Centre County Pa ©
Senior Environmental Corps
Field Manual

2022

20th anniversary

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Senior Environment Corps *1 & 2*

The mission of the Centre County Pennsylvania Senior Environmental Corps (CCPaSEC) is to develop and to support teams of senior citizens who gather and publish data on the quality of water in the streams of Centre County. Through public outreach, with the assistance of the ClearWater Conservancy, the Centre County Conservation District, Nature Abounds, and other environmentally concerned organizations, CCPaSEC seeks to keep the public informed of the importance of clean water and how the management of our civil and natural resources affects the quality of streams in the county.

Safety First

DO NOT go sampling if severe weather is predicted.
Take a buddy along! If you are measuring flow or performing macros - one volunteer should remain on dry land.
Let someone else know where you are, and when you intend to return.
Use common sense before entering a stream. Any stream is dangerous. Use a **walking stick** to steady yourself.
Never wade in swift or high water. **Do not wade if depth is greater than knee-deep**.
Flood stage information is posted on the **Middle Atlantic River Forecast Center https://www.weather.gov/marfc/**
Caution: Unstable stream banks. Disturbing these banks may cause it to collapse.

If you are visiting state game lands during hunting season or an area where you can expect hunting *you are required to wear an orange vest or hat*.

Hot temperatures and high humidity may cause heat illnesses to occur

PRECAUTIONARY/PREPAREDNESS ACTIONS...

- Drink plenty of fluids, stay in an air-conditioned room, stay out of the sun, and check up on relatives and neighbors. Young children and pets should never be left unattended in vehicles under any circumstances.

- Take extra precautions if you work or spend time outside. When possible, reschedule strenuous activities to early morning or evening.

- Know the signs and symptoms of heat exhaustion and heat stroke.

- Wear lightweight and loose-fitting clothing when possible. To reduce risk during outdoor work, the Occupational Safety and Health Administration recommends scheduling frequent rest breaks in shaded or air-conditioned environments.

- Anyone overcome by heat should be moved to a cool and shaded location.

- **Heat stroke is an emergency! Call 9 1 1**

Quality Note:

The quality of our collected data elevates the volunteers' work & recognition and it instills confidence in those who would use our data.

Follow the procedures in our field manual.

Verify that the chemical reagents we use are within shelf life each time you use them.

Perform monthly calibrations on pH, EC, and DO meters as close to each teams monthly site visitations as possible.

Verify that your data has been accurately transcribed into our database.

Include a note if you had to depart from the normal process or observed an anomaly that may affect the results.

Control and Disposing of Hazardous Wastes

Keep wastes from the nitrate and sulfate tests in a specially labeled container!

Wastes from the nitrate and sulfate tests are classified as hazardous by the US EPA and should be collected separately in containers such as wide-mouthed plastic bottles.

The wastes can be concentrated by evaporation (in a safe place, out of reach of children). The wastes should be kept in the marked container for proper disposal at a later date.

Dispose of the Hazardous dry waste to the yearly Centre County Hazardous Waste program for disposal usually held in April. **Pre-registration is required.**

https://www.centrecountyrecycles.org/contact

Survey Checklist

Monitoring Supplies Checklist

*** Required**

- ❑ Boots/Waders
- ❑ Data Recording Sheets
- ❑ ***First Aid Kit, Cellphone** & Walking Stick
- ❑ Flow meter
- ❑ DO Meter (Calibrated)
- ❑ Oakton meter (Calibrated)
- ❑ Colorimeter, Sample Cells & Reagent Packets Nitrates, Sulfates, & Phosphate
- ❑ Thermometer (^{o}C)
- ❑ Alkalinity Kit
- ❑ Hazardous/Non-Hazardous Waste Containers
- ❑ Measuring tape (Metric) for Flow, stakes, rope, mallet depth Meter stick (cm)
- ❑ ***Orange Vest (visits to Hunting areas)**
- ❑ ***Marcellas teams must have a Personal Locator Beacon** *Test the batteries yearly*

Bio-survey Supplies Checklist

- ❑ Boots/Waders
- ❑ Data Recording Sheets
- ❑ Kick Net
- ❑ Table & Legs/Supports for table
- ❑ White Table Cover
- ❑ Macros Cheat Sheet
- ❑ Photos of Macros for identification
- ❑ Ice cube trays
- ❑ Tweezers
- ❑ Magnifying Glasses
- ❑ Large Pan for crayfish
- ❑ Rake
- ❑ Macros Data Recording sheet

Observations needing Prompt ACTIONS

Action Required!

11

Observations needing Prompt ACTIONS

***STOP*! If you observe any of the following at your sampling station:**

1. Closed or leaking drums in the stream or on the stream bank.
2. An oil sheen on the water.
3. A large quantity of dead fish.
4. A pipe discharging some odd looking/smelling substance into the stream.
5. If you observe any kind of illegal dumping into waterways.

Do not sample or allow potentially polluted water to come in contact with your skin!

Contact the Centre County Conservation District to investigate and take appropriate action

(814) 355-6817

Unusual Readings

Perform our ***Unusual Reading Protocol***
If any of your chemical tests produce unusual readings in **the following pages**.

"*Volunteering for Future Generations*" is about monitoring ***changes*** in our environment. More specifically, about changes in our Centre County streams. Our primary goal is to document changes that may indicate an issue to be investigated. Pennsylvania hasn't the resources to collect and analyze samples of all her many streams.

Our mission is to recognize changes in water quality that may indicate an issue to be investigated.

How to determine an unusual reading

Nitrates higher than 10 mg/L

(= 10 ppm)

Note that the colorimeter test is accurate from 0 to 30 mg/L

Phosphates higher than 2.5 mg/L

(= 2.5 ppm)

The colorimeter test is not accurate above 2.5 mg/L

Sulfates higher than 70 mg/L

The colorimeter test is not accurate above 70 mg/L

Specific Conductivity higher than 500 micro-Siemens per centimeter (µS/cm)

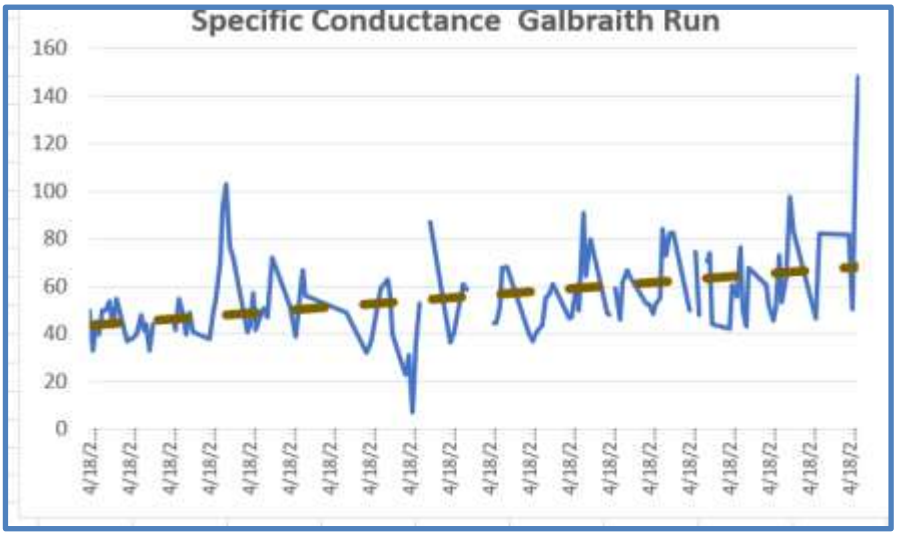
Water with conductivity above 500 µS/cm is a poor environment for fish.

You can also review the historical stream data on our website

The CCPaSEC website data for each stream includes a historical graph for each data parameter.

If your measurement seems to be very different from previous measurements, You are required to re-evaluate the test in accordance with the **Unusual Reading Protocol** page 17.

Changes may happen over a long period of time, and escape notice. Review the charts in our data base to compare current data with what's happened over the long run.



Unusual Reading Protocol

If any of your chemical tests produce unusual readings:

1. Repeat the test.
2. Re-calibrate the Multi-parameter Meter.
3. Repeat the test again.

At least 2 of the 3 readings should produce similar readings. If at least 2 of your 3 readings are abnormal, bracket the extent of any potential abnormal conditions by taking readings at designated upstream and downstream locations.

Interpret your abnormal readings by asking yourself the following questions:

Was the unusual reading isolated to just the sample site?

Were the upstream and/or downstream readings similar to the unusual reading at your site?

Was there anything noticeably different at the site?

If the unusual reading persists, Contact the Centre County Conservation District to investigate and take needed action (814) 355-6817

Please report any sighting of Invasive New Zealand Mudsnails

(Photos: Ashley Wilmont, Pennsylvania Council of Trout Unlimited)

They can be easily carried from stream to stream on boots, tools… anything used in the stream.

Report any observations of Mudsnails to:

Contact the Centre County Conservation District to investigate and take needed action

(814) 355-6817

New Zealand Mudsnails are tiny, 0.1-0.24” in length. The shell is an elongate coil in 7 to 8 whorls separated by deep grooves.

This invasive species was found in ***Spring Creek*** in 2013 and is found on rocks, particularly from the Shiloh Road bridge to the West Water Street (PA Route 550) bridge in Bellefonte with ***Fisherman’s Paradise*** having by far the highest densities of the snails.

If you find New Zealand Mudsnails in the stream you are sampling, treat your boots tools before going to a different stream.

Figure (left). NZM infested rock from Spring Creek (PA Fish and Boat Commission)

Soak gear in hot water (120°F to 140°F) for 5 to 10 minutes. It is preferable to use liquid detergent in the soak water. They survive out of water for several weeks. Only thermal methods effectively kill the snails.

The snail can close-off its shell, making it resistant to chemical disinfectants such as chlorine.

Field Guide
for Healthy Water

Field Guide for Healthy Water [5]

pH Most aquatic organisms have adapted to survive in water that has a pH range between **6 and 9.**

Dissolved Oxygen Most organisms need **at least 5 mg/L** of dissolved oxygen to survive.

For maximum, see chart for 100% Dissolved Oxygen as a function of Temperature at std Atmospheric Pressure - page 37

Phosphate Most unpolluted streams have levels **below 0.03 mg/L**.

Note: Total Phosphate Max 0.1 mg/L Excess phosphorus causes extensive algal growth called "blooms," which are a classic symptom of cultural eutrophication and lead to decreased oxygen levels in creek water.

TDS Total Dissolved Solids Max 750 mg/L

Field Guide for Healthy Water *4*

Sulfate **Max 250 mg/L** As sulfates in the form of sulfuric acid enter streams and rivers, they can decrease the pH of the body of water making it intolerable for certain species of aquatic life.

