • In an event of a bite, stay calm, seek help
Litter collection	Laceration and or infection	• Wear gloves • Contact local council to collect syringes or dangerous objects • Wash hands thoroughly afterwards • Look carefully at litter items that may be refuge for animals
Working on slippery or uneven ground	Slips, trips, falls	• Do not sample water from steep embankments • Avoid any obvious hazards such as slippery logs or loose rocks • Avoid carrying heavy or awkward objects • Ensure boots / shoes are firmly laced

Quality assurance – data confidence framework

The North Central Waterwatch program uses various types of monitoring equipment. The following list includes the name of the equipment used for monitoring physical and chemical parameters and the accuracy specifications.

Instrument type and model	Parameter monitored	Units of measurement	Range (e.g. 0 – 14 pH)	Accuracy (e.g. ± 0.05 pH units)
pH meter – laqua twin	pH	pH units	0-14	±0.03
Electrical Conductivity meter – Laqua twin low range	EC	µS/cm	0 – 19,999	±30%
Visocolor HE Phosphate test (DEV) – low range	Reactive Phosphorus	mg/l PO4-P	0.01-0.25	Unspecified
Visocolor HE Phosphate test (DEV) – high range	Reactive Phosphorus	mg/l PO4-P	0.25 – 1	Unspecified
Turbidity Tube	Turbidity	Tube NTU's	0-400	NTU scale on side of tube used as an approximation of true NTU measurement.

Step 3: Water quality testing

1. Check monitoring kits to make sure all equipment is there and in working order.
2. Prior to sampling rinse water bottles three times with water downstream of the r sampling site.
3. When collecting samples ensure you keep a good distance back from the edge of the bank.
4. Extend the water pole to get a representative sample from the middle of the waterway – try and collect water from 10-20 cm below the surface.
5. Record key information about the site on the day (this information is in your *water quality data sheet*). Take a photo and upload to the Waterwatch database.
6. Make sure equipment is calibrated (EC and pH meters).
7. Review each test, if working with a partner, compare results.
8. Follow instruction steps for each parameter. Note the safety procedures, especially for the phosphate test.

TIP: *If testing can't be completed within two hours keep the water sample in a cool, dark place.*

9. Suggested order of testing:
    - Temperature
    - Dissolved oxygen* (*not all monitors conduct this test)
    - Reactive phosphorus – wait for five minutes
    - pH – until stable
    - Electrical conductivity – until stable
    - Turbidity (stir water before testing)

10. Record results using the data sheets and/or
11. Upload results on the Waterwatch website

NOTE: *Tests can be carried out onsite or at home*

Temperature

How hot or cold the waterbody is (temperature), plays a very important role in the health and quality of a water body. It is important to measure water temperature as it can speed up or slow down chemical reactions that take place in the water. The amount of oxygen dissolved in water, the rate of photosynthesis by plants and algae and the sensitivity of aquatic organisms to toxic wastes and disease can all be influenced by water temperature.

Warmer water can lead to:

- increased levels of nutrients
- possible algal blooms
- oxygen is less soluble - i.e. decreased dissolved oxygen
- salts being more soluble in warm water - i.e. increased salinity.

The above factors can affect aquatic plant life and animals as most survive in specific temperature ranges. Certain species will only reproduce within a specific temperature range with some species dying if water temperature becomes extreme.

What factors affect temperature?

Water temperature can vary based on natural or unnatural influences. Unnatural influences can have serious implications on waterway health.

- air temperature - time of day, season, year
- depth, flow and type of waterway
- groundwater inflows to the waterway
- vegetation - the amount of instream and riparian vegetation can provide shade and trap sediment from entering the waterway
- turbidity of the water - muddy water holds more heat than clear
- thermal pollution caused by discharging warm industrial, agricultural or urban waste
- dams or water storages releasing cold water into a waterway.

Measuring temperature

UNIT: degrees (^oC)

EQUIPMENT: thermometer

Use a thermometer to measure:

a. air temperature

b. water temperature.

Air temperature varies from season to season and the time of day. Water temperature is more stable.

Air temperature

Measure air temperature in the shade at the collection site.

