Waterwatch Program

Healthy Waterways
Waterways Program - Handbook

Your Handbook includes:

- Safety information
- SEPP guidelines
- Physical and chemical testing theory
- Physical chemistry data sheet
- Habitat survey theory
- Macroinvertebrate identification
- Macroinvertebrate and habitat survey data sheets
- Monitoring plan template
- Feedback form
- Pages for your notes

This folder belongs to: _____

Melbourne Water

Contents

Introduction

What is the Healthy Waterways Waterwatch Program?

The Healthy Waterways Waterwatch Program connects people with their waterway. We provide a range of activities suitable for all ages, ranging from pre-school level through to adult.

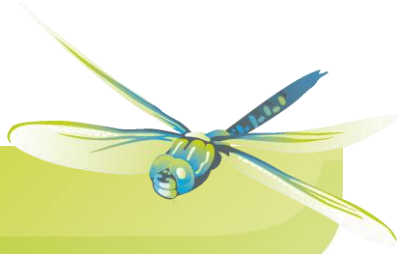
Activities can be tailored to meet the needs of specific groups. Our support and expertise enables schools and the community to:

- understand waterway health issues
- discover how to improve the health of our rivers and creeks
- become involved in activities to improve the health of our rivers and creeks
- learn how to monitor and collect data from waterways
- interpret and understand water quality data.

Volunteer Monitoring

Waterwatch volunteers are taught to monitor water quality, conduct water bug (macroinvertebrate) surveys and assess habitats. Monitoring groups are provided with specialised training and receive ongoing support from their Waterwatch Coordinator to develop and implement their own monitoring program. Information collected by these groups is made available to Melbourne Water, the EPA and local councils to help identify what can be done at a local level to improve our rivers and creeks.

Training is free and sessions are conducted regularly across our region. For more information on the next training session, visit our Volunteer Monitoring section on our website www.waterwatchmelbourne.org.au.



Safety Equipment and First Aid

Introduction

Waterwatch participant safety must be a top priority for all Waterwatch monitoring groups.

- Safety considerations should include travel to and from the site, bank stability and testing procedures. Remember, if monitoring a waterway requires putting a participant at risk, do not attempt it.

  Key message: Don't become complacent! Complete Safety Checklist every time.

Understand the risk:

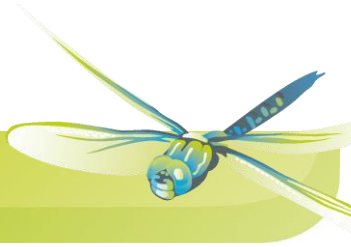
- Each Waterwatch participant should be requested to complete appropriate health and safety training prior to commencing monitoring.
- All children participating in Waterwatch activities with community groups must be under the supervision of legal guardians, and must not have any contact with chemicals.
- All Waterwatch participants must complete the required Waterwatch training course.
- All Waterwatch groups will be required to annually ensure they understand the appropriate Health and Safety requirements and they have been appropriately implemented. These reviews will be completed by your Waterwatch Coordinator.
- When monitoring, horseplay at the monitoring site can lead to possible injury. Monitoring group leaders should emphasise this safety aspect before each testing session.

Choose safe sites:

- **Always have your sites checked and approved by your Waterwatch Coordinator before commencing your monitoring program.**
- Do not be content to select sites from a map. Before selecting a site for regular monitoring, check with your local Waterwatch Coordinator and the land manager for the site, this may be; Local Council, Parks Victoria, Melbourne Water or private land owners.
- Avoid sites where there are dogs, livestock, snakes, bees, leeches, prickly plants and insects. Also ensure sites are unobstructed – clear of long grass and vegetation.
- Choose sites that have safe and easy access to the waters edge and avoid sites that have steep, slippery or unstable banks, or are adjacent to deep, swiftly flowing water.
- Check with your local council that sites such as urban storm water drains, creeks and estuaries are not prone to rapid flood or tidewater rise without warning.

Wear appropriate clothing:

- If it is cold and could rain, wear warm clothing, a raincoat and sturdy waterproof shoes.
- If it is sunny, wear a hat, sunglasses, long sleeved shirts and trousers and apply sunscreen.
- If the site is heavily vegetated, wear long pants, gaiters, strong boots and a long sleeved shirt to avoid scratches and snakebites.
- Wear clothing that is bright so that you can be easily seen.
- When entering shallow waters for the macroinvertebrate samples, make sure you wear gumboots with a good grip and don't enter water above the knee.
- Bring extra clothes and a towel in case someone slips in and gets wet.



Safety equipment and a first aid kit:

- Always wear gloves when handling chemicals or water samples.
- Wear protective eyewear when conducting chemical tests.
- Rubber gloves are essential if anyone has an open or bandaged wound.
- Ideally someone in the group should have formal training in first aid.
- Carry a bandage with your Waterwatch kit in case of snake bite, these can be provided by your Waterwatch Coordinator. It is ideal to keep a First Aid Kit nearby.

Entering water:

- Where possible ensure all sampling is done from the water's edge.
- Where macroinvertebrate sampling requires you to enter the water, only enter water that is less than knee deep. Test water depth using your sampling pole before stepping in.
- Do not wear waders unless you have conducted 'wader training'. Gumboots should be sufficient.

Avoid contact with polluted water:

- Carry drinking water with you. Do not drink water from the water source you are testing as it may be polluted.
- Bring hand washing supplies and make sure you use them after monitoring. This is especially important if the field trip involves a picnic lunch, barbeque or snack.

Chemical safety:

- Read all instructions for chemical tests prior to conducting the test.
- All Material Safety Data Sheets (MSDS) should be kept with your kit (advise your Waterwatch Coordinator if you do not have these).
- Ensure you have access to all Personal Protective Equipment (PPE) for all chemicals that will be used during the monitoring. The basic PPE to be worn should include gloves and eye protection.
- Do not dispose of used chemicals by dumping on the ground or in the waterway! Bring a container with a tight fitting lid so that wastes can be disposed of down the sewerage system.

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SAMPLE COLLECTION

1. Attach a bottle-holder onto the extendable pole.
2. Insert an empty water sampling bottle (approx. 500ml) into the bottle-holder. This bottle should be marked 'Sampling Water ONLY.'
3. Rinse water sample bottle downstream of sampling site **three times**.
4. To collect water sample plunge the sampling bottle open end down into the middle of the stream, or as close to the middle as possible, where there is flowing water.
5. Lower the bottle to **20 cm** below the surface, or the middle of the water column in the water is very shallow.
6. Turn the sample bottle sideways to allow it to fill.
7. Retrieve sample when bubbling has stopped and the bottle is full.

This type of sample is called a grab sample. All the physical and chemical tests described in the following pages are to be carried out on this one water sample.

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TEMPERATURE

Temperature is one of the most important things to measure. Many biological physical and chemical characteristics of a river, such as the solubility of compounds and rates of chemical reactions are directly affected by temperature.

The temperature of freshwater creeks and rivers, is naturally affected by the depth of water (generally the deeper the water the cooler the temperature) and the season and time of day. Temperature may also be influenced by industrial, agricultural and warm urban runoff from streets and footpaths, increased suspended sediments in the stream and by clearing of verge vegetation that shades watercourse.

The distribution and abundance of aquatic plants and animals changes as the temperature varies. Changes in temperature will alter the amount of oxygen dissolved in the water. It will also affect the rate of photosynthesis by algae and other plants.

Increases in water temperature will cause an increase in the metabolic rate of organisms in the water. Increased metabolism increases the oxygen demand of fish, aquatic insects and bacteria.

A short period of high temperatures each year can make the stream unsuitable for sensitive organisms even though the temperature is tolerable during the rest of the year. Some species have different temperature requirements at different stages of life. Fish larvae require a narrower range of temperature than do adult fish. Organisms can tolerate slow changes in temperature. Thermal stress can occur where the temperature changes more than 1 or 2°C in 24 hours.

WATER TEMPERATURE changes with…

depth of water body	size of water body
position in catchment	time of the day and year

presence of vegetation	suspended particle presence in water body

WATER TEMPERATURE changes alter the natural...

mating strategies of many animals	rates of growth of plants, bacteria and animals
oxygen levels	cellular and body functioning of animals and plants

WATER TEMPERATURE increases may indicate...

higher level of nutrients	lack of vegetation along and in the waterway providing shade
higher levels of turbidity (suspended particles)	lower levels of dissolved oxygen

ALCOHOL THERMOMETER (0-100°C) TESTING INSTRUCTIONS

Equipment required: Thermometer, water sample bottle and pole.

IMPORTANT NOTE: Test water temperature immediately after sample is collected. The thermometer can be left to sit in the sample bottle.

1. Insert bottom end of thermometer into water sample or allow whole thermometer to sit in water.
2. Leave the thermometer in the water for 2 minutes.
3. Read the temperature from the scale. The value where the blue line reaches is the recordable value.

DIGITAL THERMOMETER TESTING INSTRUCTIONS

Equipment required: Thermometer, water sample bottle and pole.

1. Insert bottom end of thermometer into water sample or allow whole thermometer to sit in water.
2. Leave the thermometer in the water for 2 minutes. Do not touch the metal part of the thermometer during this time.
3. Read the temperature from the display. Record your results.

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TURBIDITY

Turbidity is the cloudiness of water that results from suspended material in the water such as algae and silt or mud. Suspended solids in the water decrease the ability of light to pass through the water column, which can limit plant growth. This in turn affects oxygen and food availability for the fish and invertebrate communities. The most common causes of turbidity in our waterways are algae and inorganic material from soil weathering, erosion, and stormwater.

TURBIDITY changes with…

plant material and mud / silt build up	erosion and building activity
loss of vegetation	movement of water
presence of carp	nearby wetlands

TURBIDITY changes alter the natural…

level of sunlight reaching plants	growth and survival of plants and animals
water temperature	cellular and body functioning of animals and plants

TURBIDITY increases may indicate…

higher levels of nutrients and increases in algal growth	lack of vegetation along and in the waterway providing bank stability
increase in water temperature	lower levels of dissolved oxygen

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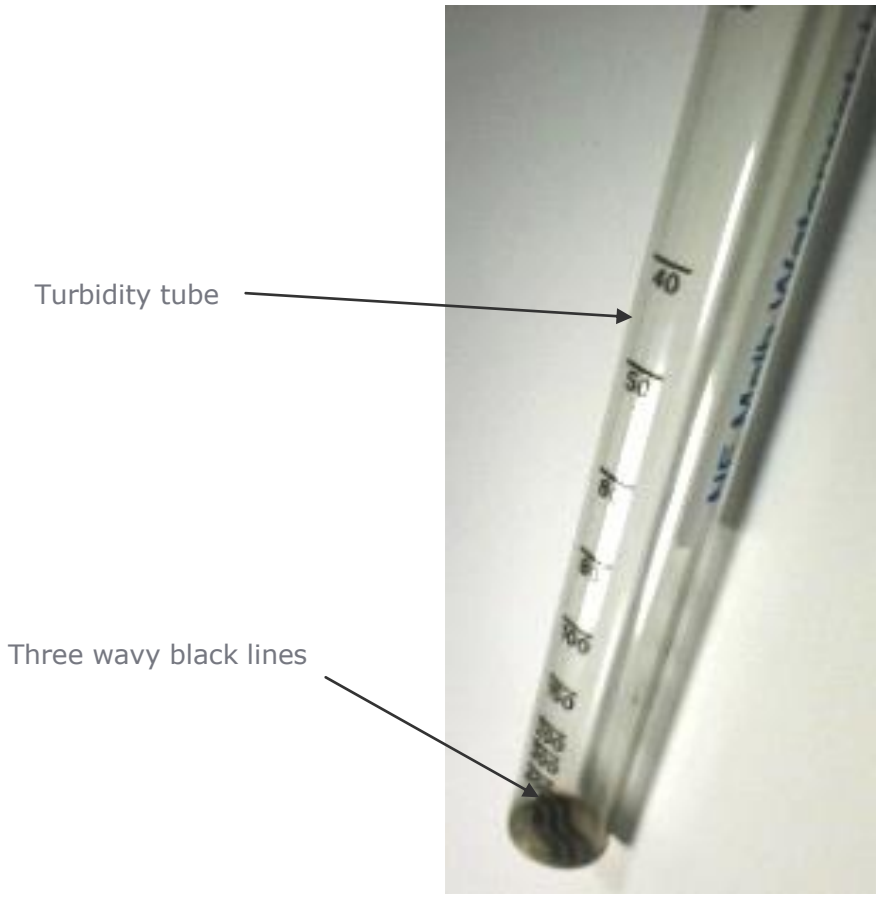
TURBIDITY TUBE (0-400 NTU) TESTING INSTRUCTIONS

Equipment required: Turbidity tube, water sample bottle.