Specific Conductance or Conductivity Studies of inland fresh water streams that support good mixed fisheries range from. **150 to 500 uS/cm**.

Nitrate Unpolluted waters have nitrate levels **below 4.4 mg/L.**

Alkalinity is a measure of the capacity of water to neutralize acids. It is the buffering capacity, or the water's ability to resist changes in pH.

Alkalinity in streams is influenced by rocks and soils, salts, and certain plant activities that bring alkaline compounds into the stream such as bicarbonates, carbonates and hydroxides. These compounds remove H+ ions and decrease the acidity of the water. Measuring alkalinity is important in determining a stream's ability to neutralize (buffer) acidic pollution from rainfall, wastewater or other industrial effluents.

Care, use and Maintenance of our **Test Equipment**

Our instruments should be treated as a fine watch. These suggestions should be considered as a checklist to follow before each stream visit. See the latest Hot Training Tips at CCPaSEC.org

The accuracy and reliability of our measurements rely on our test equipment's condition and calibration.

Contact **our Supplies Resource Advisor** for required test chemicals, calibration standards, water monitoring equipment or needed repairs.

Colorimeter 7

DR 900

DR 850

Correct sampling and clean equipment are critical for accurate testing.

Careful measurements are needed for accuracy.

Assure you have added <u>all</u> of the specified reagents.

Sample Cell orientation:
When placing any of the sample cells into the colorimeter, always have the diamond shape facing the keyboard of the colorimeter.

See our website ccpasec.org for detailed manuals and procedures

Care, use and Maintenance of our Colorimeter

- ❑ Inspect the sample cell cavity and clean with distilled water or alcohol dampened cotton swab.
- ❑ Assure the sample cells and lids have been cleaned and that they are labeled appropriately for the test. Do not mix the cells or lids.
- ❑ Verify that you have chosen the correct test program and units of measure (the CONC (6) button will switch units).
- ❑ Please remember to turn the unit OFF. Report any doubts you may have about the functioning or condition of the instrument immediately to our supplies chairman

For greatest accuracy, thoroughly clean the colorimeter sample holder and sample cells to prevent carryover from previous samples.

- ❑ Pour the small amount of detergent into the hot tap water in a plastic container.
- ❑ For each sample cell and matching lid, immerse it in the hot soapy water and then use a brush to thoroughly clean the inside of the cell.
- ❑ When complete, rinse in hot tap water until no detergent suds can be seen. Rinse the cap to the cell in the same way.
- ❑ Rinse each cell and lid with distilled water and put the cell and its lid upside down to drain and dry.
- ❑ Repeat this procedure with each of the sample cells and matching lids. After all the cells and their caps have dried, replace the caps on the cells.

Cleaning the Sample Cells

Clean the sample cells and matching Lids in between each testing cycle.

Label each sample cells and Lids to indicate the test.

Keep caps paired with sample cells.

Interchanging the phosphate cap with the nitrate cap may adversely alter the nitrate results

Dawn dish detergent™ because it does not contain *phosphates.* Other non-phosphate detergents may be satisfactory but have not been evaluated.

Nitrate test

Caution: The program setup for Nitrate NO3 and the amount of reagent that is emptied into the sample cell will have effect the accuracy of your result.

- ❑ Ensure that the desired test is displayed by pressing the "**Conc**." button. **The correct display must be NO3** not NO3-N. The button will not be active until the program number for this test has been activated.
- ❑ It is important that all the powder in the packet is added to the 10ml stream sample. It is not uncommon that some of the powder is trapped in the corner of the packets. One way to check this is to cut one side of the packet to the corner and then look into the remaining corner for powder residues. Another, perhaps simpler way to do this is to use the small screw driver in the kit to stretch the
two corners of the packet so that any powder trapped there can be scraped out.
- ❑ Clean the screw driver when finished because if it is used in more than one test there could be contamination

Colorimeter Programs

TEST	REAGENT	METHOD	Program DR 250	Program DR 900
NITRATE High Range (Note) (0 to 30.0 mg/L NO3 - -N)	NitraVer 5	Method 8039	51	355
PHOSPHORUS, REACTIVE (0 to 2.50 mg/L PO4 3-)	PosVer 3	Method 8048	79	490
SULFATE (0 to 70 mg/L)	SulfaVer 4	Method 8051	91	680
Note: *For alternate forms* (P, P2O5), press the CONC key.				

Care, and Maintenance of our

YSI Dissolved Oxygen Meter

Care and Maintenance of our **YSI Dissolved Oxygen Meter**

When the user is reinserting the probe into the YSI meter it should be carefully inserted until the red "O" ring is just inside the chamber.

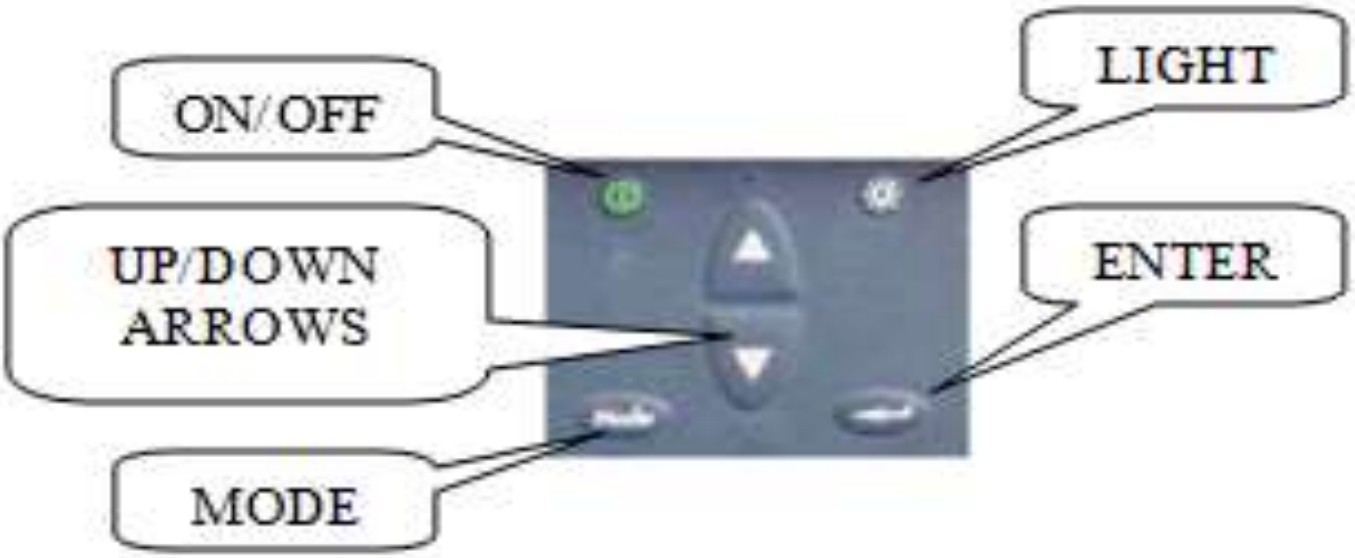
Pushing the probe too deep will cause the rubber lid on the other side to pop open.

When this happens the sponge inside this rubber lid dries out and it may delay the process when the meter is used next.

Remember to turn the unit OFF.

Report any doubts you may have about the functioning or condition of the instrument immediately to our supplies chairman

YSI Dissolved Oxygen Meter



The YSI550A DO has a built-in calibration chamber, low-battery indicator, direct salinity, and altitude compensation.

The instrument provides simultaneous readings of oxygen and temperature.

Dissolved oxygen readings are automatically compensated for temperature.

See our website ccpasec.org for detailed manuals and procedures

YSI Calibration Procedure

- ❑ **Inspect the probe it must be clean**
- ❑ Assure the sponge inside the calibration chamber is moist, but not saturated. Insert the probe gently into the calibration chamber. Do not push it beyond the indent.
- ❑ To turn on the meter press and hold the button.
- ❑ Allow the reading to stabilize. This may take 2 to 15 minutes as it depends on the age and condition of the probe.
- ❑ Press and release both UP ARROW and DOWN ARROW at the same time to enter the calibration mode.
- ❑ Press the MODE key until "%" symbol appears on the right side of the screen.

You will be prompted to enter the altitude (of your site) in hundreds of feet. Press the UP / DOWN ARROW keys to adjust the number. Example: the number 12 = 1200 feet.

CONTINUED

YSI Calibration Procedure continued

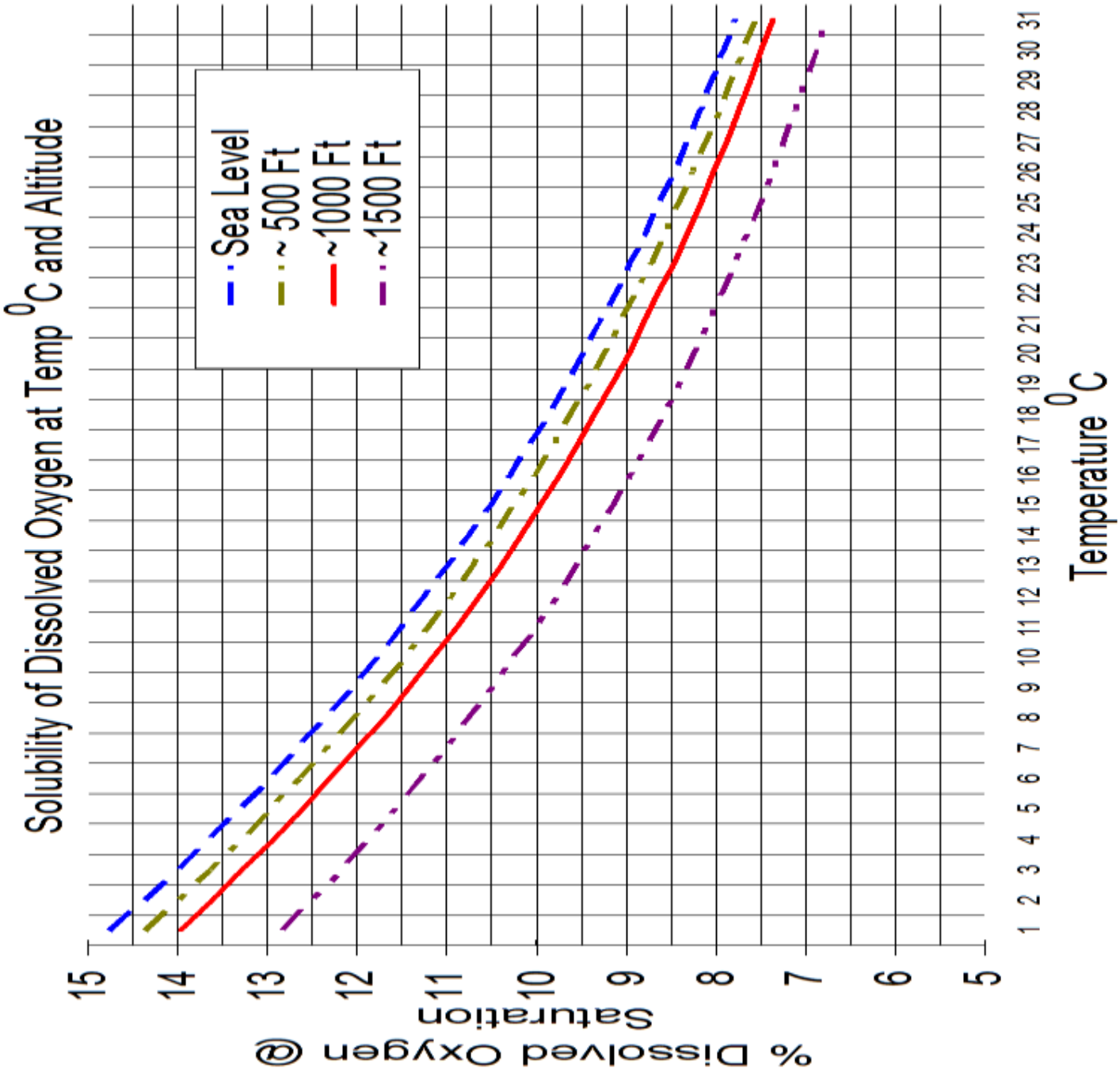
- ❑ CAL is display in the lower left corner of the screen, the calibration value in the lower right corner and the current D.O. reading (before calibration) will be in the main display. When the D.O. reading is stable, press the ENTER button.

