Ithaca Intact is an initiative of
Save Our Waterways Now Inc.
ABN 78 309 030 727

Ithaca Intact School Based Activities

Activity Name: Water Quality Testing

Activity Objective: To introduce students to the methods involved with water quality testing. This activity aims to develop skills in water collection, as well as to increase understanding of the use of water quality indicators to measure catchment health. This activity provides a snapshot assessment (as opposed to ongoing assessment) of Ithaca Creek.

Materials Required:

- Rubber gloves
- Thermometers
- pH testing equipment (litmus paper or Phenol Red)
- stopwatch
- tape measure (5m)
- handnet or pool scoop
- float
- secci disk
- Sampling pole with attached bottle
- Rubbish bags for cleaning up the creek

Safety Notes: This activity is low - medium risk, depending upon whether the students are entering the creek to collect samples. In the case of working outside, students should have sun protective clothing, sunscreen, water bottles and sturdy footwear. Students should be advised not to touch any animals with their hands without the supervision of an adult. Students should wash their hands after handling any organic materials. Students should be warned of appropriate conduct whilst working close to the waterway. A site inspection should be carried out prior to activities to ensure a suitable site is selected for sampling. To reduce safety risks, an adult could collect the sample for the students to examine.

Information about Catchments and Water Quality

- A catchment is the area of land that 'catches' water (rainfall or snow) and drains it into a common stream
- Waterways provide passageways from the land to the sea
- Waterways provide habitat, food, corridors, water and breeding areas for animals
- Waterways support a diversity of plants and animals
- Waterways provide for people in terms of industry, agriculture, recreation, drinking water, sewage
- As waterways are the common point for our catchment, the condition of our waterways can reflect the health of the catchment

General things that should be considered before beginning a water monitoring program

- What indicators to monitor?
- How often to monitor?
- Where to monitor (representativeness, comparability with other sites, safety)?
- What are your reasons for monitoring?
- What time/resources/skills do you have available?

Information about Healthy Waterways and Ecosystem Health Monitoring Program
http://www.healthywaterways.org/

- Uses scientific methodology to assess waterway health
    - Biological, physical and chemical indicators are used
- Information is used to advise councils, report on the effects of land use practices and identify any problems or issues
- Ensures that wildlife habitats are protected as well as ensuring commercial applications including drinking water, fisheries and industry
- Measure Ecosystem Health. For freshwater systems this includes
    - Vigour (rate of processes eg. slow/steady primary production)
    - Organisation (healthy ecosystems have a high level of biodiversity and complexity in food webs)
    - Resilience (in times of stress the system is able to retain integrity and/or recover quickly)
- 5 indicators are used to measure ecosystem health
    - Macroinvertebrates
    - Fish
    - Physical/chemical
    - Nutrient cycling
    - Ecosystem processes

Information about pH as an indicator of water quality

- A measure of the relative alkalinity or acidity of a substance
- Measured on a scale 1 (highly acid) to 14 (highly basic/alkaline), with 7 being neutral
- pH of rivers and streams tends to range between 4-10
- Logarithmic scale meaning that each increment is a ten-fold change from the last
- Most freshwater animals and plants prefer a pH of between 6.5 – 8. Changes to this can result in stress or even death
- pH can affect solubility of heavy metals and dissolved solids
- Can be used to indicate large pollution problems or trends over time
- Factors affecting pH include
    - Respiration and photosynthesis of aquatic plants as carbon dioxide dissolves in water to produce carbonic acid
    - Ions such as calcium, sodium and chloride can buffer or neutralise acids. Different soils contain different amounts of these and can influence pH
    - Vegetation types eg. eucalypts can reduce the pH
    - Human influences (acid sulphate soils being washed into waterways and industrial wastes or acid rain)

Important Information about water temperature as an indicator of water quality

- A measure of how hot/cold something is (Qld measured in degrees Celsius)
- Water temperature can effect
    - Rate of biological processes
    - Amount of oxygen that can dissolve in water
    - Metabolic rate of animals and plants (consider reptiles and amphibians). Extreme fluctuations or changes can result in stress/death
    - Fish spawning (different species prefer to spawn at different temperatures)
    - Macro-invertebrates may be sensitive to changes in temperature
- Sun can change water temperature, but its ability to do so depends upon season, latitude and time of day
- Other factors influencing water temperature include
    - Vegetation cover

- Cloud cover
- Flow rate
- Water depth
- Altitude
- Human activity (removal of bank vegetation, changing stream width/depth, discharging from industry and power plants, urban stormwater (absorbs heat from pavement))