The scale is non linear (logarithmic) and there are gaps between the numbers on the turbidity tube (testing apparatus). **When the water level is between two numbers, record the number lower down on the tube.** If you can see the wavy lines when the water is at the top of the tube, record the result as <10 NTU.



IMPORTANT NOTE: Stand in a shady place when viewing down the turbidity tube. Shake your sample before testing.

1. Hold the tube at stomach height and look down the tube at the three black, wavy lines.
2. Slowly and gently pour the sample water into the turbidity tube, while looking down the tube at the three black, wavy lines.
3. Stop pouring the water when you can no longer distinguish the three black lines.
4. Note the reading from the scale on the side of the tube. Record the number immediately **below** the water line. This is your result in NTUs (nephelometric turbidity units).

LAMOTTE TURBIDITY (0-400 FTU) TESTING INSTRUCTIONS

Equipment required: Smart2 colorimeter, two glass vials, distilled water, sample water.

IMPORTANT NOTES: Wipe glass vials with a soft cloth and ensure they are dry before placing into the colorimeter.

1. Press and hold ON button until colorimeter turns on.
2. Press ENTER to start.
3. Press ENTER to select **TESTING MENU**.
4. Select ALL TESTS (or another sequence containing 98 Turbidity) from **TESTING MENU**.
5. Scroll to and select 98 Turbidity from menu.
6. Rinse a clean tube with deionised water (turbidity free). Fill to the **10 mL** line with **deionised water**.

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7. Insert tube into chamber, close lid and select **SCAN BLANK**.
8. Rinse a second clean tube with sample water. Fill to the **10 mL** line with **sample water**. Cap tube. Wipe off excess water and fingerprints. Shake to resuspend particulate matter. Remove all bubbles before measurement.
9. Insert tube into chamber, close lid and select **SCAN SAMPLE**. Record result. Turbidity measurements should be taken as soon as possible after sample has been collected.
10. Press OFF button to turn colorimeter off or press EXIT button to exit to a previous menu or make another menu selection.

DISSOLVED OXYGEN

Dissolved oxygen (DO) is the small amount of oxygen gas dissolved in the water. It is essential for the respiration of fish, aquatic animals, micro-organisms and plants. To maintain a healthy and diverse aquatic ecosystem, the dissolved oxygen must be maintained at high levels to support the more sensitive species. Studies suggest that 4.5 mg/L DO is the minimum amount needed to support a large and diverse fish population.

Light and temperature affect the dissolved oxygen levels. Plants produce oxygen during the day through photosynthesis, and at night use oxygen through cellular respiration. For this reason it is necessary to record the time of day that the sample was taken.

DISSOLVED OXYGEN changes with…

amount of in-stream vegetation	flow and movement of water
temperature changes	stormwater and vehicle pollution

DISSOLVED OXYGEN changes alter the natural…

growth of plants and animals	cellular and body functioning of animals and plants

DISSOLVED OXYGEN changes may indicate…

Very high DO	Very low DO
over-production of plant life	input of soaps and detergents, agricultural or industrial runoff
increase in turbid water and temperature	increase in algal production and presence of bacteria

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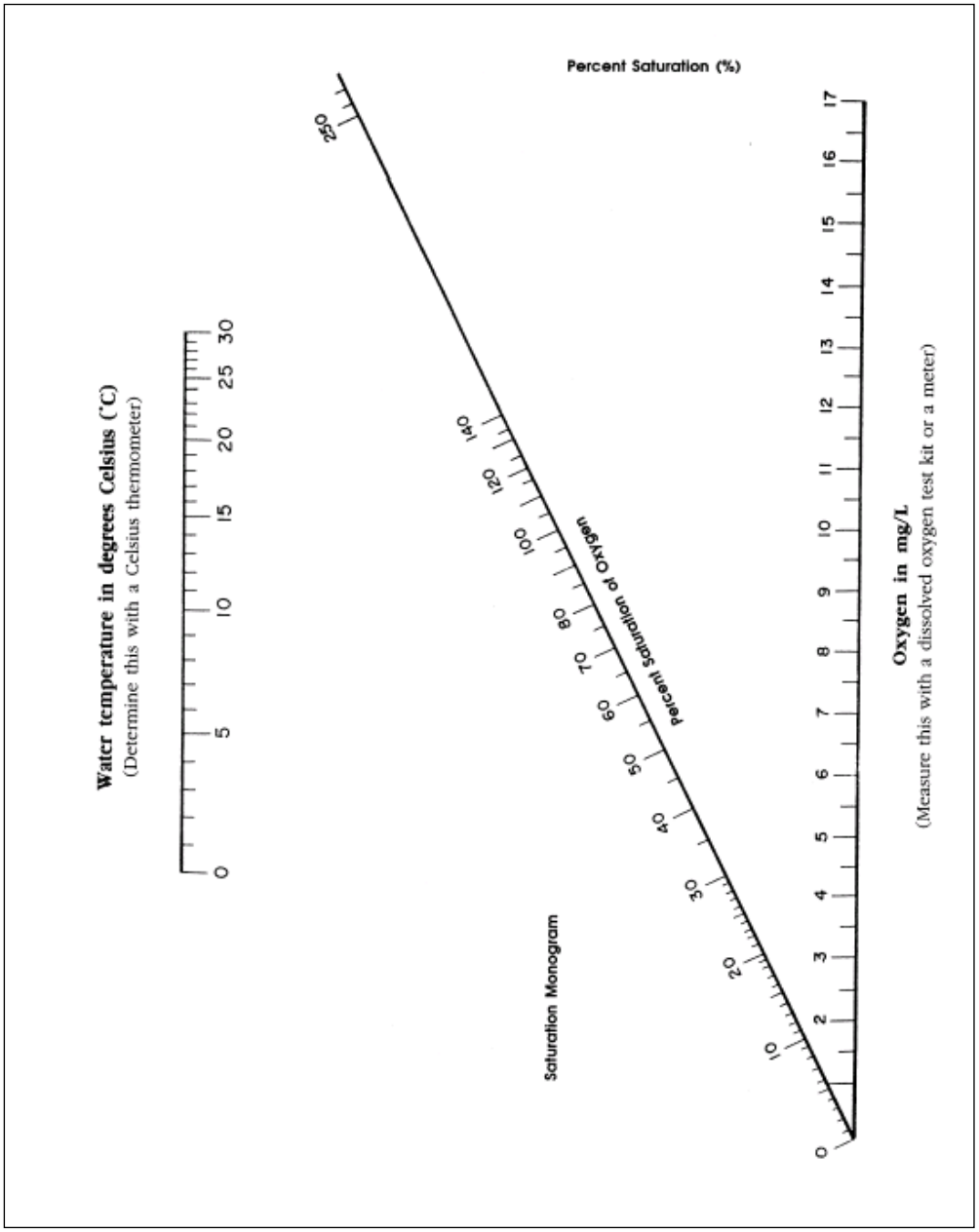
Dissolved Oxygen Monogram

Use the monogram below to convert your dissolved Oxygen mg/L result to percentage saturation.

1. Circle your result on the 'Oxygen in mg/L' scale.
2. Circle your result on the 'Water temperature in degrees Celsius' scale.
3. Run a ruler or other straight edge between these two values.
4. Record the value at which your line crosses the 'Percent saturation of Oxygen' scale.



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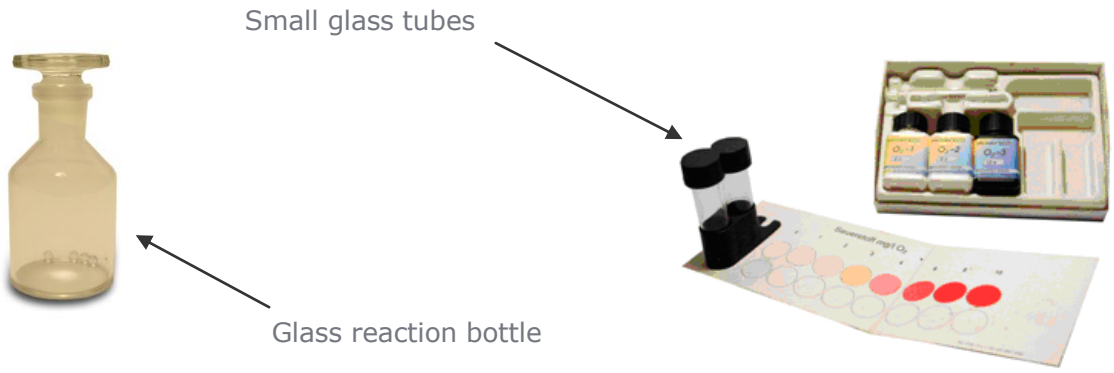
VISOCOLOR ECO DO (0-10 mg/L) TESTING INSTRUCTIONS

Equipment required: Visocolor DO kit, glass reaction bottle, sample bottle, gloves and safety goggles.



IMPORTANT NOTES: Wear gloves to undertake this test. The reaction takes place in the glass reaction bottle. Waste can be disposed of down a sink connected to the sewage system, with lots of water.

1. Set up the colour chart and small glass tubes in the plastic frame, as above.
2. Rinse the small glass tubes and the glass reaction bottle with sample water **3 times**.
3. To fill the glass reaction bottle: fill to overflowing with sample water (from the sample bottle). **DO NOT PLACE LID ON GLASS REAGENT BOTTLE.**
4. Add **5 drops** of reagent '**O_2 -1'**.
5. Immediately afterward, add **5 drops** of reagent '**O_2 -2'.**
6. Replace lid of glass reaction bottle and invert gently to mix for one minute.
7. Remove the glass reaction bottle lid and add **12 drops** of reagent '**O_2 -3**'.
8. Replace the glass reaction bottle lid and invert to mix gently. Mix until all flakes have dissolved.
9. Using the syringe add **1mL** of plain **sample water** to small glass tube over 'A' (over red circles on colour chart).
10. Using the syringe add **1mL** of **reacted solution** to small glass tube 'B' (over white circles on colour chart).
11. Move the plastic frame along until the two colours match. Record the mg/L value above the closest matching circles.

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LAMOTTE DO TITRATION (0-10 mg/L) TESTING INSTRUCTIONS

Equipment required: LaMotte DO kit (glass sample bottle, glass titration vial, direct titration syringe, alkaline potassium iodide azide, mangenous sulphate, sulphuric acid, starch indicator, thiosulphate), gloves and safety goggles.

IMPORTANT NOTES: Wear gloves to undertake this test. The reaction takes place in the glass reaction bottle. Waste can be disposed of down a sink connected to the sewage system, with lots of water.

1. Rinse the glass sample bottle with sample water 3 times.
2. To fill the glass sample bottle: Submerge glass sample bottle in sample water (directly from the waterway or from a bucket). Place the lid on the glass sample bottle whilst bottle is submerged making sure there are no air bubbles present in the sample.
3. Remove the glass reaction bottle lid and add **8 drops** of reagent **Mangenous Sulphate**.
4. Immediately afterward, add **8 drops** of reagent **Alkaline Potassium Iodide Azide**.
5. Replace lid of glass reaction bottle and invert gently to mix. The sample will turn a brownish yellow colour and look curdled.
6. Wait one minute until the curdles drop below the shoulder of the bottle.
7. Remove the glass reaction bottle lid and add **8 drops** of reagent **Sulphuric Acid**.