- ❑ You will be prompted to enter the salinity of the water. You may skip this as the units are Parts Per Thousand (PPT) as none of our streams have a value in that range. Press ENTER and press MODE to reset the units for milligrams per liter "mg/L".

- ❑ **IMPORTANT: Verify the units are milligrams per liter "mg/L"** to be compatible with our CCPaSEC database.

Contact **our Supplies Resource Advisor** for required test chemicals, calibration standards, water monitoring equipment or needed repairs.

Dissolved Oxygen[1] as a function of Temperature at Atmospheric Pressure



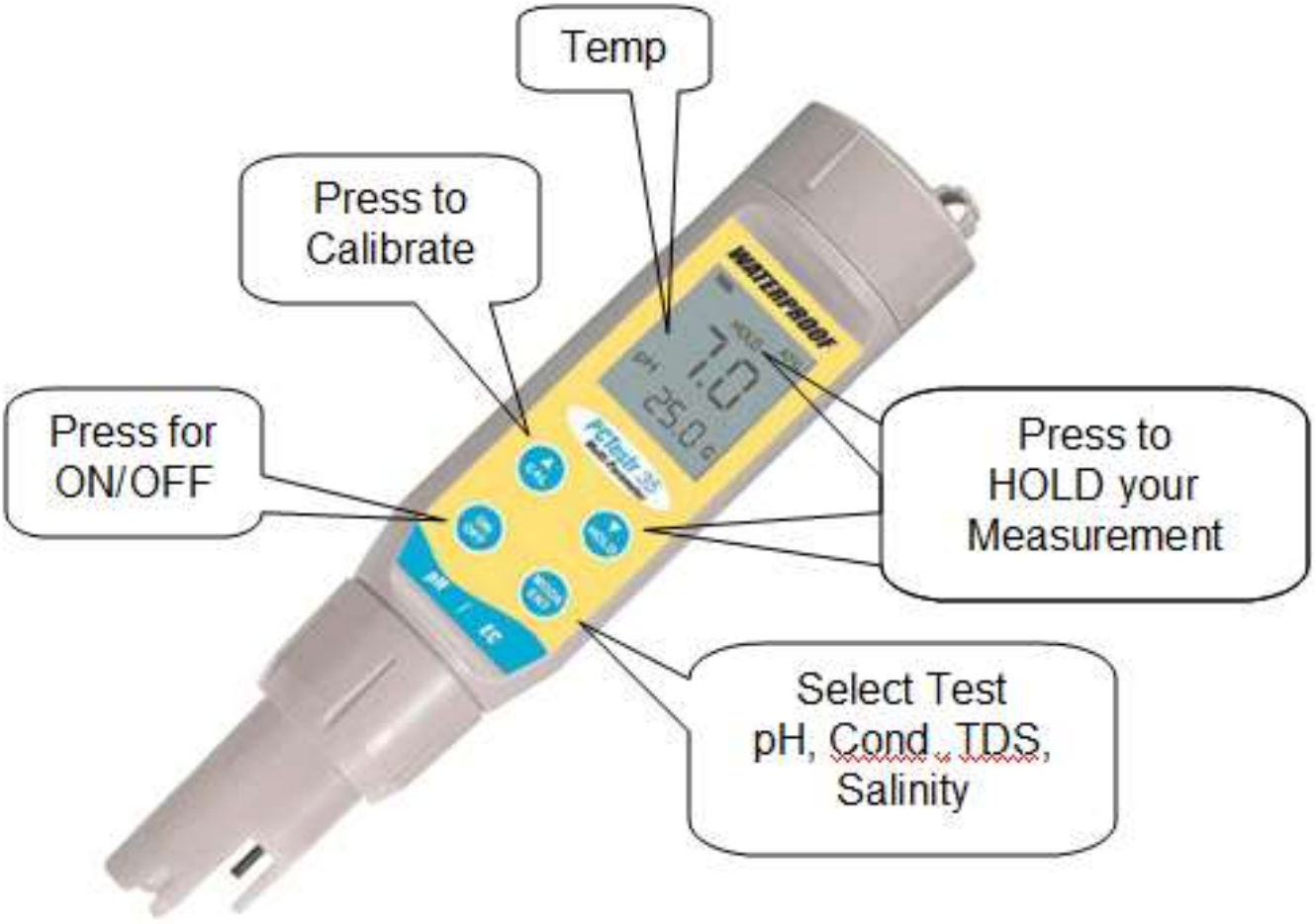
Care, use and Maintenance of our **Oakton Meter**

pH, Conductivity, Total Dissolved Solids, Salinity

OAKTON® Meter

Caution

The glass bulb at the end of the electrode is sensitive to electrostatic discharges – Avoid touching it at all times.



See our website ccpasec.org for detailed manuals and procedures

Preparation and Use

Caution The glass bulb at the end of the electrode is sensitive to electrostatic discharges – Avoid touching it at all times.

- ❑ Inspect the probe, the glass bulb should be clean, the fluid level visible and the two electrodes free of debris.
- ❑ **Calibrate less than 24 hours before use. pH and conductivity calibrations are temperature dependent. The pH meters are compensated but the calibration setting you enter for conductivity should be set at the temperature value shown on the standard bottle label.**
- ❑ Please remember to turn the unit OFF. (We have set most of them for automatic turn-off but please verify that it shut down to conserve battery life.)
- ❑ Use the potassium chloride solution to prolong the life of the probe. See our supplies resource advisor.
- ❑ The chemical in the probe will eventually be consumed and a new probe will be needed. The availability of Oakton 25 meters and probes are limited.
- ❑ Report any doubts you may have about the functioning or condition of the instrument immediately to our supplies chairman.

Conductivity Calibration

- ❑ Press ON/OFF to turn on
- ❑ Press mode button the number of times it takes to put the meter into EC or COND mode. COND will appear briefly on the screen when it is in EC mode.
- ❑ Press the CAL button to place meter in calibration mode. At the bottom of the screen the temperature value will be replace by standard values. If in auto calibration, the bottom of the display will cycle through some possible standard values. If manual calibration, the meter just guesses at a standard and displays it until you manually tell it what standard you are using.
- ❑ Rinse the meter probe off in tap water and shake vigorously to rid the probe of large drops moisture, then place the meter probe into the 1413uS/cm standard. If set to auto calibration, the meter will recognize which standard it is in and display that value at the bottom. (The meter must be reading within a certain value of the standard or it won't lock onto that value as described above.
- ❑ If after waiting a minute or so the meter won't lock onto the value, contact the supply chairman.) If set to manual calibration, give the meter a minute or so to settle on a value, without moving the meter much, press the up or down arrow keys to adjust the top display reading to match the 1413 standard reading.

Conductivity Calibration continued

- Now, regardless of which method was used to define the standard to the meter; after it has sufficiently settled, (15 or 30 secs. without significant change).
- Press the ENTer button to complete the calibration. The 1413 standard at the bottom will flash a few times and then the meter will return to EC measurement mode with temperature displayed again at the bottom of the display.
- The meter is now ready to measure EC. Vigorously shake of the water droplets and place the probe into the sample to be measured.
- **Don't forget to turn off the meter after measurement. The auto shut off feature was disabled because of the length of time the calibration can take.**

Contact **our Supplies Resource Advisor** for required test chemicals, calibration standards, water monitoring equipment or needed repairs.

Oakton Meter pH Calibration

Calibrate using US standard 3 point calibration. 4.0, 7.0, 10.0

Press On/Off (Just turn on, no hold depression needed.)

- ❑ Press mode button the number of times it takes to put the meter into pH mode. pH will appear briefly on the screen when it is in pH mode.

- ❑ Press the CAL button to place meter in calibration mode. At the bottom of the screen the temperature value will be replaced by any one of the three standard values, cycling through those values until the meter is placed into one of the three standards.

- ❑ Rinse the meter probe off in tap water and shake vigorously to rid the probe of large drops moisture, then place the meter probe into anyone of the three standards. The meter will recognize which standard it is in and display that value at the bottom. (The meter must be reading within 1 pH unit of the standard value or it won't lock onto that value as described above. If after waiting a minute or so the meter won't lock onto the value, contact the supply chairman.)
- ❑ Give the meter several minutes to settle down on a particular reading/value. (Use 15 or 30 seconds without a change in the hundredths place, depending on the time you have available.)