***NOTE**: Consider using an electronic source for measuring air temperature.*

Water temperature

Water temperature should be measured from the bucket or bottle soon after collecting the sample. Place the thermometer in the sample and swirl gently.

1. Leave for about 30 seconds to ensure an accurate result.
2. Record results on the water quality data sheet or directly into the Waterwatch website.

***NOTE**: Water temperature is not rated but is important to measure it as it can speed up or slow down chemical reactions that take place in the water.*

Reactive phosphorus

Phosphorus is a nutrient that naturally occurs in water and is essential for all life. It comes from the weathering of rocks and through the decomposition of organic material (plants and animals). There are different forms of phosphorus found in water. Reactive phosphate, what is tested, is readily available and biologically active.

Why monitor phosphorus?

Although phosphorus is a naturally occurring nutrient, phosphate levels can change dramatically after a rainfall event following a prolonged dry period or due to poor land or stormwater management.

What causes phosphorus to change?

Elevated phosphorus levels may result from many sources including:

- erosion and sediment entering waterway containing phosphorus
- accidental sewage discharge
- input from stormwater drains, which might include detergents
- animal waste or industrial waste
- rural runoff containing fertilisers, animal or plant matter.

What are the environmental impacts?

High levels of phosphorus can lead to excessive growth of plants, including invasive weeds which can:

- choke waterways
- reduce habitat quality and limit growth of native plants
- affect sunlight reach which can increase rotting plant matter and lower oxygen levels impacting on the survival of fauna and flora
- stimulate algal blooms producing toxic chemicals harmful to humans and livestock.

Managing phosphorus levels

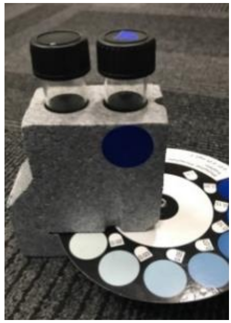
Improved land management practices such as fencing, revegetation and the installation of off-stream watering helps separate crops and livestock from waterways and filter possible inputs. The management of stormwater, sewage and industrial waste are also vital strategies to control phosphorus levels.

Measuring reactive phosphorus

UNIT: milligrams per litre (mg/L)

EQUIPMENT: reactive phosphorus kit, a colour comparator test kit

SAFETY NOTE: *Please read the first aid procedures in the kit before testing*



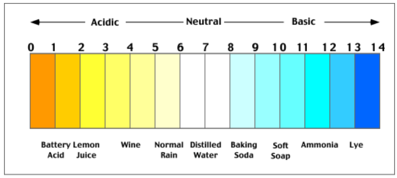
1. Put on **gloves** and **safety glasses**
2. Set up kit:
   - Remove test tubes from foam holder.
   - Slide in colour wheel and ensure bolt is in place.
   - Rinse both tubes three times with the sample water. Do not tip the rinsed water back into sample bucket. Tip into waste bucket.
   - Fill both test tubes with sample water to line.

NOTE: Test tube **with NO** blue dot is the control sample. Place it in the **outside** and put the lid on. Test tube **with** blue dot should be placed on the **inside** of the colour wheel, add chemicals to the test tube.

3. Add one level micro-**spoon** of **PO_4^{-1}** to the tube with blue dot.
4. Add **15 drops of PO_4^{-2}** into the same tube.
5. Place the **lid on** tube (with blue dot) and **shake gently** to dissolve the powder. Put tube back in holder.
6. Leave the solution for **five minutes** to allow colour to develop.
7. Take the **lids off** both test tubes and look directly down at the tubes from about 30cm away with the blue dot on the foam holder facing you. **Compare the colour** of the water in both test tubes and slowly turn the colour wheel to achieve the best colour match.
8. Once there is a close **colour match**, read the number value displayed on the colour wheel in the notch of the foam holder.
9. **Record results** on the *water quality data sheet* or website
10. Tip both tubes into the waste container. Tip waste down mains sewer system (drain or toilet).

pH

In a sample of water, pH is a measure of the concentration of hydrogen ions. pH evaluates how acidic or alkaline the water is. The pH scale ranges from 0 to 14, with 7 being neutral.