8. Replace the glass reaction bottle lid and invert to mix gently. Mix until all flakes have dissolved and the solution is a clear golden brown. Add several extra drops of Sulphuric Acid if flakes haven't dissolved after 5 minutes.
9. Decant 20ml of golden solution into glass titration vial. 20ml is marked on the side of the vial.
10. Add **8 drops** of reagent **Starch Indicator**. Solution will turn a purple/black colour. Place cap on the titration vial. (It is a snap on cap with a hole in the middle)
11. Fill direct read titrator (syringe) with reagent **Thiosulphate** until the barrel of the syringe is on the 0 mark.
12. Insert the syringe into the hole in the cap of the titration vial. Slowly add thiosulphate a few drops at a time to the back/purple solution making sure to mix after every addition.
13. As the solution clears, slow the addition of thiosulphate until you are only adding a drop at a time. Mix after every drop. Stop when the solution is completely clear with no trace of purple left. Read off how much thiosulphate was added and record as mg/L DO.

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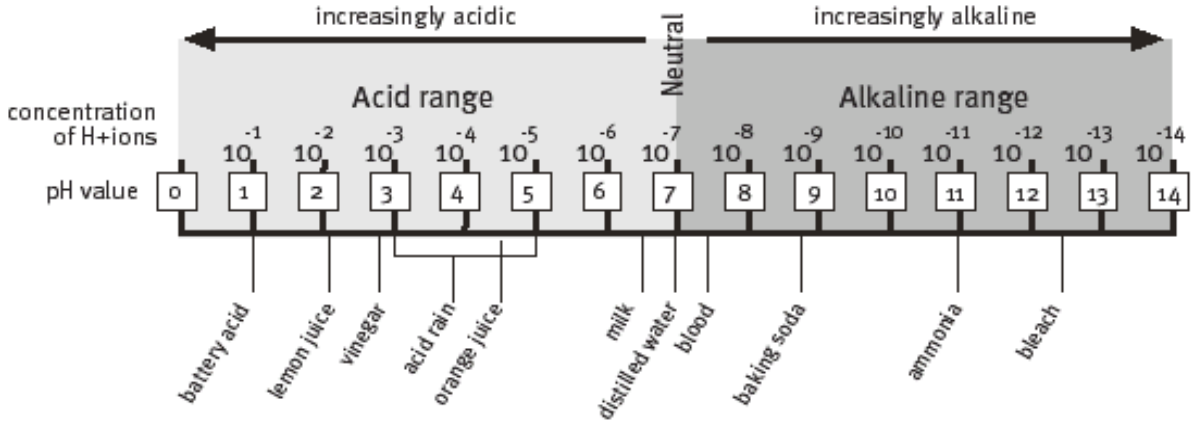
pH – ACIDS AND ALKALINES

The pH of our waterways is a measure of how acidic or alkaline (basic) the water is on a scale of 1 to 14. Water contains both H^+ and OH^- ions and the pH is a measure of the hydrogen ion (H^+) concentration. Pure distilled water contains an equal number of H^+ and OH^- ions and has a neutral pH (7). A pH measurement between 0 and 7 means that the water is acidic and contains more H^+ ions than OH^- ions. Measurements from 7 to 14 indicate alkalinity and the water contains more OH^- ions than H^+ ions.



The pH of a waterway naturally depends on the geology and soils of the catchment. Aquatic plants and animals are adapted to the natural pH range of their stream habitat. Human activities, such as stormwater, industrial and agricultural runoff can alter the pH of a waterway and impact upon aquatic ecosystems. In general a pH range of 6.5-8.2 appears to provide protection for the life of fresh water fish and bottom dwelling macro-invertebrates.

pH changes with…

drought	increase in dissolved oxygen
industrial and agricultural runoff	stormwater and vehicle pollution
animal excretion	soil and geology of the area

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pH changes alter the natural...

functioning of plants and animals

pH changes may indicate...

input of soaps and detergents and other stormwater fed pollutants	agricultural and industrial runoff
high levels of animal excretion	changes in levels of dissolved oxygen and salt

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EUTECH pH SCAN2 (1-14) TESTING INSTRUCTIONS

Equipment required: pH probe, water sample bottle and beaker.

IMPORTANT NOTES: Pour water from your sample bottle into a rinsed beaker for testing. Insert only the tip of your pH meter into the water.

1. Remove cap and press ON/OFF button on the keypad to turn on the pH Scan2.
2. Dip the electrode about 2 cm into the test solution.
3. Stir once and let the display stabilise for 2 minutes.
4. Press HOLD/CON button if you wish to hold the reading. Press again to release.
5. Press the ON/OFF button to shut off.

EUTECH pH SCAN2 (1-14) CALIBRATION INSTRUCTIONS

Equipment required: pH probe, pH buffer 7 (rinse and final), pH buffer 4 (rinse and final), pH buffer 10 (rinse and final) and calibration record sheet.

1. Press ON/OFF button to power on.

2. Start with pH 7 buffer. Immerse electrode in chosen buffer about 2 cm deep and stir gently. Wait for 2 minutes for the displayed value to stabilise at or near the pH buffer chosen. Write the un-calibrated pH value on the calibration record sheet.
3. Next, press the CAL button to enter calibration sequence. When display flashes continuously, press HOLD/CON button to confirm.
4. If necessary, proceed to next buffer value (pH 4 or pH 10) and repeat the calibration procedure.

EUTECH pH TESTR10 (1-14) TESTING INSTRUCTIONS

Equipment required: pH probe, water sample bottle and beaker.

IMPORTANT NOTES: Pour water from your sample bottle into a rinsed beaker for testing. Insert only the tip of your pH meter into the water.

1. Calibrate meters according to manufacturer's instructions if necessary.
2. Turn pH meter to ON.
3. Swirl the meter in the sample water for up to 2 minutes until reading is stable.
4. Record result and turn meter OFF.

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EUTECH pH TESTR10 (1-14) CALIBRATION INSTRUCTIONS

Equipment required: pH probe, pH buffer 7 (rinse and final), pH buffer 4 (rinse and final), pH buffer 10 (rinse and final) and calibration record sheet.

1. Press ON/OFF button to switch unit on.
2. Dip electrode about 2 to 3 cm into the pH standard buffer solution. Start with pH 7.
3. Press the CAL button to enter calibration mode. The 'CAL' indicator will be shown. The upper display will show the measured reading based on the last calibration while the lower display will indicate the pH standard buffer solution. **Note:** All testers have dual display during calibration mode **Note:** To abort calibration, press the 'CAL' button.
4. Allow about 2 minutes for the tester reading to stabilize. Write the un-calibrated pH value on the calibration record sheet.
5. Press the HOLD/ENT button to confirm the first calibration point. The upper display will be calibrated to the pH standard buffer solution and the lower display will then be toggling in between readings of the next pH standard buffer solutions.
6. Repeat with other buffers if necessary. Rinse electrode in distilled water before dipping into next buffer.

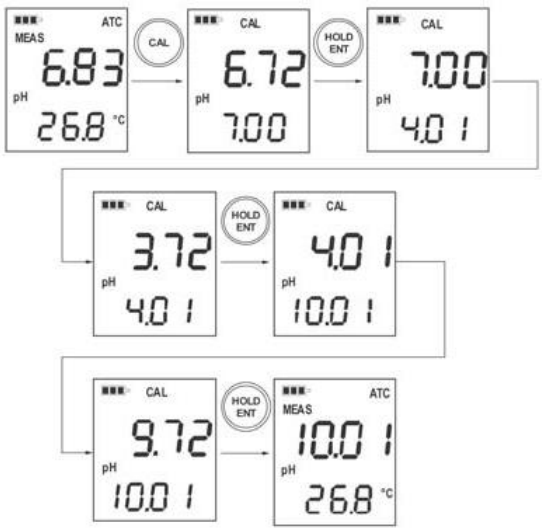

Figure 1: Eutech pH Testr10 Calibration

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EUTECH pH TESTR20 (1-14) TESTING INSTRUCTIONS

Equipment required: pH probe, water sample bottle and beaker.

IMPORTANT NOTES: Pour water from your sample bottle into a rinsed beaker for testing. Insert only the tip of your pH meter into the water.

1. Calibrate meters according to manufacturer's instructions if necessary.
2. Turn pH meter to ON.
3. Swirl the meter in the sample water for up to 2 minutes until reading is stable.
4. Record result and turn meter OFF.

EUTECH pH TESTR20 (1-14) CALIBRATION INSTRUCTIONS

Equipment required: pH probe, pH buffer 7 (rinse and final), pH buffer 4 (rinse and final), pH buffer 10 (rinse and final) and calibration record sheet.

1. Press ON/OFF button to switch unit on.
2. Dip electrode about 2 to 3 cm into the pH standard buffer solution. You should always begin calibration with buffer 7.
3. Press the CAL button to enter calibration mode. The 'CAL' indicator will be shown. The upper display will show the measured reading based on the last calibration while the lower display will indicate the pH standard buffer solution. **Note:** All testers have dual display during calibration mode **Note:** To abort calibration, press the 'CAL' button.
4. Allow about 2 minutes for the tester reading to stabilize. Write the un-calibrated pH value on the calibration record sheet.
5. Press the HOLD/ENT button to confirm the first calibration point. The upper display will be calibrated to the pH standard buffer solution and the lower display will then be toggling in between readings of the next pH standard buffer solutions.
6. Repeat with other buffers if necessary. Rinse electrode in distilled water before dipping into next buffer.

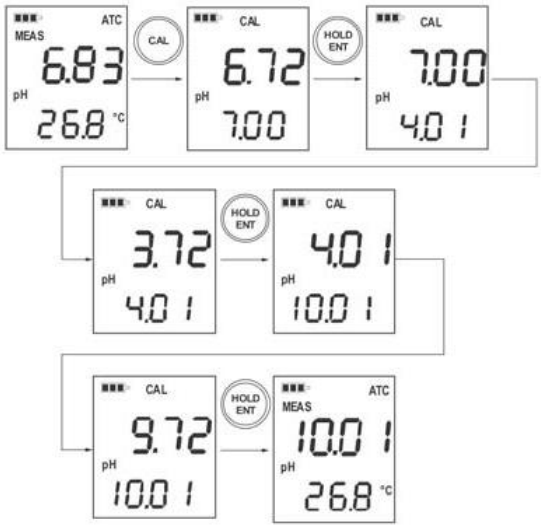

Figure 1: Eutech pH Testr10 Calibration

EUTECH ECO SCAN2 (1-14) TESTING INSTRUCTIONS

Equipment required: pH probe, water sample bottle and beaker.

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IMPORTANT NOTES: Pour water from your sample bottle into a rinsed beaker for testing. Insert only the tip of your pH meter into the water.

1. Calibrate meters according to manufacturer's instructions if necessary.
2. Turn pH meter to ON.
3. Swirl the meter in the sample water for up to 2 minutes until reading is stable.
4. Record result and turn meter OFF.

EUTECH ECO SCAN2 (1-14) CALIBRATION INSTRUCTIONS

Equipment required: pH probe, pH buffer 7 (rinse and final), pH buffer 4 (rinse and final), pH buffer 10 (rinse and final) and calibration record sheet.

1. Press ON to turn on the tester.
2. Start with pH 7.00 buffer. Dip sensor in 20 mm of standard solution, stir gently and wait for 2 minutes for the value to stabilise at or near pH 7. Write the un-calibrated pH value on the calibration record sheet.
3. Press CAL to enter the calibration sequence. Display flashes CAL momentarily, then shows a flashing default reading.
4. To confirm calibration, press HOLD/ENT and wait for the auto confirmation.
5. To obtain your second and third calibration points, proceed to the next buffer value (pH 4.00 or pH 10.00) and repeat.
6. To abort calibration, press CAL to escape.

EUTECH PC TESTR35 MULTIPARAMETER (1-14) TESTING INSTRUCTIONS

Equipment required: pH probe, water sample bottle and beaker.

1. Calibrate meters according to manufacturer's instructions if necessary.
2. Turn pH meter to ON.
3. Swirl the meter in the sample water for up to 5 minutes until reading is stable.
4. Record result and turn meter OFF.

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EUTECH PC TESTR35 MULTIPARAMETER (1-14) CALIBRATION INSTRUCTIONS

Equipment required: pH probe, pH buffer 7 (rinse and final), pH buffer 4 (rinse and final), pH buffer 10 (rinse and final) and calibration record sheet.