Oakton Meter pH Calibration continued

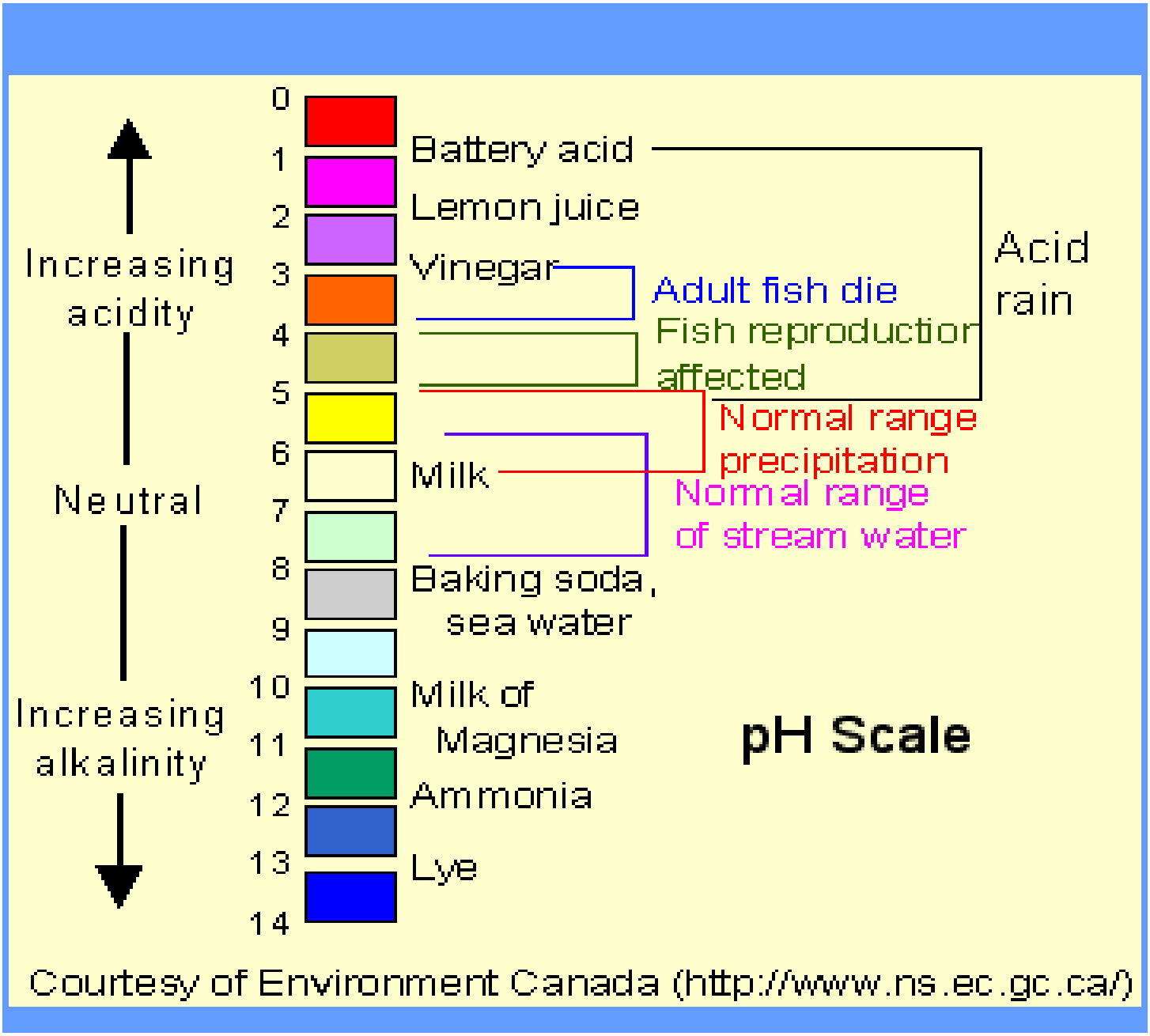
❑ Once you are satisfied that the reading has settled, press the Mode/Enter button to confirm that step in the process. The display will flash that particular standard's value a few times and then begin to display a cycling between the remaining two standard values.

❑ Withdraw the probe from the first standard and again vigorously shake off the moisture, then place the probe into either of the remaining standards. Repeat the procedure in step 5 where the meter recognizes into which standard it was placed, and follow procedure back to here. This procedure will be repeated for the third standard after which time the meter will automatically place itself back into pH measurement mode.
❑ At this point it should be ready to measure samples after again shaking it vigorously to remove droplets of standard.

❑ **Don't forget to turn off the meter after measurement. The auto shut off feature was disabled because of the length of time the calibration can take. (You will notice that as the meter probe ages, it takes longer to settle onto a value.)**

Contact **our Supplies Resource Advisor** for required test chemicals, calibration standards, water monitoring equipment or needed repairs.

The pH Scale


Increasing acidity
Neutral
Increasing alkalinity
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Battery acid
Lemon juice
Vinegar
Milk
Baking soda, sea water
Milk of Magnesia
Ammonia
Lye
Acid rain
Adult fish die
Fish reproduction affected
Normal range precipitation
Normal range of stream water
pH Scale
Courtesy of Environment Canada (http://www.ns.ec.gc.ca/)

Measuring Flow

See our website ccpasec.org for detailed manuals and procedures

Measuring Flow

Measure flow with at least two partners. While wading is the preferred method, someone should always remain out of the stream to help.

Use common sense before entering a stream. Never wade in swift or high water. Do not enter stream if your wade depth is greater than knee-deep.

Be careful when walking in the stream. Use a walking stick to steady yourself.

Units of measure

Stream Width: measurements in **meters (m)**.

Depth: measurements in **centimeters (cm).**

Velocity: Measure the **average velocity (cm/Sec)** at approximately 60% of the stream depth.

Flow Meter

Calibration is not needed; assure the hand set it is set for “Average” and “cm/second”. Setup instructions should be in the instrument case.

Please do not disconnect the cable from the hand unit.

The turbine (looks like a little fan) needs to be pushed completely onto the wand tip.

Inspect the turbine. It should spin easily with just a breath of air. All four of the blades must appear to be uniform in shape and pitch (the angle they are set at).

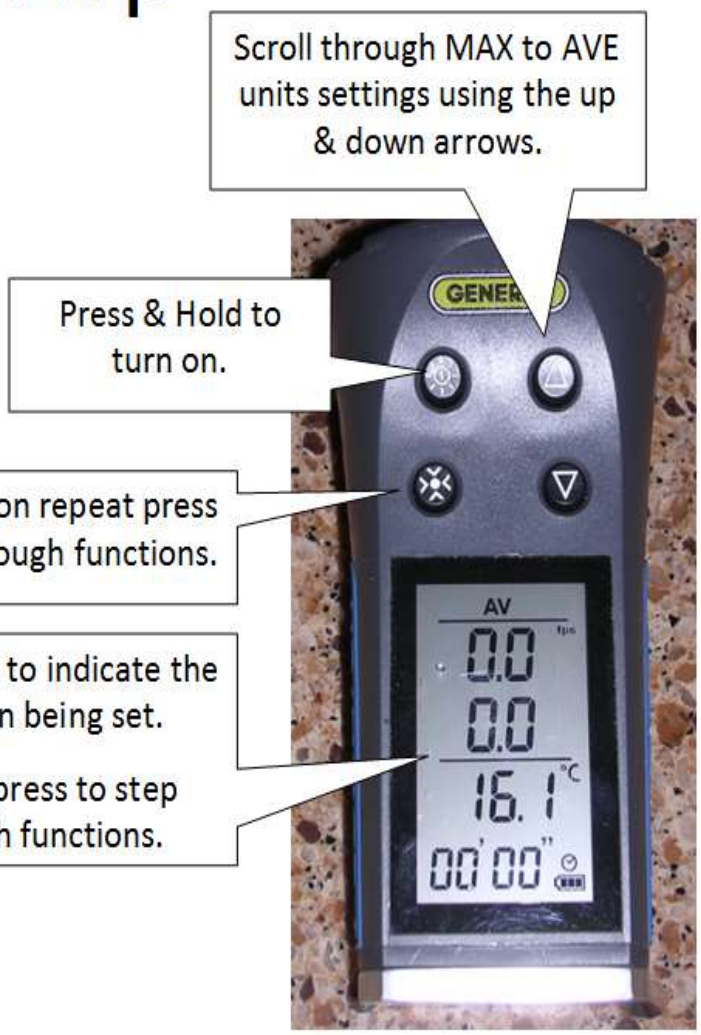
Please remember to turn the unit OFF

Velocity Meter (Flow Meter)

FLOWATCH® Setup 8

Press the indicated button. The function will flash. Scroll through the available settings for that function. Press the setup button again to save a new setting or if not changed it will step to the next function.

Press the setup button and the down arrow to clear.