In Victoria, the acceptable pH level for the health of aquatic plants and animals in freshwater ecosystems is 6.0 to 8.5.

A more acidic solution contains more H+ ions than OH- ions (< 7). A more alkaline solution contains more OH- ions than H+ ions (> 7). An increase in pH of one unit equals a tenfold increase in concentration e.g. an increase from eight to nine is 10 times more alkaline, while from eight to 10 is 100 times more alkaline.

Why monitor pH?

Large changes in pH can have a dramatic effect on the abundance and diversity of species found within a waterway. Some animals are very sensitive to changes and will migrate out of the system if possible.

What causes pH to change?

- increases in carbon dioxide levels due to plant respiration
- decreases in carbon dioxide due to photosynthetic consumption
- chemicals introduced through stormwater
- pollutants such as fertilisers, exhaust fumes, and sewage
- increases or decreases in salinity
- soil type and disturbance.

What are the environmental impacts?

- interruptions to breeding cycles, altering aquatic species growth
- decreased health or death of aquatic species, e.g. burning skin.

Managing pH levels

Actions to manage extreme fluctuations include reducing the primary source of pollution, e.g. stormwater and sewage management, reducing soil disturbance and improving farming practices.

Measuring pH

UNIT: a number on the pH scale (1 -14)

EQUIPMENT: pH meter, HORIBA – laquatwin hand held meter

1. Turn the **meter on** (ON/OFF button).

2. **Calibrate** the meter **each time** before using it
 . Use the 7.0 calibration solution to do this. Make sure there are no bubbles on the electrode.

3. Press the **'C' button** for 0.5 seconds to calibrate.

4. **Rinse** the sensor with the sample water after calibration.

5. Place a small amount of the **sample water** on the sensor. There is a pipette to help do this.

6. Once stable, **record results** on the *water quality data sheet or website*

7. After measurement wash the sensor with water (tap or similar) and then press the on/off button to **turn it off**. Store somewhere safely.

Salinity

Salinity (also referred to as Electrical Conductivity or EC) refers to the movement and concentration of salt in the water. Salinity is a natural component of soils and water tables due to weathering of rocks. =Inland seas that retreated 10 million years ago left sediments containing large quantities of salt.

Why monitor salinity?

Plants and animals need low levels of salt to help them grow but all organisms have specific tolerance levels for salinity. When salinity levels change this can impact the variety and number of species.

What causes salinity to change?

Salinity may occur when deep-rooted vegetation is removed from the landscape, allowing large volumes of rainfall to reach the water table below. This rain collects salt particles from the soil profile as it seeps down, adding saline water to the water table. As groundwater rises it carries large amounts of salt previously stored underground. Higher rainfall and irrigation can exacerbate the problem causing salt to rise to the surface and enter waterways.

What are the environmental impacts?

- severely limits the growth and diversity of vegetation
- reduces the capacity and productivity of the land
- degrades habitats and decreases fauna health and diversity
- impacts water quality and reduces the value of water
- contributes to erosion and damages infrastructure.

Managing salinity levels

Planting deep-rooted native trees in high recharge areas (where rainfall is entering groundwater) can help lower the water table. Improved land management practices, efficient watering, monitoring salinity levels in the ground and in surface water, can all also help manage salinity levels.

Measuring Electrical Conductivity

Unit: salinity (EC) is measured using micro-siemens per centimetre (µS/cm). The more salt in the water the more electricity it conducts.

Equipment: an EC meter to measure salinity

Turn the **meter on** (ON/OFF button).

1. **Calibrate the meter each time** before use. Use the 1413 calibration solution to do this. Make sure there are no bubbles on the electrode.
2. Press the **'C' button** for 0.5 seconds to calibrate.
3. **Rinse** the sensor the sample water after calibration.
4. Place a small amount of the **sample water** on the sensor. There is a pipette to help you do this.
5. Once stable, **record results** on the *water quality data sheet* or website.

After measurement wash the sensor with water (tap or similar) and then press the on/off button to **turn it off**. Store somewhere safely.