Information about water flow as an indicator of water quality

- Important physical indicator
- Rate the water moves impacts both the water in the area being tested as well as water quality further downstream
- What is important is how fast the water is moving (velocity) and how much water is moving (discharge)
- Both of these can affect through processes including dilution, scouring and settling
- Factors affecting flow include
  - Weather, rainfall and climatic variability
  - Evaporation
  - Human activity (eg. dams)

Information about water transparency as an indicator of water quality

- Measure of how clear the water is and how far visible light will pass through it
- Reduced light may have the following impacts
  - Photosynthetic capacity of plants/algae, therefore changing DO (dissolved oxygen) and pH. This can have major implications on food webs
  - Changing visibility may impact on ability to find mates/prey
  - Reduces how far light can penetrate
  - Aesthetic effects
- Factors effecting transparency
  - Material entering the water eg.
    - Run-off
    - Erosion
    - Wastes
    - Animals stirring up the sediment
    - Algal blooms
    - Disturbance of the channel or surrounding land (development, logging, agriculture)
- NOTE: a secchi disk is being used to undertake this activity. Interpreting the results is really only relevant in demonstrating changes over time as no standards currently exist. The activity is not suitable for shallow water where the bottom is highly visible, or in areas where deployment cannot happen vertically, in water with surface waves or with biological blooms.

Collecting the Water Sample Activity Procedure and measuring water temperature:

1. The site will have been pre-selected and a sampling site pre-determined
   - Monitor in flowing water where possible
   - As close to the middle as possible
2. Students should always working in pairs to ensure safety
   - Partners should take turns and collecting data and recording results
3. Place a thermometer in the water so that the cord is attached to something and there is no risk of it floating away
4. The sampling pole should be reached out as far into the waterway as possible (without risk of falling in)

5. The sample bottle should be turned so that it is upside down (opening facing the water surface)
6. The sample bottle should be completely submerged prior to starting to turn it up the right way
    - This is to avoid collecting excessive surface scum which is the thin layer of dust, pollens and plant material that forms on the surface of the water. This can reduce the accuracy of some water quality tests
7. Turn the sampling bottle upright. Air will start escaping as the bottle fills. Once the bubbles stop rising, remove the sample bottle from the water
8. Return the water to the creek, downstream from where collection occurred. This should have cleaned out your sample bottle
9. Repeat steps 4-7
10. Undertake the pH tests (see below)
11. Retrieve the thermometer from the water and record the temperature on your data sheet.
12. Return the water to the creek, downstream from where collection occurred.

Evaluating pH Activity Procedure:

1. The water from the above sample collection should be used to rinse the pH test kit
2. Fill the test kit tube to the mark
3. Following the instructions associated with the kit, add the required amount of ?????
4. Replace the cap on the top of the test kit
5. Shake until mixed and allow to settle for 1min
6. Determine the pH from the colour scale on the test kit tube
7. Record your results
8. Next use the water from the above sample to use an alternative method for testing pH
9. Dip the indicator strip into the water sample
10. Wait for 1min for the colour to settle
11. Compare the strip with the indicator strip on the bottle to determine the pH
12. Record your results

Measuring Water Flow Procedure:

1. Measure out a 5m section of the creek
    - This section should be fairly straight and free from obstacles
    - Speed of water flow can be calculated as the distance travelled divided by the time taken (this can be done in class)
    - This should be multiplied by 0.9 correction factor associated with water velocity variability at different depths and across the channel.
2. Position someone at the end of the 5m in order to catch the float with the scoop/net
3. Place the float in the water a few meters up stream of your pre-determined 5m.
4. Start the stopwatch when the float reaches the start of the 5m
5. Stop the stopwatch when the float reaches the end of the 5m
6. Repeat 5 times and calculate the average

Measuring Water Transparency Procedure:

1. Secci disk is lowered straight down until no longer visible. This depth is marked on the rope.
2. Secci is disk is then brought up until visible again. This depth is marked on the rope.
3. The average between the two is the value recorded

Additional Notes:

- Students should reminded to respect the environment within which they are working
    - No running or sliding as it may cause erosion
    - Return any logs/rocks to how they were found, as they provide important micro-habitats
    - Be gentle and slow whilst sorting through the sample to avoid damaging the animals
    - If vertebrate animals are caught, they should be noted, counted and returned to the waterway immediately
    - Animals should be returned to the same habitat they were sampled from
- Students will be required to share equipment and take turns

Note: Parts of this procedure have been adapted from the Streamwatch Sampling Kit and the Queensland Community Water Quality Monitoring Manual.