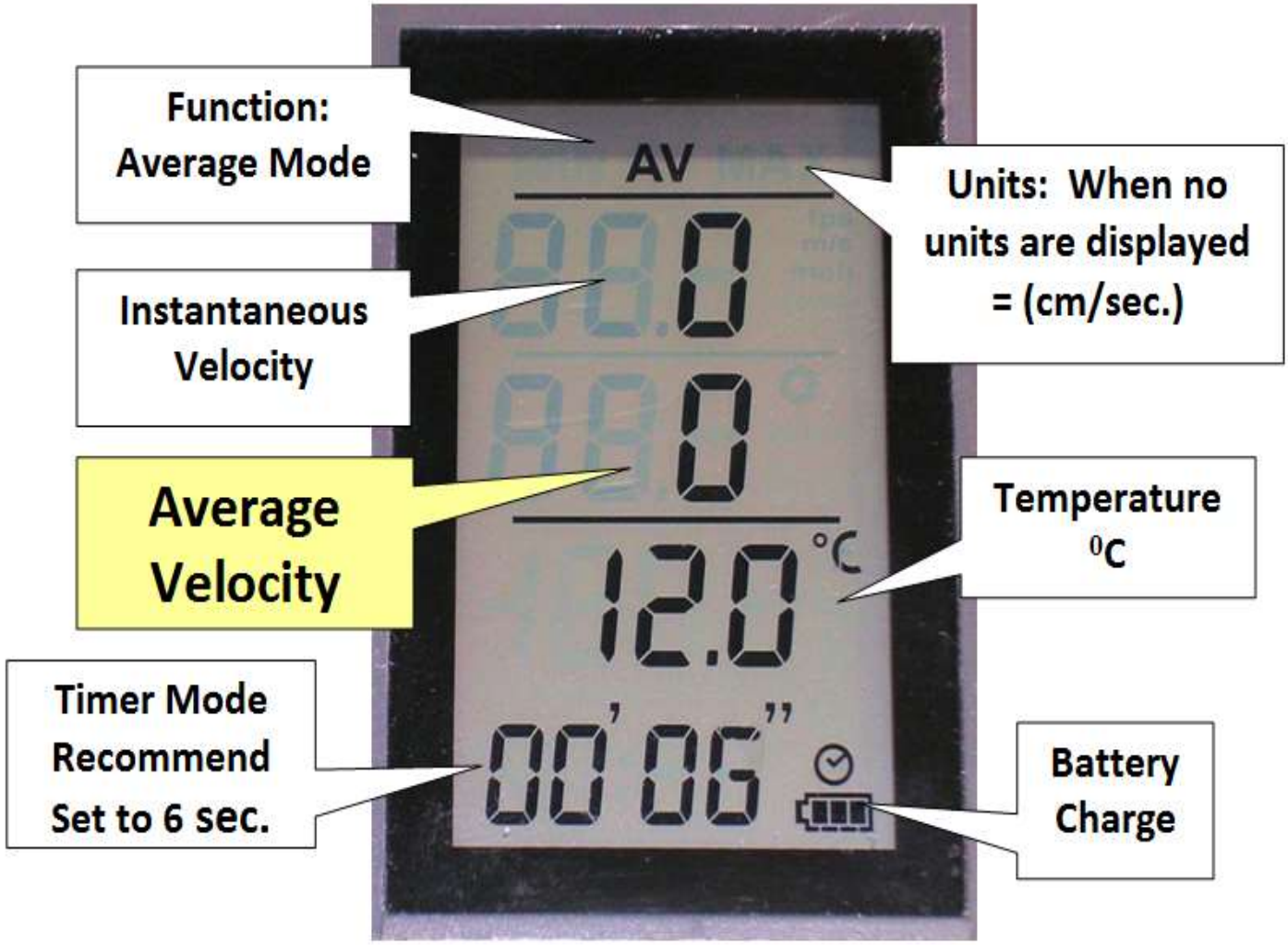


Measuring flow with the Flowatch meter only requires one stream cross section. Take depth & velocity readings at approx. 10 equal spacing's across the width of the stream. Calculate the area of each cell, multiply by the velocity in that cell and sum all of the cells for the total flow

Velocity Meter

FLOWATCH® Screen

For best results use units of cm/sec. The CCPaSEC website online Flow Calculator requires units of cm/sec.

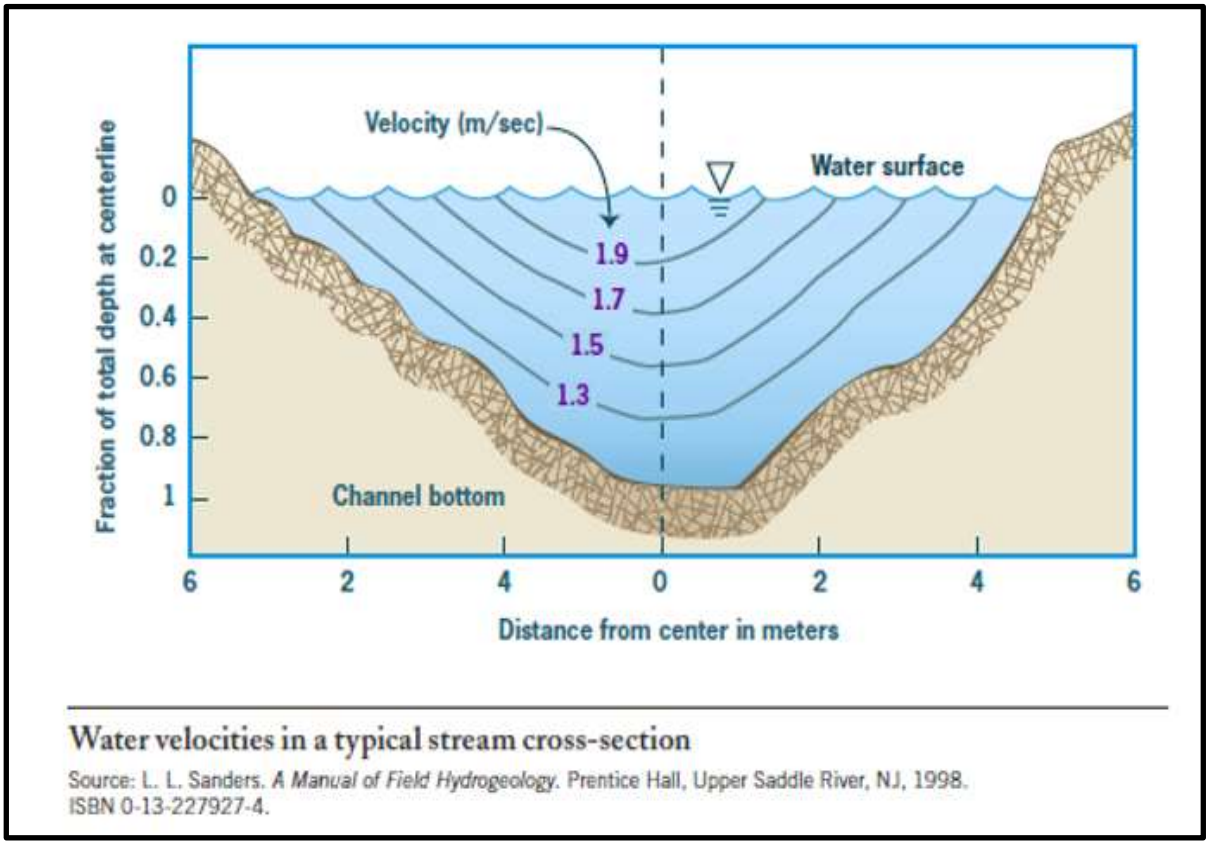


Measure velocity at approximately 60% of depth

Velocity as a Function of Width & Depth.

The velocity of moving water varies both with the width of a stream channel and from the surface to the bottom of the stream. Irregularities slows the water near the bottom and sides of a channel so that the fastest water is usually near the center of the channel and near the surface.

We measure the average velocity at about 60% of the depth from the surface to determine the average.

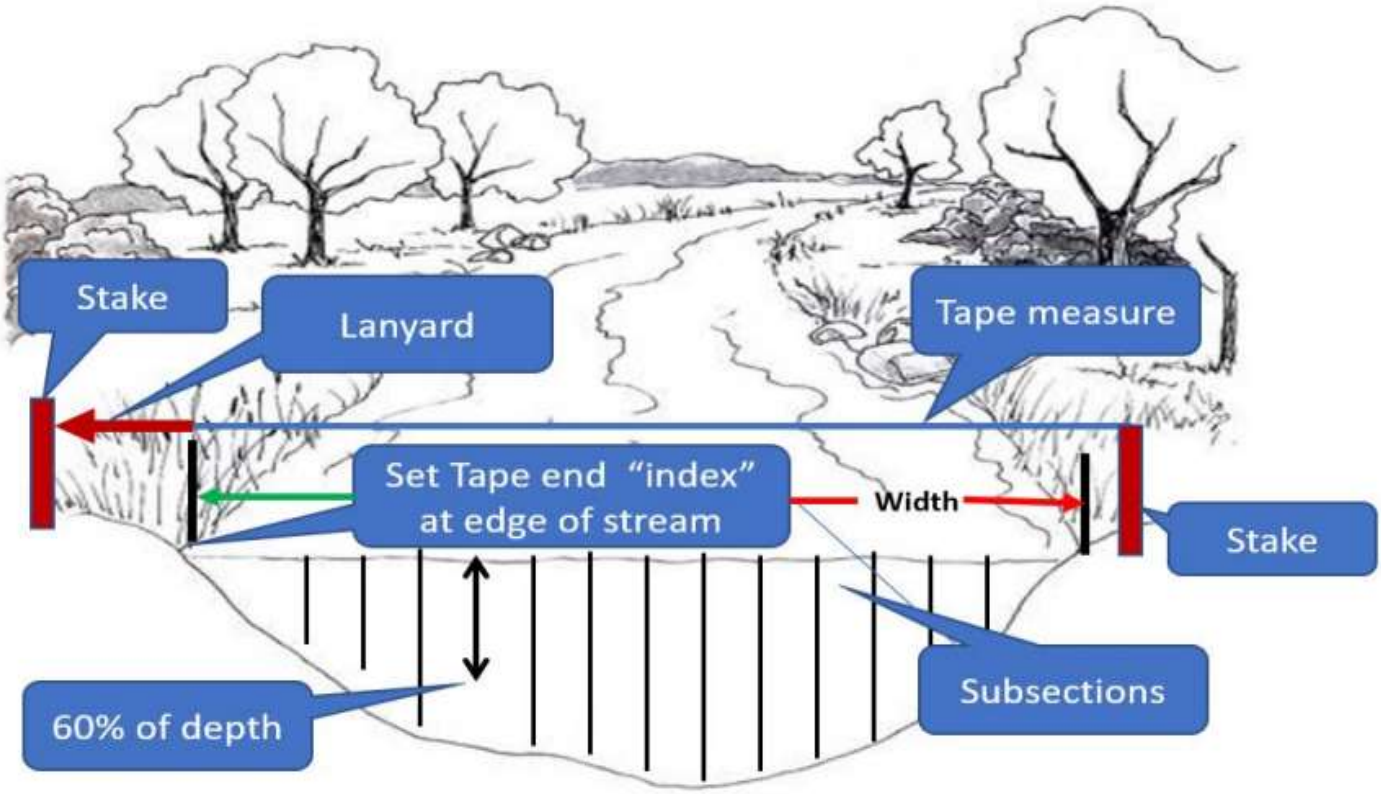


Water velocities in a typical stream cross-section

Source: L. L. Sanders. *A Manual of Field Hydrogeology*. Prentice Hall, Upper Saddle River, NJ, 1998. ISBN 0-13-227927-4.

Site setup

Our monitoring sites are located mainly for accessibility and are approximately 30 meters long. Using a designated location for measuring flow may be handy but is not necessary as long as the site does not include a tributary or drain.



Choosing how many intervals

The stream widths may vary greatly during the year and the topology of the stream bed may force a major portion of the flow into a narrow zone. In those situations, it may be useful to change the number of intervals to either simplify the process in the case of a very narrow stream or to capture an unusual narrow flow zone.

The proper way to include a narrow zone is to adjust the number of intervals to capture that zone.

If you find it necessary to choose a different number of intervals (say 4 or 15… up to 20)

You still need to locate your intervals evenly across the stream width for our calculator to determine the average rate of flow.

Choosing how many measurements

The number of measurements is related to the level of accuracy

This is a foundational statement based on statistics. A larger sample containing more measurements will provide a more accurate estimate compared to a sample based on fewer measurements.

The stream widths may vary greatly during the year and the topology of the stream bed may force a major portion of the flow into a narrow zone. In those situations, it may be useful to change the number of measurements to either simplify the process in the case of a very narrow stream or to capture an unusual narrow flow zone.

If you find it necessary or to improve accuracy to choose a different number of subsections (say 4 or 15… up to 20) but **you need to locate your subsections evenly across the stream width for our website calculator to determine the average rate of flow.**

Figuring your spacing

Chose a number of measurements, divide the width by the desired number of measurements + 1.