1. Press ON/OFF to turn meter on and MODE/ENT to select pH mode.
2. Rinse the meter in the pH rinse. The rinse is made up of the pH buffer solution that you intend to calibrate. You should always begin calibration with buffer 7.
3. Immerse the sensor into another beaker with the pH buffer, swirl gently and allow 2 minutes for the reading to stabilise.
4. The primary display will show the un-calibrated pH value, while the secondary display should search for and lock on the closest automatic calibration value. Write the un-calibrated pH value on the calibration record sheet.
5. Press ▲/CAL.
6. Allow the primary display to stabilise, then press MODE/ENT to confirm the calibration value. The primary value will blink briefly before the secondary value automatically scrolls through the remaining pH buffers available for calibration.
7. Rinse the sensor with distilled water.
8. Repeat steps 2 & 3 with additional buffers or press ▲/CAL to return to measurement mode.

ELECTRICAL CONDUCTIVITY

Electrical Conductivity is the amount of dissolved salts (ions) in the water. The types of salts may include chlorides, sulphates, carbonates, sodium, magnesium, calcium and potassium. These salts enter the waterway through run off from rocks and soils of a catchment. The soils and geology of the waterways catchment normally determine salinity, however human activities can drastically increase salinity levels. Salty water conducts electricity more readily than pure water; therefore salinity is measured as electrical conductivity (EC).

Electrical Conductivity varies naturally with the depth of the water. Variations in conductivity may also be the result of the geology of the area, ground water seepage, industrial and agricultural effluent, stormwater runoff, land clearing and sewage effluent.

Salinity problems arise through the removal of deep-rooted vegetation and through poor irrigation practices. This results in more water infiltrating the soil, causing the water table to rise. This water can move towards the surface, bringing large amounts of salt from the underground storage. When the water evaporates it leaves behind the high concentration of salt, which eventually finds its way into the watercourses.

ELECTRICAL CONDUCTIVITY changes with…

drought	soil and geology of the area
proximity to estuary outlet	amount of vegetation in catchment

ELECTRICAL CONDUCTIVITY changes alter the natural…

functioning of plants and animals	growth and survival of plants and animals

Physical/Chemical Training Manual

ELECTRICAL CONDUCTIVITY increases may indicate…

Excessive loss of catchment vegetation	
Industrial or agricultural pollution	Rising groundwater (salinity issues)

EUTECH EC TESTR10 LOW (0-1990 µS/cm) TESTING INSTRUCTIONS

Equipment required: EC probe, water sample bottle and beaker.

IMPORTANT NOTES: Pour water from your sample bottle into a rinsed beaker for testing. Insert only the tip of your EC meter into the water.

1. Calibrate meters according to manufacturer's instructions.
2. Turn EC meter to ON.
3. Swirl the meter in the sample water until reading is stable.
4. Record result, and units (as written on the EC meter) and turn meter OFF.

EUTECH EC TESTR10 LOW (0-1990 µS/cm) CALIBRATION INSTRUCTIONS

Equipment required: EC probe, EC solution 1413 µS/cm (rinse and final) and calibration record sheet.

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Manual calibration only, use low range use buffer solution 1413 µS/cm. To begin manual calibration:

1. Switch on the tester.
2. Unscrew the cap on the top of the probe. Press INC or DEC key to enter calibration mode. See Figure 1.
3. Rinse the electrode with the calibration standard that you intend to calibrate and then dip the electrode in the other beaker with same calibration standard. Swirl gently to create a homogenous sample and allow time for the reading to stabilise. The 'CAL' indicator appears in LCD. The display briefly shows 'CAL'
4. Place the meter in the solution, swirl gently to create a homogenous sample. Write the un-calibrated reading on the calibration record sheet.
5. Use INC and DEC keys to adjust the display to the correct conductivity value of the calibration solution.
6. Wait for 5 seconds for the tester to automatically confirm the calibration by flashing three times on the display and return to the measurement mode.
7. Rinse the probe with distilled water.

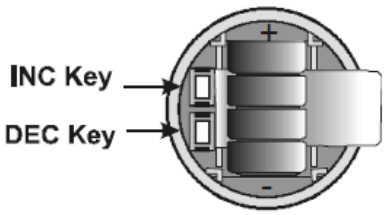

Figure 1: Battery compartment

EUTECH EC TESTR10 HIGH (0-19,900 µS/cm) TESTING INSTRUCTIONS

Equipment required: EC probe, water sample bottle and beaker.

Physical/Chemical Training Manual

IMPORTANT NOTES: Pour water from your sample bottle into a rinsed beaker for testing. Insert only the tip of your EC meter into the water.

1. Calibrate meters according to manufacturer's instructions.
2. Turn EC meter to ON.
3. Swirl the meter in the sample water until reading is stable.
4. Record result, and units (as written on the EC meter) and turn meter OFF.

EUTECH EC TESTR10 HIGH (0-19,990 µS/cm) CALIBRATION INSTRUCTIONS

Equipment required: EC probe, EC solution 12.88 mS/cm (rinse and final) and calibration record sheet.

Manual calibration only, use low range use buffer solution 1413 µS/cm. To begin manual calibration:

1. Switch on the tester.
2. Unscrew the cap on the top of the probe. Press INC or DEC key to enter calibration mode. See Figure 1.
3. Rinse the electrode with the calibration standard that you intend to calibrate and then dip the electrode in the other beaker with same calibration standard. Swirl gently to create a homogenous sample and allow time for the reading to stabilise.
4. The 'CAL' indicator appears in LCD. The display briefly shows 'CAL'
5. Place the meter in the solution, swirl gently to create a homogenous sample. Write the un-calibrated reading on the calibration record sheet.
6. Use INC and DEC keys to adjust the display to the correct conductivity value of the calibration solution.
7. Wait for 5 seconds for the tester to automatically confirm the calibration by flashing three times on the display and return to the measurement mode.
8. Rinse the probe with water.

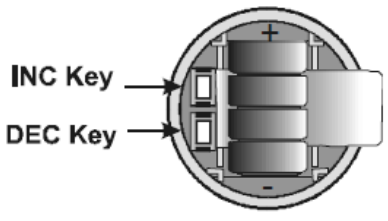

Figure 1: Battery compartment

Physical/Chemical Training Manual

EUTECH EC TESTR11 DUAL RANGE (0-20,000 µS/cm) TESTING INSTRUCTIONS

Equipment required: EC probe, water sample bottle and beaker.

IMPORTANT NOTES: Pour water from your sample bottle into a rinsed beaker for testing. Insert only the tip of your EC meter into the water.

1. Calibrate meters according to manufacturer's instructions.
2. Turn EC meter to ON.
3. Swirl the meter in the sample water until reading is stable.
4. Record result, and units (as written on the EC meter) and turn meter OFF.

Physical/Chemical Training Manual

EUTECH EC TESTR11 DUAL RANGE (0-20,000 µS/cm) CALIBRATION INSTRUCTIONS

Equipment required: EC probe, EC solution 1413 µS/cm (rinse and final), EC solution 12.88 mS/cm (rinse and final) and calibration record sheet.

To begin automatic calibration:

1. Switch on the tester. Unscrew the cap on the top of the meter. Press INC or DEC key to enter calibration mode. See Figure 1.
2. 'CAL' indicator appears in LCD. The display briefly shows 'CAL' and the number of points the tester will be calibrated.
3. The upper display shows the conductivity reading and the lower display sequentially shows calibration standard values 1413 µS & 12.88 mS if the measuring range of the tester is set to AUTO.
4. Rinse the electrode with the calibration standard that you intend to calibrate and then dip the electrode in the other beaker with same calibration standard. Swirl gently to create a homogenous sample and allow time for the reading to stabilise. Write the un-calibrated reading on the calibration record sheet.
5. Press HOLD/ENT key to confirm the calibration. LCD shows 'CO' for 2 seconds. The calibration is complete and the tester returns to measurement mode.

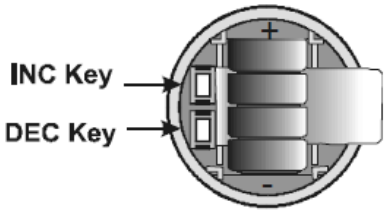

Figure 1: Battery compartment

EUTECH PC TESTR35 MULIPARAMETER (0-20,000 µS/cm) TESTING INSTRUCTIONS

Equipment required: EC probe, water sample bottle and beaker.

Physical/Chemical Training Manual

IMPORTANT NOTES: Pour water from your sample bottle into a rinsed beaker for testing. Insert only the tip of your EC meter into the water.

1. Calibrate meters according to manufacturer's instructions.
2. Press ON/OFF to turn meter on and MODE/ENT to toggle between pH mode and conductivity mode.
3. Immerse the sensor into the water sample
4. Swirl the meter in the sample water until reading is stable.
5. Record result and units (as written on the EC meter), and press ON/OFF to turn meter off.

EUTECH PC TESTR35 MULIPARAMETER (0-20,000 µS/cm) CALIBRATION INSTRUCTIONS

Equipment required: EC probe, EC solution 1413 µS/cm (rinse and final), EC solution 12.88 mS/cm (rinse and final) and calibration record sheet.

1. Press ON/OFF to turn meter on and MODE/ENT to select conductivity mode as needed.

2. Rinse the meter with the calibration standard that you intend to calibrate and then dip the electrode in the other beaker with same calibration standard. Swirl gently to create a homogenous sample and allow time for the reading to stabilise.
3. Immerse the sensor in your standard and press ▲/CAL. The primary display will show the un-calibrated value, while the secondary display should search for and lock on the closest automatic calibration value.
4. Allow the primary display to stabilise. Write the un-calibrated reading on the calibration record sheet.
5. Press MODE/ENT to confirm the calibration value. The primary value will blink briefly before returning to measurement mode.
6. Rinse the sensor with distilled water.
7. Repeat steps 2 & 3 with additional buffers or press ▲/CAL to return to measurement mode.

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PHOSPHATE

Phosphorus is a nutrient that occurs naturally at low levels in water and is essential for all forms of life. Phosphorus comes from processes such as the weathering of rocks and from the decomposition of organic matter such as plants. Phosphorus concentrations vary naturally depending on the local soil type, geology and seasonal conditions. Phosphorus is present in streams as soluble phosphates, in soil bound to clay particles and in living organisms such as algae.

Increases in phosphorus levels in waterways may result from erosion, sewage leaks, detergents, urban stormwater and rural runoff containing fertilisers and animal and plant material. Phosphate stimulates growth of plankton and aquatic plants, providing food for aquatic macro-invertebrates and fish. Algae and aquatic plants prosper with an excess of phosphate, which often enters waterways through human activity. This excess plant matter encourages bacterial growth, which uses up dissolved oxygen and can lead to anoxic (without oxygen) conditions.

PHOSPHORUS changes with…

geology of soils	presence of plants and animals

PHOSPHORUS increases alter the natural…

cellular and body functioning of animals and plants	rates of growth of plants, bacteria and animals

PHOSPHORUS increases may indicate…

inputs of nutrient pollutants (stormwater, industry or agriculture or sewage)	over production of algae in waterway
higher levels of turbidity (suspended particles)	lowering levels of dissolved oxygen

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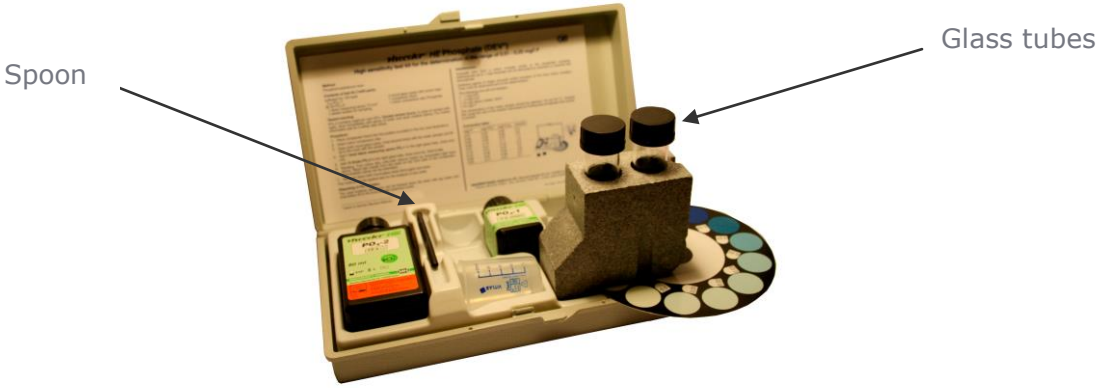
VISOLCOLOR HE PHOSPHATE LOW RANGE (0.0-0.25 mg/L) TESTING INSTRUCTIONS

Equipment required: Visocolor low range phosphate kit, gloves and safety goggles.