Notes:

- Ambient air may cause the measured values to fluctuate. To reduce environmental interference, close the protection cover.
- If 'Or' is displayed, the salinity level is too high for the EC meter to measure. Contact your coordinator.
- If 'Ur' is displayed, the salinity level is too low for the EC meter to measure. Contact your coordinator.
- Do not wipe or push the sensor strongly. It may damage the sensor. Please dab softly with a tissue or coth to remove excess liquid before storage.

Turbidity

Turbidity is a measure of water clarity. Highly turbid water appears cloudy or murky because of many suspended particles including:

- organic materials - algae, soil or plant particles, human or animal waste
- inorganic materials such as oils, chemicals and fertilisers.

Why monitor turbidity?

Turbidity levels are one of the most immediate and recognisable indicators of poor water quality.

What causes turbidity to change?

- storm events
- bottom of waterway-feeding fauna such as carp
- nutrient and particle rich urban stormwater, causing algal growth
- bank erosion due to unrestricted stock access and/or removal of protective riparian vegetation
- highly saline water usually has low turbidity due to its high ionic strength which forces particles to settle.

What are the environmental impacts?

High turbidity levels limit the amount of light able to penetrate the water's surface, affecting plant growth as it reduces their ability to photosynthesise. Reduced plant growth leads to decreased amounts of oxygen in the water and the loss of vital habitat for aquatic animals. Fine particles settle on surfaces, smothering plants, rocks, logs and fish eggs and larvae. Fish can also suffer from clogged gills.

Managing turbidity levels

Limiting stock access and revegetating streams decreases erosion. Grasses and groundcover act as physical filters by trapping sediments while larger shrubs and trees stabilise banks.

Measuring turbidity

UNIT: Nephelometric Turbidity Unit (NTU)

EQUIPMENT: turbidity tube or meter.

In low levels of turbidity, it is possible to clearly see through a larger volume of water. In highly turbid water it is difficult to clearly see through smaller amounts.

1. Test the water shortly after sampling or mix solution to ensure no sediments have settled.
2. Hold the turbidity tube half way down and keep your arm straight. Look to see the wavy lines at the bottom of the tube - this is what you need to keep an eye on!
3. Using a small container, slowly pour small amounts of the sample water into the tube.
4. After each pour, wait for the bubbles to settle and check that the lines at the bottom are still visible at arm's length. If not, pour a little more into the tube. Keep checking for visibility regularly.
5. When there are no longer three **distinct** lines stop adding water.

TIP: *Pour a bit back out and then add again small amounts of water to find the exact point where lines blur.*

6. Look at the numbers on the side of the tube; this is how to achieve a measurable result. Results need to be recorded as less than (<) the last line passed on the tube.
7. Record results on the water quality data sheet or website.

Water quality indicator levels

The Victorian government has a set of the guidelines that provide limits to acceptable water quality levels for healthy ecosystems. These levels are based on biological characteristics assigned to parts of the catchment which is determined by its position in the region.

In the North Central CMA region, most of the upper catchments lie within the Cleared Hills Bioregion, while the lower elevation and floodplain areas lie within the Murray Plains Bioregion.

When assessing sites to determine the health of our waterways, each site must be assessed against reference values for the bioregion it is in. Reference condition values are calculated based on information known for an area as if it was in the best available condition for that region.

Water quality indicator levels for the Murray plans and Cleared Hills bioregion.

SEPP (WoV) segment	River health category	Reactive Phosphorus (mg/L)	pH Lower	pH (upper)	EC (µS/cm)	Turbidity (NTU)
Cleared Hills	Good	≤0.03	≥6.3	≤8.5	≤700	≤15
	Moderate	>0.03 ≤0.1	<6.3 ≥5.5	>8.5≤9.0	>700 ≤1500	>15 ≤25
	Poor	>0.1	<5	>9.0	>1500	>25
Murray Plains	Good	≤0.06	≥6.3	≤8.5	≤2000	≤40
	Moderate	>0.06 ≤0.1	<6.3 ≥5.5	>8.5≤9.0	>2000 ≤3000	>40 ≤50
	Poor	>0.1	<5	>9.0	>3000	>50

Thank you for your contribution to collecting important information about the health of waterways in the North Central CMA region.