Example, for 18 subsections and the stream width of 12.6 meters.

You would divide the stream width by 19 (the number of measurements you chose plus one). For our example the result is 0.663 which becomes the desired spacing.

Most smart phone have a calculator App but any calculator will do. Use your calculator result to find the locations.

- ❑ Your first location is at 0.663 meters.
- ❑ Add 0.663 for your second location,
- ❑ Again for your third location and so on….>.
- ❑ Once you've completed the depth measurements, simply start backwards for the flow velocity or by repeatably "taking away" the same result.

It is important to locate your spacings evenly across the stream width for our website calculator to determine the average rate of flow

Example:

Stream width = 12.6 meters, Number of subsections = 18

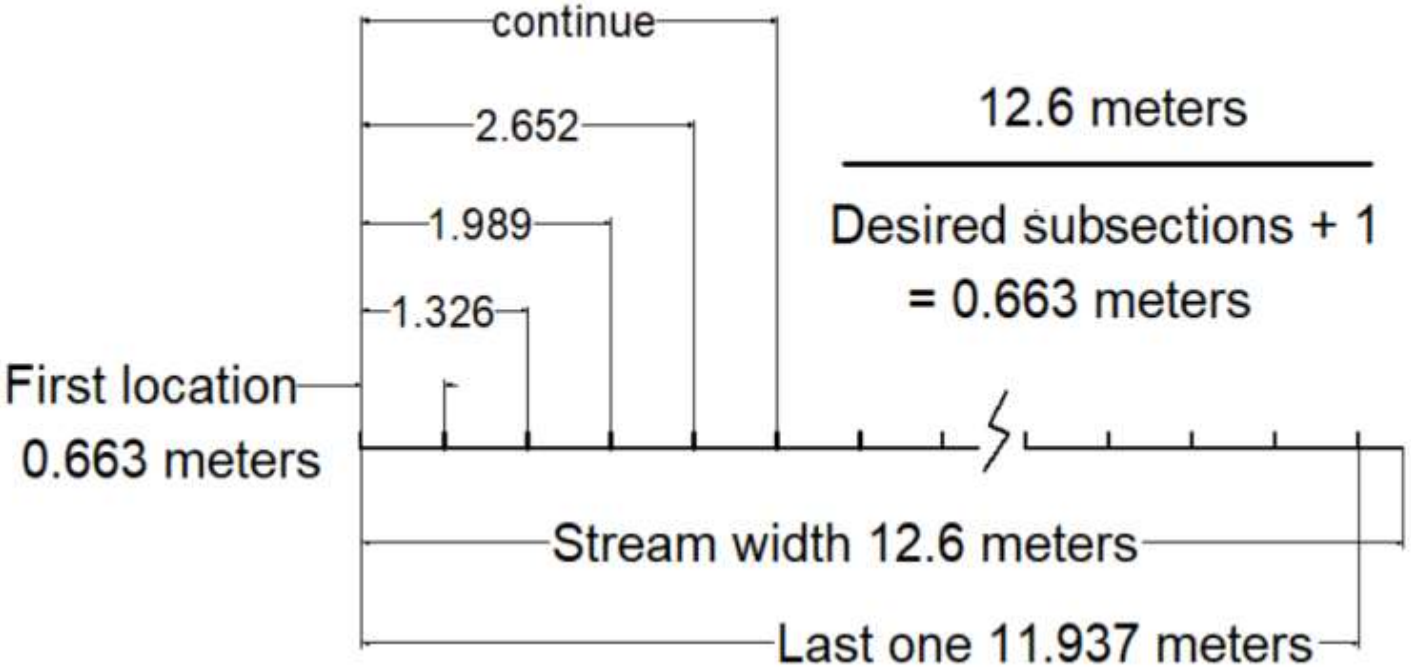


Table 1 Suggested 5 Interval Spacing

Approximate Stream Width (Meters)	Intervals					
	1	2	3	4	5	
	Meters					
1.00	0.17	0.33	0.50	0.67	0.83	1.00
1.25	0.21	0.42	0.63	0.83	1.04	1.25
1.50	0.25	0.50	0.75	1.00	1.25	1.50
1.75	0.29	0.58	0.88	1.17	1.46	1.75
2.00	0.33	0.67	1.00	1.33	1.67	2.00
2.25	0.38	0.75	1.13	1.50	1.88	2.25
2.50	0.42	0.83	1.25	1.67	2.08	2.50
2.75	0.46	0.92	1.38	1.83	2.29	2.75
3.00	0.50	1.00	1.50	2.00	2.50	3.00
3.25	0.54	1.08	1.63	2.17	2.71	3.25
3.50	0.58	1.17	1.75	2.33	2.92	3.50
3.75	0.63	1.25	1.88	2.50	3.13	3.75
4.00	0.67	1.33	2.00	2.67	3.33	4.00
4.25	0.71	1.42	2.13	2.83	3.54	4.25
4.50	0.75	1.50	2.25	3.00	3.75	4.50
4.75	0.79	1.58	2.38	3.17	3.96	4.75
5.00	0.83	1.67	2.50	3.33	4.17	5.00
5.25	0.88	1.75	2.63	3.50	4.38	5.25
5.50	0.92	1.83	2.75	3.67	4.58	5.50
5.75	0.96	1.92	2.88	3.83	4.79	5.75
6.0	1.00	2.00	3.00	4.00	5.00	6.00
	Distance from the far side (meters)					

Healthy Water

Healthy Water

Clear water is not necessarily healthy water.

Photo: by Terri Nugenie former member of CCPaSEC

The following pages are intended to help volunteers recognize the chemical and biological characteristics of healthy streams.

Look for the presence of life forms that Are Sensitive to Pollution

Normal tolerance
to Oxygen level and Temperature 1

Table 1		
Animal	**Temperature Range (°C)**	**Minimum Dissolved Oxygen (mg/L)**
Trout	5 – 20	6.5
Smallmouth bass	5 – 28	6.5
Caddisfly larvae	10 – 25	4.0
Mayfly larvae	10 – 25	4.0
Stonefly larvae	10 – 25	4.0
Catfish	20 – 25	2.5
Carp	10 – 25	2.0
Mosquito	10 – 25	1.0
Water boatmen	10 – 25	2.0

Characteristics affect the ability of species to persist in given local habitat. Physical parameters include light penetration (e.g., turbidity, suspended solids), temperature and ionic strength (e.g., conductivity). Chemical parameters include the concentrations of dissolved gases, major cations, anions, and nutrients (i.e., nitrogen, phosphorus).

Periphyton
are algae, fungi, bacteria, protozoa, and associated organic matter associated with channel substrates. Periphyton are useful indicators of environmental condition because they respond rapidly and are sensitive to a number of anthropogenic disturbances, including habitat degradation, contamination by nutrients, metals, herbicides, hydrocarbons, and acidification.

Aquatic Macro invertebrates
play important functional roles in local ecosystems and are good indicators of stream quality. Aquatic macro invertebrates represent a fundamental link in the food web between organic matter resources (e.g., leaf litter, periphyton, detritus) and fishes. Because many aquatic macro invertebrates have limited migration patterns or a sessile mode of life, they are particularly well suited for assessing site-specific effects.

Fish and Aquatic Vertebrate
can indicate stream and riparian quality. Extensive life history information is available for many species, and because many are high order consumers, they often reflect the responses of the entire trophic structure to environmental stress. Also, fish provide a more publicly understandable indicator of environmental degradation. Fish generally have long life histories and integrate pollution effects over longer time periods and large spatial scales.

Aquatic Macroinvertebrates 9

That Are Sensitive to Pollution

The presence of these invertebrates indicate a healthy environment.

Unlike our surveys that can only spot check the stream once a month, they are 24 hours a day stream monitors that provide evidence that the stream has not endured a pollution event during our absence.

Aquatic Macroinvertebrates

That Are Sensitive to Pollution

Stonefly Larvae

Facts

- About 500 species in North America are found in cool, clean streams with high levels of dissolved oxygen.
- They develop in the stream for period of three months to three. years.
- Are either predators or feed on fungi and bacteria from rotting leaves.

Description

- Two long antennae.
- Two hair-like tails.
- Gills often located on or behind each leg.
- Six segmented legs on middle section of body.
- Each leg has two hooks on the end.

Aquatic Macroinvertebrates That Are Sensitive to Pollution

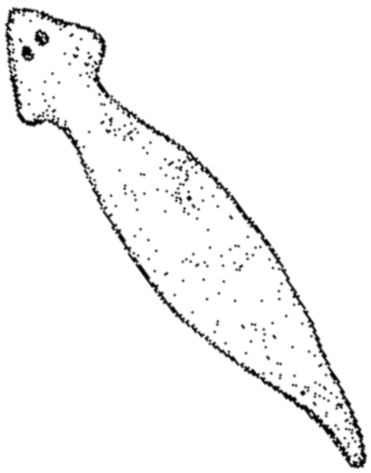
Planarian

Facts

- Found on the bottom of rocks or on leaf litter.
- Slides smoothly along surfaces.

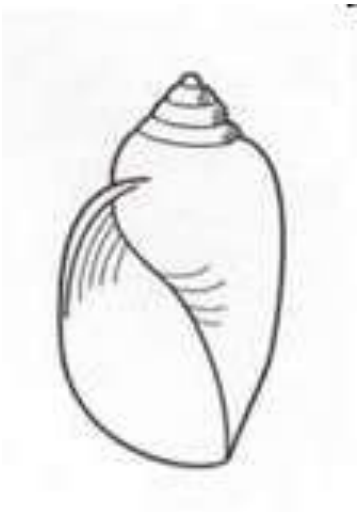
Description

- Unsegmented, soft, cigar-shaped, flat body.
- May or may not have distinct head.
- Head may be arrow-shaped with distinct eye spots.
- Body is wider than it is high (flat) Up to 3/4 inches long.



Aquatic Macroinvertebrates That Are Sensitive to Pollution

Gilled Snail



Facts

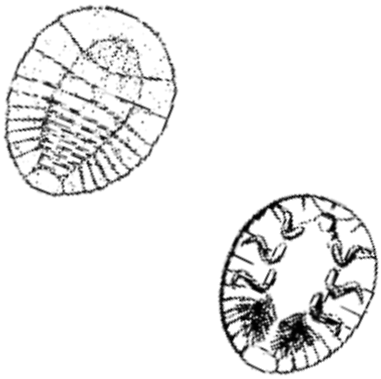
- Rely on oxygen in the water for respiration.
- Have gills for breathing.
- Shell is made of calcium. carbonate.
- It's important to make sure that the snail is alive (someone is at home) before counting it in a survey.