IMPORTANT NOTES: Wear gloves to undertake this test. Waste can be disposed of down a sink connected to the sewage system, with lots of water.

1. Place test tube in grey block and insert colour chart (as above).
2. Rinse the glass tubes three times with sample water.
3. Fill both glass tubes with sample water to the black line.
4. Replace the lid of the glass tube over the blue circles. This tube is shown on the left in the picture above. This is our control sample and will not have any chemicals added to it.
5. Remove the lid of the test tube over the white (shown on the right in the picture above) and add **1 spoon full** of reagent '**PO_4 -1'**. Shake to dissolve powder.
6. Immediately afterward, add **15 drops** of reagent '**PO_4 -2'.**
7. Replace lid of glass tube and invert to mix.
8. Wait 5 minutes.
9. Remove lids from both glass tubes.
10. Look down the tubes and turn the colour chart until the two colours match.
11. When colours are matched as close as possible your result will be found in the groove on the side of the grey block.
12. Record your result in mg/L.

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VISOCOLOR HE PHOSPHATE HIGH RANGE (0.05 - 1.0 mg/L) TESTING INSTRUCTIONS

Equipment required: Visocolor high range phosphate kit, gloves and safety goggles.

IMPORTANT NOTES: Wear gloves to undertake this test. Waste can be disposed of down a sink connected to the sewage system, with lots of water.

1. Place comparator block into the position provided in the box (see illustration).
2. Insert colour comparison disc.
3. Open both round glass tubes, rinse three times with the water sample and fill up to the mark with the sample.
4. Add **6 drops** of **P-1** to the right glass test tube, close and mix.
5. Add **6 drops** of **P-2** to the right glass test tube, close and mix. **Wait 10 min**.
6. Reading: Turn colour disc until both colours match by transmitted light from above. Read test results from the mark on the front side of the comparator. Record your result.
7. After use clean both round glass tubes thoroughly and close.

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LAMOTTE PHOSPHATE (ASCORBIC ACID REDUCTION METHOD) (0-70 ppm) TESTING INSTRUCTIONS

Equipment required: Smart colorimeter, La Motte phosphate kit, gloves and safety goggles.

IMPORTANT NOTES: Wear gloves to undertake this test. Waste can be disposed of down a sink connected to the sewage system, with lots of water.

1. Rinse two glass vials **three times** with **sample water**.
2. Fill both glass vials with sample water to the line
3. Replace the lid of one of the glass vials. Wipe the outside dry with a clean cloth. This tube is the blank and nothing is added to it.
4. Into the other glass vial add **1ml** of **Phosphate Acid Reagent** (using syringe or dropper) and **1 spoon full** of **Phosphate Reducing Reagent**. Be careful to keep spoon and powder dry as it will clag up easily and destroy the chemical.
5. Replace lid of glass tube and invert to mix until powder is dissolved. Dry outside of tube with soft clean cloth.
6. **Wait 5 minutes**. Warm the tube if the water temperature is below 18°C.
7. Switch on colorimeter and follow menu to **PHOSPHATE LR** test.
8. Insert and read blank
9. Remove blank and insert test vial. Read.
10. Record your result in mg/L PO4.

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IMPORTANT NOTES: Wipe glass vials with a soft cloth and ensure they are dry before placing into the colorimeter.

ECO PHOSPHATE (0-5 mg/L) TESTING INSTRUCTIONS

Equipment required: Eco phosphate test kit, gloves and safety goggles.

IMPORTANT NOTES: Wear gloves to undertake this test. Waste can be disposed of down a sink connected to the sewage system, with lots of water.

1. Pour a **5 ml** water sample into each of the measuring glasses using the plastic syringe.
2. Place a measuring glass on **position A** in the comparator.
3. Add **6 drops** of **PO4-1** to measuring **glass B**, seal the glass and mix.
4. Add **6 drops** of **PO4-2** to measuring **glass B**, seal the glass and mix.
5. Open the glass after **10 min** and place it on **position B** in the comparator.
6. Slide the comparator until the colours match in the inspection hole on top. Check the measurement reading in the recess on the comparator reed. Mid-values can be estimated.
7. After use, rinse out both measuring glasses thoroughly and seal them.

AMMONIUM

Nitrogen is a nutrient that occurs naturally in the environment and is essential for all living things. Nitrogen originates from the atmosphere and weathering of rocks, but few organisms can use atmospheric nitrogen, rather they use compounds with nitrogen in them, such as ammonium. Ammonium is one form of nitrogen that occurs in water and it cycles between ammonia (a toxic form) and nitrate and nitrite (often referred to as NOx). Ammonium comes from the weathering of rocks and breakdown of organic material, however human activities can drastically increase levels.

Ammonium varies naturally with pH and oxygen. Decreasing oxygen levels result in more NOx converting to ammonia/um, while increasing pH results in more ammonia.

Ammonium problems arise through the discharge of sewage and fertilizer runoff. High levels can result in excess algal and plant growth, which can lead to algal blooms, particularly in the marine environment.

AMMONIUM changes with…

Oxygen availability	pH level

AMMONIUM changes alter the natural…

Algal and plant growth	May indirectly affect oxygen through excessive plant respiration of a night

AMMONIUM increases may indicate…

Human impacts from sewage or fertilizer	
Animal wastes	Can be transported through groundwater

VISOCOLOR HE AMMONIUM (0.0-0.5 mg/L) TESTING INSTRUCTIONS

Equipment required: Visocolor HE ammonium test kit, gloves and safety goggles.

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IMPORTANT NOTES: Wear gloves to undertake this test. Waste can be disposed of down a sink connected to the sewage system, with lots of water.

1. Rinse two glass test tubes **three times** with **sample water**.
2. Place comparator block into the position provided in the box (see illustration).
3. Insert colour comparison disc.
4. Open both round glass test tubes and fill up to the mark with sample water.
5. Add **10 drops** of **NH4-1** to the right glass test tube, close and mix.
6. Add **1 level measuring spoon** of **NH4-2** to the right glass tube, close and mix. **Wait 15 min**.
7. Reading: Turn colour disc until both colours match by transmitted light from above. Read test results from the mark on the front side of the comparator. Record your result.
8. After use clean both round glass tubes thoroughly and close.

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LAMOTTE AMMONIUM (NESSLERIZATION METHOD) (0-3 ppm) TESTING INSTRUCTIONS

Equipment required: Smart colorimeter, LaMotte Ammonium test kit, gloves and safety goggles.

IMPORTANT NOTES: Wear gloves to undertake this test. Waste can be disposed of down a sink connected to the sewage system, with lots of water.

1. Press and hold ON button until colorimeter turns on.
2. Press ENTER to start.
3. Press ENTER to select **TESTING MENU**.
4. Scroll to and select ALL TESTS (or another sequence containing 5 Ammonia-N H) from **TESTING MENU**.
5. Scroll to and select 5 Ammonia-N H from menu.
6. Rinse a clean tube with sample water. Fill to the **10 mL** line with **sample water**.
7. Insert tube into chamber, close lid and select **SCAN BLANK**.
8. Remove tube from colorimeter. Add **8 drops** of **Ammonia Nitrogen Reagent #1**. Cap and mix. **Wait 1 minute**.
9. Use the 1.0 mL pipet to add **1.0 mL** of **Ammonia Nitrogen Reagent #2**. Cap and mix. Allow **5 minutes** for maximum colour development.

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10. At end of the 5 minute waiting period, immediately mix, insert tube into chamber, close lid and select **SCAN SAMPLE**. Record result.
11. Press OFF button to turn the colorimeter off or press the EXIT button exit to a previous menu or make another menu selection.

IMPORTANT NOTES: Wipe glass vials with a soft cloth and ensure they are dry before placing into the colorimeter.

CALCULATIONS:

To express results as Unionized Ammonia (NH3):

ppm Unionized Ammonia (NH3) = ppm Ammonia-Nitrogen (NH3–N) x 1.2

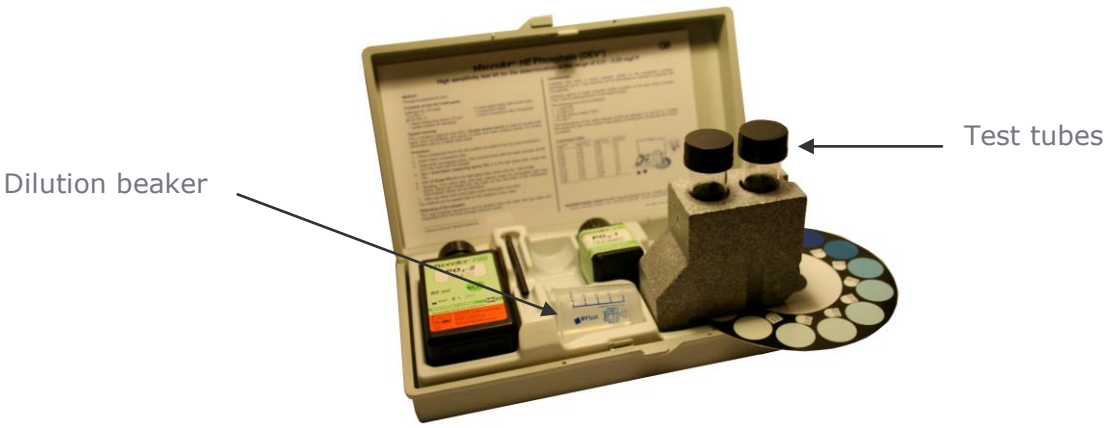
To express results as Ionized Ammonia (NH4):

ppm Ionized Ammonia (NH4+) = ppm Ammonia-Nitrogen (NH3–N) x 1.3

Physical/Chemical Training Manual

Diluting a Visocolor Phosphate or Ammonium Sample

Equipment required: Visocolor Phosphate or Ammonium kit, gloves and safety goggles.



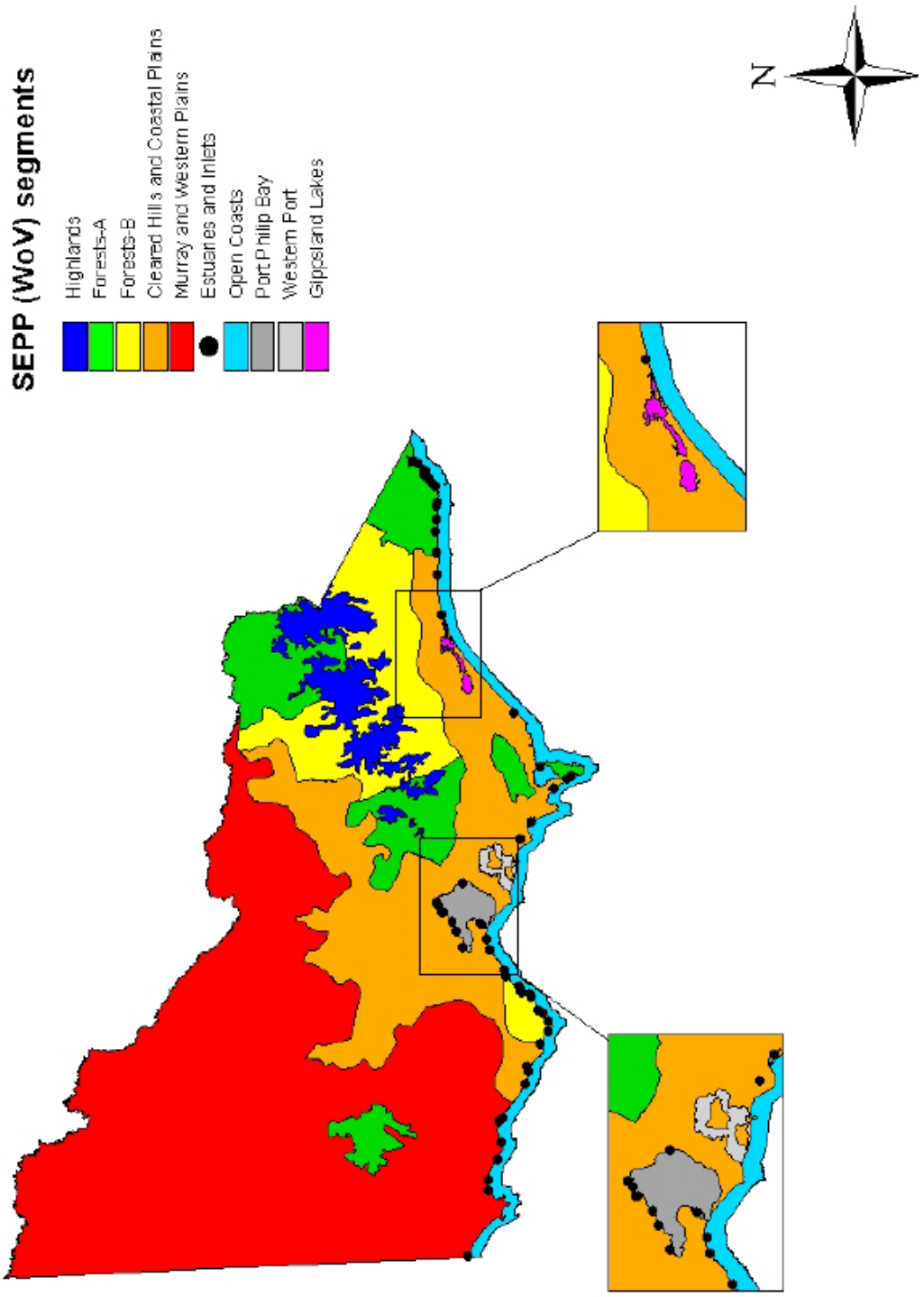
IMPORTANT NOTES: Wear gloves to undertake this test. Waste can be disposed of down a sink connected to the sewage system, with lots of water.