Description

- Soft body inside a hard, spiral shaped shell.
- Plate-like door (called the operculum) protects the opening of the shell and can be closed. quickly.
- Shells usually open on the right side which can be seen if you hold the shell with its tip pointing up and the opening facing you.

Aquatic Macroinvertebrates That Are Sensitive to Pollution

Water Penny



Facts

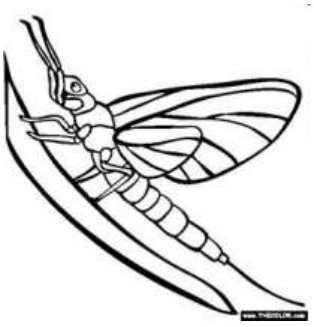
- The water penny is the aquatic larva of a beetle; the adult of the species is not aquatic.
- The body is often stuck flat to surfaces and looks like a tiny round leaf.

Description

- Round body.
- Segmented plate-like covering.
- Six tiny segmented legs beneath the round body.
- Color is brown, black or tan.

Aquatic Macroinvertebrates That Are Sensitive to Pollution

Mayfly



Facts

- About 700 species in North America.
- Develop in the stream during period of two weeks to two years.
- Live on exposed rock surfaces in fast current or buried in soft stream beds.
- Large numbers of flying adults may emerge from stream at the same time.

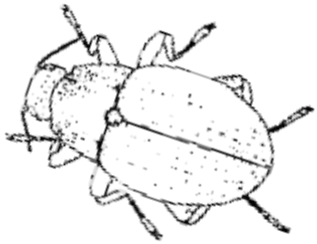
Description

- Plate like or feathery gills along the side of the abdomen.
- Two or three long hair-like tails
- Six segmented legs on middle section of body.
- Each leg has one claw on the end.
- The body can be up to one inch long.
- Body is usually flat.

Aquatic Macroinvertebrates That Are Sensitive to Pollution

Riffle Beetle Adult

Facts About Riffle Beetle Adult



- Adults are considered better indicators of water quality than larvae because they have been subjected to water quality conditions over a longer period.
- Walks very slowly under the water.
- Does not swim on the surface.

Description of Riffle Beetle Adult

- Small oval body 1/4" long.
- One pair of tiny antennae.

Aquatic Macroinvertebrates That Are Sensitive to Pollution
Caddis fly Larvae

Facts

- Some make houses or cases for themselves out of different materials such as rocks, sand, gravel, twigs or leaves using a glue-like substance secreted from their back end.
- most species are very sensitive to pollution, some are pollution tolerant.

Description

- Up to 1 1/2 inches long.
- Very small or no antennae.
- Six segmented legs on upper. middle section of body
- Filamentous gills may be on the end of the body or on the underside.
- Two small, thick extensions at the end of the body each with a single hook at the end.

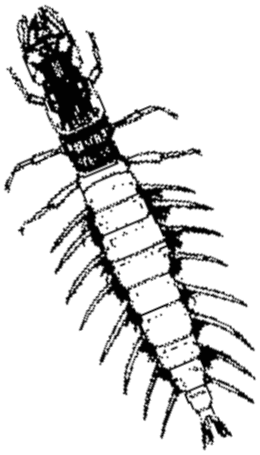
Aquatic Macroinvertebrates That Are Sensitive to Pollution

Hellgrammite

Facts

- Develop from one to four years
- Carnivorous and may bite.

Description



- One to four inches long.
- Mouth has large, chewing pinchers.
- Six segmented legs on middle section of body with tiny pinchers at the end of each.
- Many fleshy, filamentous appendages on each side of the abdomen.

- Back end is forked with two short tails and two hooks on each tail.
- Gill tufts on the underside of the tail that look like "hairy armpits“.

Invasive Plants

Invasive Plants 6

Please make note if your survey site has invasive plants.

The plants featured in this Field Guide have been selected as some of the most significant invasive plant species found in our riparian and wetland areas.

For more information obtain a copy of:

"*Invasive Plants in Pennsylvania*" or

"*Pennsylvania Field Guide Common Invasive Plants in Riparian Areas*"

From: *The Alliance for the Chesapeake Bay*

Invasive Plants [6]

Japanese Knotweed

Of all the invasive riparian plant species, **Japanese Knotweed is the top one that we can efficiently monitor & control.**

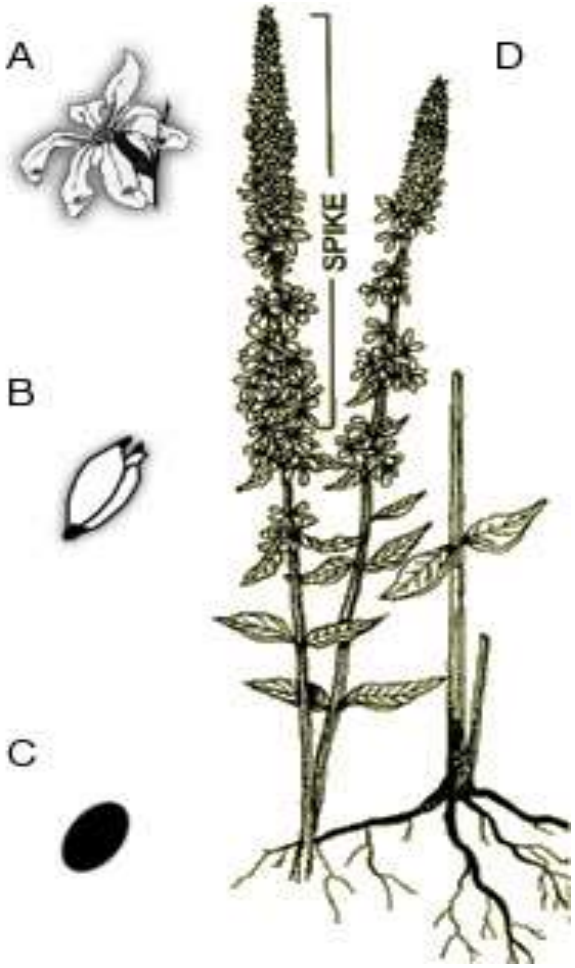
Japanese Knotweed is an upright, shrub that can grow to over 10 feet in height. As with all members of this family, the base of the stem above each joint is surrounded by a membranous sheath.

Stems: of Japanese Knotweed are smooth, stout and swollen at joints where the leaf meets the stem. Although leaf size may vary, they are normally about 6 inches long by 3 to 4 inches wide, broadly oval to somewhat triangular and pointed at the tip.

Flower: The minute greenish-white flowers occur in attractive, branched sprays in summer and are followed soon after by small winged fruits. Seeds are triangular, shiny, and very small, about 1/10 inch long.

Invasive Plants 6

Purple Loosestrife



Flower (A): Individual flowers have five or six pink-purple petals surrounding small, yellow centers. Each flower spike is made up of many individual flowers.

Seed Capsule (B): As flowers begin to drop off, capsules containing many tiny seeds appear in their place.

Seed (C): Each mature plant can produce up to 2.7 million seeds annually.

Stalks (D): Stalks are square, five or six-sided, woody, as tall as 2m (6+ ft.) with several stalks on mature plants.

Invasive Plants

Multiflora Rose

Plant

- Thorny, perennial shrub with arching stems
- Grows to approximately 13 feet tall and can form large dense hedges as it spreads
- Divided into five to eleven leaflets with sharply toothed edges fringed or hairy structure at leaf stipules

Flower

- Grows in clusters
- Small, white to pinkish-white, fragrant, five-petal flowers
- Appears May-June

Fruit

Reddish, fleshy fruit, known as rose hips, develops during the summer and remains on the plant through winter to provide food for birds and wildlife.

Invasive Plants 6

Thistle - Canada & Bull

Plant

- Erect branching stems topped by flowers
- Mature plants stand 1.5-5 feet tall
- Bull thistle grows taller than Canada thistle forming a rosette of lance shaped, spine tipped leaves.

Leaf

- Alternate spiny, oblong to lance-shaped leaves with toothed edges
- Bull thistle has course hairs on the upper surface and softer whitish hairs below.

Flower

- Disk shaped flowers -1 inch in diameter
- Flower head surrounded by spiny bracts in Bull thistle, spineless bracts in Canada Thistle
- Pink to purple flower in Canada thistle, reddish pink to purple in Bull thistle

Field
Precautions & Emergencies

Tick Removal[4] & Lyme Disease [5]

Lyme disease is a potentially
serious disease carried by deer ticks.

Use fine-tipped tweezers or a loop of thread to grasp the tick as close to the skin's surface as possible.

Pull upward with steady, even pressure. Don't twist or jerk the tick; this can cause the mouth-parts to break off and remain in the skin. If this happens, remove the mouth-parts with tweezers. If you are unable to remove the mouth easily with clean tweezers, leave it alone and let the skin heal.

After removing the tick, thoroughly clean the bite area and your hands with rubbing alcohol, an iodine scrub, or soap and water.

Avoid folklore remedies such as "painting" the tick with nail polish or petroleum jelly, or using heat to make the tick detach from the skin.

Tick and pathogen testing

After you have removed the tick, put it in an empty prescription pill container or in a plastic bag.

Put the container in the freezer.

To have the tick identified and tested for the pathogens it may have been carrying, contact….

https://www.tickcheck.com/

If the report indicates that the tick was carrying a pathogen, contact your doctor immediately with the information.

Treatments are available.

After you have removed the tick, put it in an empty prescription pill container or in a plastic bag.

Put the container in the freezer.

To have the tick identified and tested for the pathogens it may have been carrying, contact….

https://www.tickcheck.com/

If the report indicates that the tick was carrying a pathogen, contact your doctor immediately with the information.

Treatments are available.

Poison Ivy, Poison Oak, and Poison Sumac

Leaves of Three, let them be!

After the oil has touched the skin, it usually takes some time for it to penetrate and do its damage. Before this happens, it is wise to wash the skin thoroughly several times with plenty of soap and water. Care should be taken not to touch any part of the body, for even tiny amounts of the oil will cause irritation. If poisoning develops, the blisters and red, itching skin may be treated with dressings of calamine lotion, Epsom salts, or bicarbonate of soda.

If you don't cleanse quickly enough, or your skin is so sensitive that cleansing didn't help, redness and swelling will appear in about 12 to 48 hours. Blisters and itching will follow. For those rare people who react after their very first exposure, the rash appears after seven to 10 days.

Black Bear [3]

STAY CALM -- If you see a bear and it hasn't seen you, leave the area calmly. While moving away, talk to help the bear discover your presence.

GET BACK -- If you have a close encounter, back away slowly while facing a bear. Avoid direct eye contact, which a bear may perceive as a threat. If you're on a trail, step off on the downhill side and slowly leave the area.