When your result in the VISOCOLOR kits (ammonium or phosphate) is higher / darker than the kit allows, you need to 'dilute the sample' by making a 'diluted solution', testing it, and doubling the result.

1. Fill your kit's beaker with **half your creek sample** and **half distilled (de-ionised) water** (you can get this at a supermarket or petrol station).
2. Rinse your test tubes **three times** with **sample water**.
3. Dry tubes.
4. Follow kit instructions to test for phosphate again using this **'diluted solution' in both test tubes** instead of straight sample water.
5. Whatever result you get, multiply it by **two**. Record this. It is your 'real' answer.
6. If it is still too high, repeat again using a 'diluted solution' and multiply your result by **four**.

Physical/Chemical Training Manual

SEPP Segments



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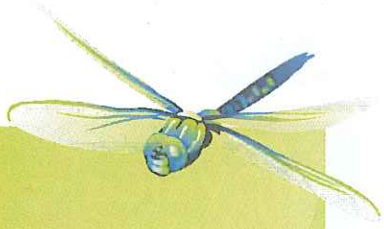

Physical and Chemical Analysis Data Form

Waterwatch Melbourne Physical and Chemical Analysis

Monitoring site details

Site code:

Site description:

Name of monitoring group

Persons monitoring:

Date and time of monitoring:

Please record your data below:

Parameter	Reading	Comments
Air Temperature	**° C**	
Water Temperature	**° C**	
Turbidity	**NTU**	
pH	**Unit**	
Conductivity	**µ S / cm**	
Dissolved Oxygen	**mg / L**	**% Saturation**
Phosphate (If using Lamotte Smart2 Colorimeter multiply by 0.326 to calculate mg/L)	**mg / L**	
Ammonium	**mg / L**	
Nitrate	**mg / L**	

Observations and Notes:

What has changed since last time you monitored?

What stands out about the site today?

Other observations:

Melbourne Water

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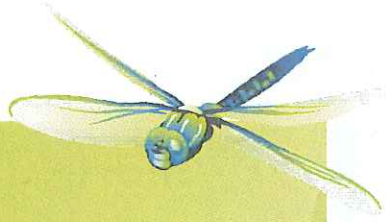


Physical and Chemical Analysis Data Form

Waterway Information

Rate of flow:

☐ Very fast ☐ Fast ☐ Normal base flow ☐ Slow ☐ Trickle
☐ None ☐ Permanent ☐ Temporary ☐ Other

If 'Other', please specify:

Type of flow:

☐ Rising ☐ Steady ☐ Falling ☐ Peak ☐ Dry ☐ Pools / Puddles ☐ Other

If 'Other', please specify:

Waterway Appearance:

☐ Clear ☐ Muddy ☐ Smelly ☐ Frothy ☐ Scummy
☐ Oily ☐ Discoloured ☐ Milky ☐ Stained brown ☐ Other

If 'Other', please specify:

Waterway depth: _____**cm** (0 to 3000cm)
Waterway width: _____**m** (0 to 100m)

Weather:

☐ Sunny ☐ Cloudy ☐ Overcast ☐ Showers ☐ Rain
☐ Hail ☐ Windy ☐ Foggy ☐ Other

If 'Other', please specify:

Last rainfall:

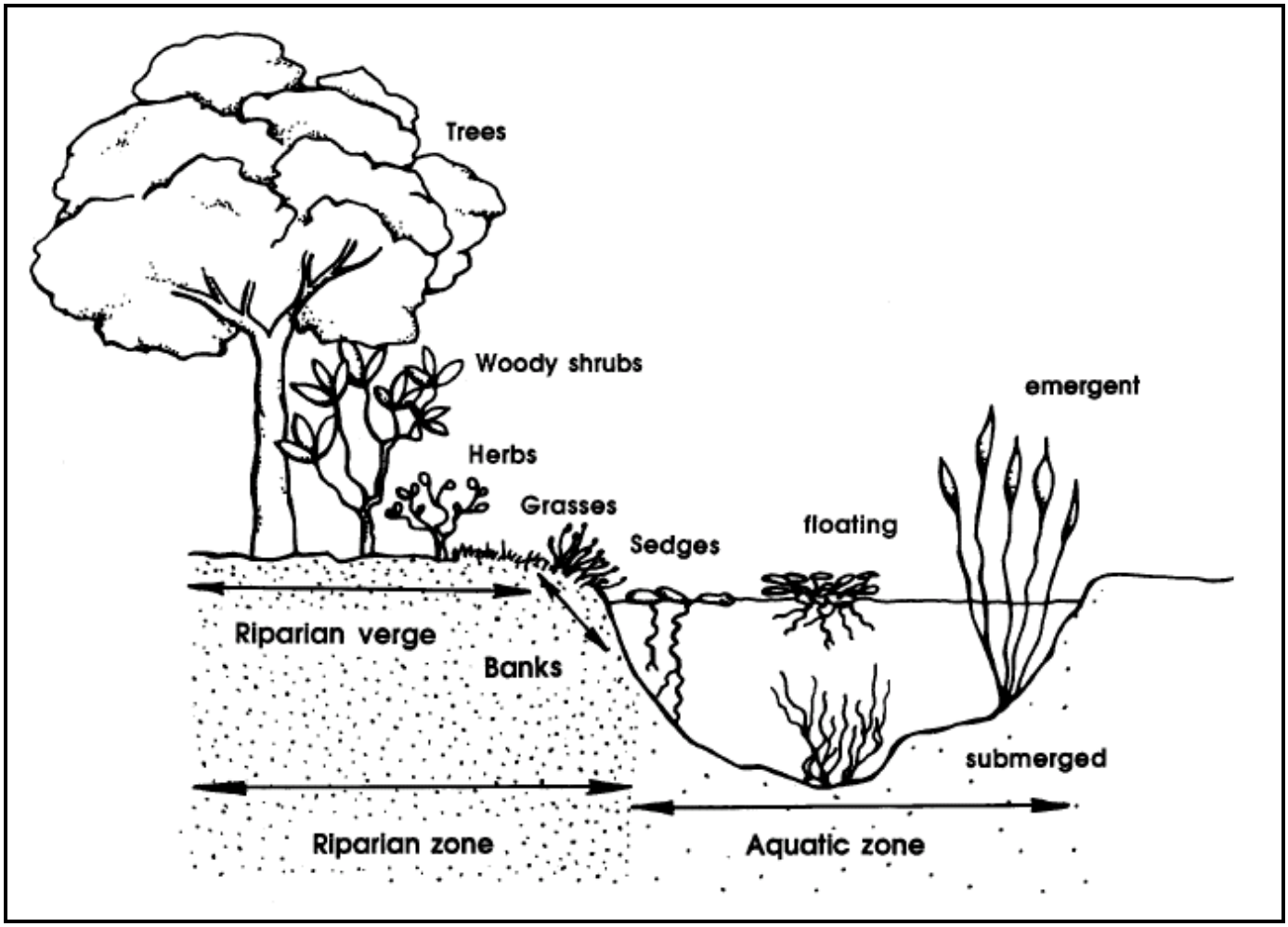
☐ Raining now ☐ Last 24hrs ☐ Last 3 days ☐ Last 7 days ☐ More than a week ago

Litter / Pollutants (record no.):

___ Cans ___ Paper ___ Clothing ___ Oil (m^2)
___ Food Packets ___ Plastic ___ Polystyrene ___ Car bodies
___ Waxed Cardboard ___ Bottles ___ Petrol/Diesel (m^2) ___ Other (specify)

Melbourne Water

Habitat Theory Cross Section Diagram



Waterwatch Program

Habitat Data Form

Observation Information

Monitoring site details

Site code:

Site description:

Name of monitoring group

Persons monitoring:

Date and time of monitoring:

Habitat Assessment

Bank vegetation: _____ (0-10)

Verge vegetation: _____ (0-10)

In-stream cover: _____ (0-10)

Bank erosion and stability: _____ (0-5)

Riffles, pools and bends: _____ (0-5)

Final Habitat Score: _____ (Add your scores)

Score	Definition
Excellent (36-40)	Site in natural or virtually natural condition; excellent habitat condition.
Good (29-35)	Some alteration from natural state; good habitat conditions.
Fair (20-28)	Significant alteration from the natural state but still offering moderate habitat; stable.
Poor (12-19)	Significant alterations from the natural state, with reduced habitat value; may have erosion or sedimentation problems.
Degraded (8-11)	Very degraded, often with severe erosion or sedimentation problems.

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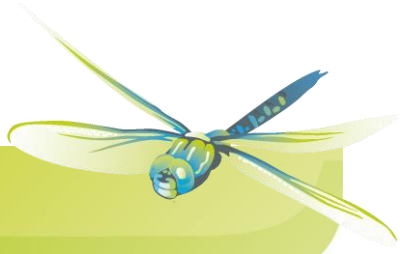
Habitat Data Form

Bank vegetation				
(10) Mainly undisturbed native vegetation. No signs of site alteration.	(8) Mainly native vegetation. Little disturbance or no signs of recent site disturbance.	(6) Medium cover, mixed native / introduced. Or one side cleared, the other undisturbed.	(4) Introduced ground cover, little native under storey or over storey, predominantly introduced vegetation.	(2) Introduced ground cover with lots of bare ground, occasional tree. Also includes sites with concrete lined channels.
Verge vegetation				
(10) Mainly undisturbed native vegetation on both sides of stream. Verge more than 30m wide.	(8) Well-vegetated wide verge corridor. Mainly undisturbed native vegetation on both sides of stream; some introduced or reduced cover of native vegetation.	(6) Wide corridor of mixed native and exotics, or one side cleared, and other wide corridor of native vegetation.	(4) Very narrow corridor of native or introduced vegetation.	(2) Bare cover or introduced grass cover such as pastureland.
In-stream cover				
(10) Abundant cover. Frequent snags, logs or boulders with extensive areas of in-stream, aquatic vegetation and overhanging bank.	(8) A good cover of snags, logs or boulders, with considerable areas of in-stream and overhanging vegetation.	(6) Some snags or boulders present and / or occasional areas of in-stream or overhanging vegetation.	(4) Only slight cover. The stream is largely cleared, with occasional snags and very little in-stream vegetation. Generally no overhanging vegetation.	(2) No cover. No snags, boulders submerged or overhanging vegetation. No undercut banks. Site may have rock or concrete lining.
Bank erosion and stability				
(5) Stable; no erosion / Sedimentation evident. No undercutting of banks, usually gentle bank slopes, lower banks covered with root mat grasses, reeds or shrubs.	(4) Only spot erosion occurring. Little undercutting of bank, good vegetation cover, usually gentle bank slopes, no significant damage to bank structure.	(3) Localised erosion evident. A relatively good vegetation cover. No continuous damage to bank structure or vegetation.	(2) Significant active erosion evident especially during high flows. Unstable, extensive areas of bare banks, little vegetation cover.	(1) Extensive or almost continuous erosion. Over 50% of banks have some form of erosion; very unstable with little vegetation cover.
Riffles, pools and bends (flowing water only)				
(5) Wide variety of habitats. Riffles and pools present of varying depths. Bends present. Good	(4) Good variety of habitats - e.g., riffles and pools or bends and pools. Variation in depth of riffle and pool.	(3) Some variety of habitats - e.g., occasional riffle or bend. Some variation in depth.	(2) Only slight variety of habitat. All riffle or pool with only slight variation in depth. Very poor	(1) Uniform habitat. Straight stream, all shallow riffle or pool of uniform depth - e.g.; channeled stream or irrigation channel.