DON'T CLIMB OR RUN -- Running may prompt the bear to give chase, and you can't outrun a bear.

PAY ATTENTION -- It may stand upright or move closer. Don't consider this a sign of aggression. Once a bear identifies you, it will usually leave the area. It may pop its jaws as a warning sign that it's uncomfortable. If you ignore the jaw popping warning, some bears have been known to bluff charge to within a few feet. If this occurs, wave your arms wildly and shout at the bear.

FIGHT BACK -- Bears have been driven away when people have fought back with rocks, sticks, binoculars and even their bare hands. **The cardinal rule when you meet a mother and cub is not to get between the two.** Even then, it has been found that the female will put on a ferocious display but is not likely to physically attack.

Snakes [3]

Rattle snake photo taken by team 14 at the Beach Creek Watershed

Most snakes are harmless. Snakes commonly can appear in grassy or wooded areas in your yard. They often hide under things like wheel barrows or a wood pile. So always be careful.

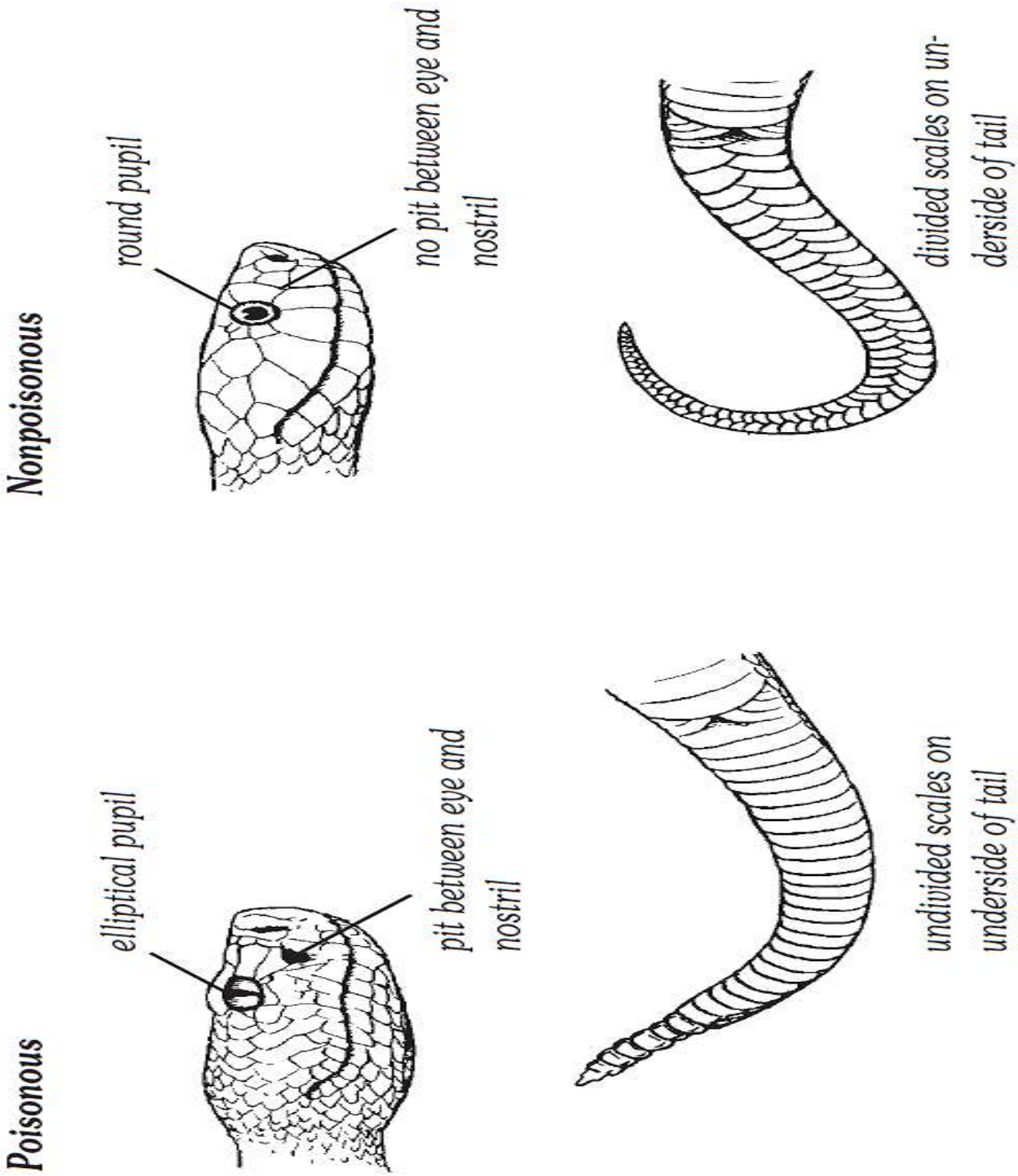
Poisonous snakes such as the copperhead, timber rattlesnake and eastern massasauga). belong to the pit viper family. Pit vipers have a “pit” or opening between the eye and the nostril. They also have a vertically elliptical eye pupil.

Nonpoisonous snakes lack the “pit” and have round eye pupils.

Remember **do not to provoke a snake,** and that it's probably just as scared of you as you are of it. With that in mind, be especially careful if you come across one.

See illustration on the next page.

Determining Poisonous vs non- poisonous



SNAKEBITE ? Call 911

DO'S

1. Calm and reassure the victim and keep the victim immobile.
2. Notify Emergency Services – **Call 911**.
3. Keep the bite below the level of the heart.
4. Wash the bite area to prevent bacteria from entering the wound.
5. You may apply a light constricting band (**not a tourniquet**) above the bite area. Do not allow it to become too tight from swelling.
6. Move the victim to a medical facility without delay.

DON'TS

1. Don't use ice, cold packs, or sprays.
2. Don't incise and suction unless directed by a physician.
3. Don't use a tourniquet!
4. Don't give alcohol or any drinks.
5. Don't wait to see if symptoms develop.

Temperature conversion table

Conversion Table °F to °C	
°F	°C
0	-17.8
1	-17.2
2	-16.7
3	-16.1
4	-15.6
5	-15.0
6	-14.4
7	-13.9
8	-13.3
9	-12.8
10	-12.2
11	-11.7
12	-11.1
13	-10.6
14	-10.0
15	-9.4
16	-8.9

°F	°C
17	-8.3
18	-7.8
19	-7.2
20	-6.7
21	-6.1
22	-5.6
23	-5.0
24	-4.4
25	-3.9
26	-3.3
27	-2.8
28	-2.2
29	-1.7
30	-1.1
31	-0.6
32	0.0
33	0.6
34	1.1
35	1.7
36	2.2
37	2.8

°F	°C
38	3.3
39	3.9
40	4.4
41	5.0
42	5.6
43	6.1
44	6.7
45	7.2
46	7.8
47	8.3
48	8.9
49	9.4
50	10.0
51	10.6
52	11.1
53	11.7
54	12.2
55	12.8
56	13.3
57	13.9
58	14.4

°F	°C
59	15.0
60	15.6
61	16.1
62	16.7
63	17.2
64	17.8
65	18.3
66	18.9
67	19.4
68	20.0
69	20.6
70	21.1
71	21.7
72	22.2
73	22.8
74	23.3
75	23.9
76	24.4
77	25.0
78	25.6
79	26.1

°F	°C
80	26.7
81	27.2
82	27.8
83	28.3
84	28.9
85	29.4
86	30.0
87	30.6
88	31.1
89	31.7
90	32.2
91	32.8
92	33.3
93	33.9
94	34.4
95	35.0
96	35.6
97	36.1
98	36.7
99	37.2
100	37.8

Glossary

acidity - a measure of the number of free hydrogen ions (H+) in a solution that can chemically react with other substances.
alkalinity - a measure of the negative ions that are available to react and neutralize free hydrogen ions. Some of most common of these include hydroxide (OH), sulfate (SO4), phosphate (PO4), bicarbonate (HCO3) and carbonate (CO3).
deionized water - water that has had all of the ions (atoms or molecules) other than hydrogen and oxygen removed.
dissolved oxygen (DO) - oxygen dissolved in water and available for living organisms to use for respiration.
distilled water - water that has had most of its impurities removed by evaporation and condensation.
eutrophication - the natural and artificial addition of nutrients to a water body, which may lead to depleted oxygen concentrations. Eutrophication is a natural process that is frequently accelerated and intensified by human activities.

Glossary

hypoxia - depletion of dissolved oxygen in an aquatic system.
kick net - a fine mesh net used to collect organisms. Kick nets vary in size, but generally are about three feet long and are attached to two wooden poles at each end.
macro invertebrates - organisms that lack a backbone and can be seen with the naked eye.
orthophosphate - inorganic phosphorus dissolved in water.
reagent - a substance or chemical used to indicate the presence of a chemical or to induce a chemical reaction to determine the chemical characteristics of a solution.
riparian - of or pertaining to the banks of a body of water.
saturated - inundated; filled to the point of capacity or beyond.
water quality criteria - maximum concentrations of pollutants that are acceptable if those waters are to meet water quality standards as listed in state water quality standards.
water quality standards - written goals for state waters, established by each state and approved by EPA.

Credits

The information contained herein was summarized from these official resources:

1) Pennsylvania Senior Environment Corps Water Quality Monitoring
2) Field Manual © 2011 *Compiled by Nature Abounds in cooperation with the Pennsylvania Department of Environmental Protection, and with support from the US Environmental Protection Agency's 319 Non-point Source program.*

3) U.S. Environmental Protection Agency (EPA) *Volunteer Stream Monitoring: A Methods Manual*

4) Pennsylvania Game Commission

5) Pennsylvania Fish & Boat Commission

6)Centers of Disease Control and Prevention

7)Images of insects:

Public Domain images of aquatic insects in Pa

Public Domain images of macro invertebrates

8)DR/850/DR 900 Colorimeter manual HACH

9) FloWatch Inc. @**Flowatch**.net 17230 HUffmeister Rd. - Cypress, TX 77429 copyright© **FloWatch**, Inc. 20

10) Invasive plants:

Pennsylvania Field Guide Common Invasive Plants in Riparian Areas

13) Oakton *Water Quality Measurement Tools*

14) ClipARTOF *cartoon*

Important Phone Numbers

Ambulance-Fire-Police dial 911

Spills or Environmental emergency:

Contact the Centre County Conservation District to investigate and take needed action

(814) 355-6817

Poisoning:

Call 911 if the person is unconscious, has trouble breathing, or has convulsions.

Otherwise, call

National Poison Control

1-800-222-1222