Photopoint Monitoring

Photopoint monitoring visually records site changes over time. Melbourne water has developed standards for photopoint monitoring.

Setting up a Photopoint

In deciding where, consider:

- Safe access to the site, both now and in the future.
- The use of landmark features which future pictures can be matched up with which will not change or be hidden - use a particular tree, fence post, range of hills or bend in the drain for a guide.
- Ensure the present and future view from the camera to the point of interest is uncluttered.
- That young tree/shrub vegetation will get taller as it grows and can become a wall of green at the front of your site.
- Photopoints need to taken with the sun behind the camera. Always face south if possible to reduce the potential for too much sunlight and over-exposure of the picture.

Equipment:

- Digital camera or mobile phone with camera
- Hand-held GPS unit (with Waterwatch coordinator at training)
- Site notes - mark roughly on a map the sites of your photopoints, and use an arrow to indicate the direction of the photo(s)
- Tape measure

Directions:

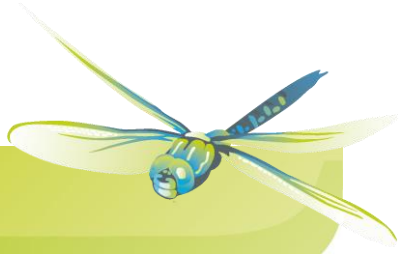
Accurately identify your photopoint for exact repeatability.

- In urban areas it is not possible to install stakes as reference points, so you will need to identify reference points at your site that will not move over time.
- This may be a particular fence post that you stand at each time you take a photograph (camera post).
- You should also include a reference point within the picture that you line the shot up with each time (ie: top of drain).

Taking photos – initial and subsequent visits:

Only take one photo from each photopoint to avoid confusion

- Take the photos on a cloudy but fine day, between the hours of 9am and 3pm, facing south if possible.
- Set camera to record GPS coordinates (if applicable), date stamp “on”, and set to “Auto” setting. Do not use a wide angle or a telephoto lens, as this alters the perspective of the photo and makes it difficult to repeat.



Photopoint Monitoring

- Stand next to the camera post. Position your reference point within the frame (it must be in the same position each time, so make it something easily replicable such as the centre, top or bottom of the image).
- Take a hard copy of the picture(s) with you on future visits to make lining up the shots easier, make sure they are framed in the same manner.
- Have as little "sky" in the shot as possible.

Photo naming convention:

Upon returning to the office, rename your photos according to this convention.

PP_DM_(SITE CODE)_(date (dd/mm/yy)).

If more than one photopoint is active at a site, include the letter P after the date and the number. For example P1, P2, etc.

Example photograph name:

This is the name that would appear on a photo taken on Jacksons Creek (site code MJA850) for a photo taken on January 27, 2009. This particular site has two photopoint monitoring positions and the photo was taken from position 2:

PP_DM_MJA850_270109_P2

Legend for naming conventions:

- PP = Photopoint (to distinguish between non-photopoint photographs).
- DM = Data Monitoring
- P = Position

A Beginners Guide to Identifying Macroinvertebrates

VERY SENSITIVE

Stonefly nymph (Class: Insecta, Order: Plecoptera, Families: 4)

Sensitivity Rating (bug score) = 8

Features

- Are often confused with Mayfly nymphs
- Two long thin tails (caudal filaments)
- Most common family is Gripopterygidae, identified by the tufts between their tails.
- Can undergo 10-25 development stages vefore hatching into fly.
- Herbivores / Detritivores
- Clings to rocks and plants
- Confined to streams due to the need for cool temperatures (5-15°C) for egg development and larval growth and good oxygen levels.
- Primitive and believed to be one of the first insects to develop flight.
- Take up to three years to develop into adults and then only live up to a month.
- Number and diversity rapidly declines at first signs of human disturbance or pollution (in particular reduction in oxygen levels) even at very low levels, therefore good indicator species and one to keep an eye on if found

VERY SENSITIVE

Mayfly nymph (Class: Insecta, Order: Ephemeropters, Families: 7)

Sensitivity Rating (bug score) = 7

Features

- Three long thin tails
- Gills often located along abdomen
- Herbivores / Detritivores/ Predators
- Flattened nymphs live clinging to and scurrying on rocks in fast flowing conditions, rounded nymphs are strong swimmers
- Fishermen tie flies to mimic these.
- Take up to three years to develop into adults and then only live up to a month.
- Some families more tolerant than others but most good indicators of water quality

VERY SENSITIVE

Caddisfly nymph (Class: Insecta, Order: Trichoptera, Families: 26)

Sensitivity Rating (bug score) = 7

Features

- Related to butterflies and moths
- Fake legs (pro-legs) on abdomen
- Often enclosed in a case but some naked!
- Case can be made of sticks, sand, leaves, web, reeds
- Bottom dwellers
- Favourite food of platypus
- Clasps on tail to hold onto house
- Like well vegetated streams with good habitat values for food and shelter.
- Some species are quite tolerant and others are very sensitive to pollutants and human disturbance.

SENSITIVE

Dragonfly nymph (Class: Insecta, Order: Odonata)

Sensitivity Rating (bug score) = 6

Features

- The top-level predator (carnivore) in the bug realm! Eat tadpoles, small fish, insects. Can be cannibals and eat each other.
- Up to 5cm in length
- No external gills
- Hinges bottom jaw with two spikes (labrum) which extends to catch prey
- Breathes by sucking water through its abdomen to move it over its internal gills. Once it has absorbed enough oxygen it releases water by squeezing it out which propels them through the water.
- Moults up to 15 times before it emerges on land as an adult with functional wings
- Sensitive to habitat disturbance.

SENSITIVE

Damselfly nymph (Class: Insecta, Order: Odonata)

Sensitivity Rating (bug score) = 6

Features

- "Cousins" with dragonflies
- More slender abdomen than dragonflies
- Three long gills like leaves attached to end of tail
- Hinges bottom jaw which extends to catch prey
- Moults up to 15 times before it emerges on land as an adult with functional wings
- Sensitive to habitat disturbance.

SENSITIVE

Shrimp, Yabbies, Spiny Crays (Class: Crustacea, Order: Decapoda,)

Sensitivity Rating (bug score) = 5

Features

- 10 legs!

SENSITIVE

Mites (Class: Aracina)

Sensitivity Rating (bug score) = 5

Features

- Mites look like a fast-running freckle, or rotund spider
- Red, black, brown, green, yellow
- Globular body
- 4 pairs of hairy legs
- Move towards and congregate at edge of trays
- Social – where there is one, there will be more
- Most abundant in shallow, still waters
- Its an arachnid and not an insect, hence 8 legs, not 6

TOLERANT

Beetle Adults (Class: Insecta, Order: Coleoptera)

Sensitivity Rating (bug score) = 4

Features

- Wings coverings act as protective sheaths – often shiny and hard
- Membranous wings beneath
- Most common is the diving beetle and water scavenger beetle
- Big groups ranging from large to very small in size

TOLERANT

Beetle larvae (Class: Insecta, Order: Coleoptera)

Sensitivity Rating (bug score) = 4

Features

- There are many different types of beetle larvae and they all look different. Gennerally they have:
- 6 well developed legs and mouth parts for chewing
- Carnivores
- A segmented body
- Most common ones are diving beetles, scavenger beetles, riffle beetles, whirligig beetles.

Sensitivity

Cannot tolerate low oxygenated water.

TOLERANT

Amphipods (Class: Crustacea, Order: Amphipoda)

Sensitivity Rating (bug score) = 4

Features

- Look like a swimming banana
- Also known as Scuds, side-swimmers, sand-hoppers
- Laterally compressed body
- No shell
- 7 pairs of legs
- Scavengers and like to burrow into sand

TOLERANT

True bugs (Class: Insecta, Order: Hemiptera)

Sensitivity Rating (bug score) = 3

Features

- Can fly from one place to another
- Entire life cycle aquatic
- Sucking and piercing mouthparts
- Predators
- Waterboatman, Backswimmer and Water strider most common
- Carry bubble of air around for breathing

TOLERANT

Nematodes (Phylum: Nematoda)

Sensitivity Rating (bug score) = 3

Features

- Also known as roundworms
- They look like an eyelash - Long and thin with pointed ends
- Swim in S-motion
- Common, hard to see.

TOLERANT

Flatworms (Class: Turbellaria, Order: Tricladida)

Sensitivity Rating (bug score) = 3

Features

- Can change their shape between long and thin or round and flat
- Two eye-spots at more pointed end are not really eyes
- Very primitive creatures
- Up to 1cm only
- Mottled in colour
- Reproduce sexually or asexually by splitting in two

VERY TOLERANT

Segmented worms (Class: Oligochaeta)

Sensitivity Rating (bug score) = 1

Features

- Earthworms that live in H2O
- Live in dirt and sediment
- Hard to find in trays
- Live for up to 3 years
- Mud feeders - Can see mud in body sometimes

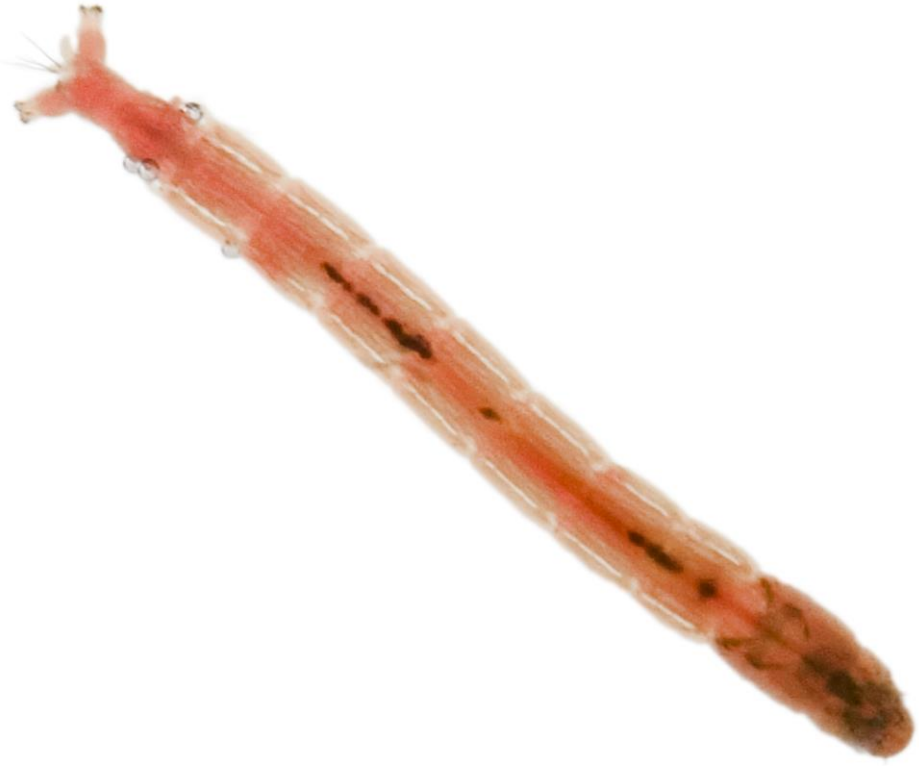
VERY TOLERANT

Bloodworms (Class: Insecta, Order: Diptera, Family: Chironomids)

Sensitivity Rating (bug score) = 1

Features

- Bright red hence the nickname
- Not a worm, but larvae of common midges (small flies). Larval stage lasts for 2-3 months. Adult midges emerge early evenings often in great swarms
- Many are light in colour and only species with haemoglobin appear red
- Abundant and can be found in most aquatic environments.



Waterwatch Program

Instructions for Surveying Macroinvertebrates

Macroinvertebrate Survey and I.D. Instructions

This survey will take 1-1.5 hours per site and requires at least 2 people.

Equipment

1 x standard bugging net
1 x 10 L bucket (filled to 25% with local waterway water)
1 x rope (site specific)
2 x shallow white trays
2 x ice cube trays
2 x plastic spoons

Instructions

1. Collect your sample from the 'riffle', 'edge' or 'combined' section of the waterway over 10 metres for 10 minutes in one or in various types of habitat (see figure 1.). (take note of where you sample, as this will need to be entered in the database).

2. Empty netted contents into 10L bucket. Use a water bottle to squirt the stuff off the net sides.

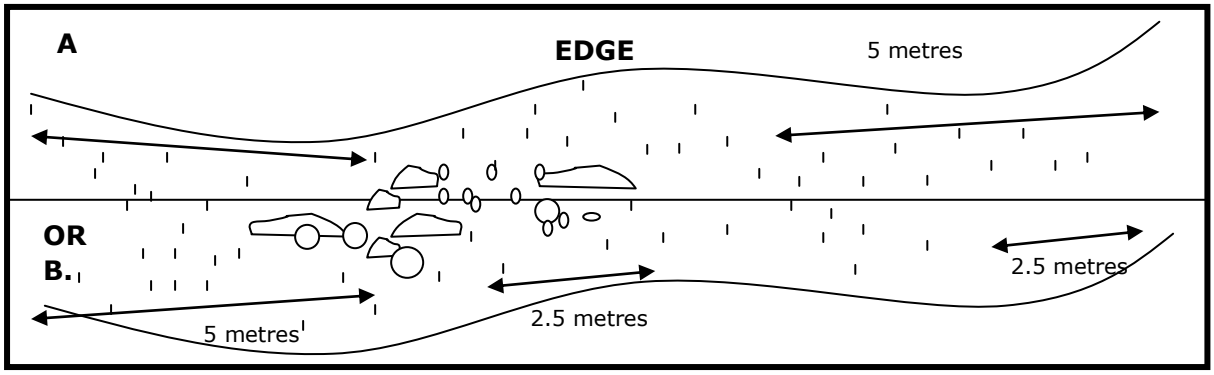
3. Pour bucket contents into sorting trays.

4. Sort through the live sample.

Sort for 30 minutes and remove the macroinvertebrates, sorting them by putting each type of bug into an ice cube tray with water. Group bugs together so that it is easier to classify them by abundance later. If after 30 minutes you find an invertebrate that you haven't observed before, sort for a further 10 minutes.

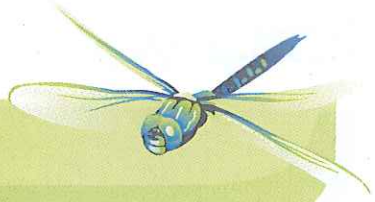
5. Use your reference resources to identify the macroinvertebrates and record what you have found on the Macroinvertebrate Data Form. Record any other species such as fish and frogs or tadpoles, and birds observed. Still fill in a form if you found no animals.

Figure 1. Netting over '10 metres' can be a mix of any locations along your site that add up to 10m.



healthy waterways **Waterwatch Program**

Macro-invertebrates data form



Monitoring Group Information

Monitoring site details

Site code:

Site description:

Name of monitoring group

Persons monitoring:

Date and time of monitoring:

Macro-invertebrates

Sample Type

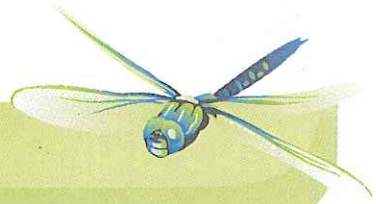
☐ Edge ☐ Riffle

Please record your data below:

Common Name	Order	Bug Score	Abundance
Very Sensitive Macro-invertebrates			
Stonefly Nymph	Plecoptera	8	
Mayfly Nymph	Ephemeroptera	7	
Caddisfly Nymph	Trichoptera	7	
Very Sensitive Macro-invertebrates			
Toebiters/Dobsonflies	Megaloptera	6	
Damselfly Nymph	Odonata	6	
Dragonfly Nymph	Odonata	6	
Freshwater Mussel	Class: Bivalvia	5	
Aquatic Caterpillars	Lepidoptera	5	
Freshwater Shrimp/Prawn	Decapoda	5	
Freshwater Yabby/Crayfish	Decapoda	5	
Water Mite	Acarina	5	
Freshwater Slater	Isopoda	5	

healthy waterways **Waterwatch Program**

Macro-invertebrates data form



Common Name	Order	Bug Score	Abundance
Tolerant Macro-invertebrates			
Hydra	Hydrozoa	4	
Beetle Larvae	Coleoptera	4	
True Bugs (Backswimmers, Water Boatman, Water Strider)	Hemiptera	4	
Side Swimmer/Scud	Amphipoda	4	
Aquatic Beetles (Diving Beetles, Whirligig Beetles)	Coleoptera	3	
Round Worms	Nematoda	3	
Leech	Hirudinea	3	
Freshwater Snails	Gastropoda	3	
Flatworm	Turbelliaria	3	
Very Tolerant Macro-invertebrates			
Mosquito Larvae	Diptera	2	
Biting Midge Larvae	Diptera	2	
Fly Larvae	Diptera	2	
Segmented Worm	Oligochaeta	1	
Non Biting Midge (Bloodworms)	Diptera	1	
	TOTALS		

Overall Bug Rating

☐ Very good ☐ Good ☐ Fair ☐ Poor

Total Abundance	200+	**Fair**		**Very Good**
	0-200	**Poor**		**Good**
		0-35	**Total Bug Score**	35+

Melbourne Water

ALT Macroinvertebrate Surveys

Macroinvertebrate Monitoring – The ALT Method (Agreed Level Taxonomy)

Until recently, Healthy Waterways Waterwatch monitors use a method of classifying macro-invertebrates called the modified SIGNAL method. This is the method that you will have been taught in your Healthy Waterways Waterwatch training.

The modified SIGNAL method of classifying macro-invertebrates is an excellent general gauge of stream health. This method looks broadly at the orders of each type of macro-invertebrate and groups them according to sensitivity.

The advantage of using the modified SIGNAL method is that it is relatively easy to learn the different types of macro-invertebrate to order level and classify them whilst they are alive. However, the disadvantage with this type of classification is that it is general by nature and different types of one order of macro-invertebrate can score differently. For example, there are many different types of damselfly and some score a lot higher than others.

In the past, to go to a more advanced level of SIGNAL monitoring, we have had to study the bugs under the microscope, which meant that they had to be preserved in ethanol.

The ALT method allows for reliable identifications to family level and beyond, using live specimens in the field without a microscope. As the specimens are alive, ALT can utilise cues such as colour and movement as part of the identification process. Results can be compared to SIGNAL scores used by the EPA and other agencies when scoring a waterway.

ALT level identification of bugs requires further training, your Healthy Waterways Waterwatch Coordinator will be able to assist you in becoming trained in ALT.

Visit thewaterbug.net for more information

You can now also download a waterbug ID app from waterbugapp.com

Monitoring Plan

Insert picture here

Monitoring Plan

Monitoring Group Name

Waterway Name

Waterwatch Program

Monitoring Plan

This Monitoring Plan has been developed by ***Monitoring Group Name***. This plan will guide the group in monitoring the water quality of ***Waterway*** in ***Municipality***.

The Plan will be reviewed yearly and adapted and amended as necessary.

General details

Information about our Healthy Waterways Waterwatch group

Name of monitoring group	
Name of group leader	
Waterway(s) to be monitored	
Local Government Area	
Commencement date of monitoring	

Our Members

Group members will be registered on the Healthy Waterways Waterwatch database. Provide details of ALL group members who participate in monitoring.

Full name	**Email**	**Phone / Mobile**

Emergency Contact Details

Full name	**Emergency Contact name**	**Relationship**	**Phone / Mobile**

Waterwatch Program

Monitoring Plan

Training Schedule

Your Healthy Waterways Waterwatch Coordinator will guide you through the first steps of monitoring water quality and assessing the environment.

Event	Proposed date	Complete
Healthy Waterways Waterwatch Training		
First site visit: site selection and monitoring plan		
Second site visit: first water testing and equipment delivery		
Third site visit: second water testing		
Annual field visit and shadow testing		

Data Confidence Schedule

Healthy Waterways Waterwatch Network meetings are designed to guide you through maintaining your equipment and testing the accuracy of your data. You will also meet other Healthy Waterways Waterwatch participants.

Event	Proposed date	Complete
Healthy Waterways Waterwatch Data Confidence Exercise: Shadow Testing In-Field		
Healthy Waterways Waterwatch Data Confidence Exercise: Shadow Testing at Network Meeting		
Healthy Waterways Waterwatch Victoria Data Confidence Exercise: 'Mystery Sampling' Event		

A schedule of monitoring is included at the end of this document.

Monitoring Plan

Monitoring Plan and Objectives

A brief description of the history of this area:

The following land uses are present within the catchment:

The possible concerns for water quality, habitat and biodiversity are:

Monitoring Plan

The following positive changes in the area may be measured through Healthy Waterways Waterwatch monitoring:

Reflecting on the above questions, the group wants to know about:

To tell us the answers to these questions we will measure:

Monitoring Plan

Our Sites

Monitoring at the one or two sites specified below will help us to answer our questions about the health of the area (after the first year of testing additional sites may be added).

Site code (Healthy Waterways Waterwatch Coordinator to provide)		
Site description		
Suburb/town		
Melways reference		
Local Government area		
Catchment		
Management unit		
Sub-management unit		
Type of waterway		
Type of land use		
Access to site		
Risks to be aware of at this monitoring site		
GPS reading		

Waterwatch Program

Monitoring Plan

Monitoring Parameters (monitors keep a copy)

Please tick which parameters you will monitor, including the frequency of monitoring.

Parameters	Monitoring Frequency			
	Monthly	Seasonally	Spring and Autumn	Annually (date)
Temperature				
Dissolved Oxygen				
Turbidity				
pH				
Electrical Conductivity (Salts)				
Phosphate				
Ammonium				
Macro-invertebrates				
Habitat assessment				
Photo point monitoring				

Data Management

We plan to keep a copy of all data collected in the following location:

Data we collect will be forwarded to the Healthy Waterways Waterwatch Coordinator in the following way:

We will share the data with our community in the following ways:

Waterwatch Program

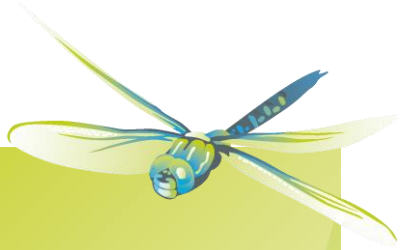
Monitoring Plan

Our Data Collection Schedule (monitors to keep a copy)

Include in the calendar below the planned dates of water quality data collection, habitat survey, macro-invertebrate surveys and Healthy Waterways Waterwatch Network meetings.

January	February	March
April	May	June
July	August	September
October	November	December

Training Evaluation



Healthy Waterways Waterwatch Melbourne Training Evaluation

Date: **Venue:**

Was the venue satisfactory?

What did you enjoy about today's session?

What did you learn that you expect to find useful after today?

How did the Healthy Waterways Waterwatch Coordinator tailor the session to your level of background knowledge?

What should have been covered in the session but wasn't?

How do you plan to use the Healthy Waterways Waterwatch training after today?

Would you be interested in attending further Healthy Waterways Waterwatch training/activity events?

Has the day changed the way you think about your local waterway or creeks/rivers in general? If so, how?

Notes

Notes

Notes