THEME:	**Water Monitoring**
SCOPE & SEQUENCE UNIT:	**Creek monitoring**
OBJECTIVE:	**How can the creek be described?**
ACTIVITY 1:	**In the field creek monitoring**

Notes:	outside, some initial in-class predictions, later in-class data recording
Teacher Prep.:	gather equipment, see Materials; request parent volunteers to work in small student groups, if possible; students need to be dressed for the weather; prepare a master table for archiving all results from all sampling dates – either on a computer or flipchart paper
Time:	15 minutes for predictions and review of behaviour and tasks; ~60 minutes (depends on creek access), ~15 minutes returning equipment, recording data on master file

Skills:

- Math Literacy
- Reading
- Ecological literacy
- Critical and creative thinking
- Collaboration, teamwork, leadership

Objectives:

- To experience the scientific method of sampling
- To apply this learning to a real situation, at the creek
- To experience field monitoring

Background Information:

Consider using the creek monitoring as an application to constructivist learning. See the poster under Resources showing this application.

Consider having students in small groups and this may mean dividing the class into four groups for more effective learning and management outside. This will require more adults attending, needing one per group.

The difference between going out once to the creek to experience field science and going out several times is the positive impact on learning. Repeated measurements over time allow the students to monitor the creek – looking for change over time. Repeating the measurements gives students the opportunity to deepen their understanding of the protocols and the relationship of the creek to its environment, including the local weather, seasonal changes, the surrounding land, the riparian, and creek life, including invertebrates and fish. It allows students to connect the dots within the system.

The first time students conduct the measurements in the field there may be a lot of chaos, some students standing around not knowing what to do, the group not effectively self-organizing, and the teacher or parent volunteer needing to guide the process. By the third time monitoring most students will know what to do, how to do it, and why they were doing it. The fourth and fifth times of creek measurements can be at the request of the students – students wanting to measure the creek again and again. Through monitoring, students develop competency in the tests, their team learns to function well in self-organizing, and they connect positively with their section of creek that they monitor. The power of monitoring for learning should not be underestimated. Learning the large concepts or the specific protocols can happen in one or two sessions of engagement, but the deeper and larger learning happens with more consecutive measurements and more reflection on the results and changes over time.

Vocabulary:

Monitoring: to observe a situation over time looking for any changes over time
pH: a measure of the acid content of water, and a determining factor in chemical reactions in the water and what life can be sustained in the water; measured with pH paper (or a pen or metre); most freshwater has a pH ranging between 6.5 and 8.5.

Transparency: the degree to which light is able to penetrate into the water; measured with a transparency tube for shallow waters, and by a Secchi disk for deeper waters; light is required for plants and algae to photosynthesize, transparency decreases with the amount of particles in the water column, the importance of transparency is to know the average or normal readings for a water body and to recognize when a change occurs.

Water temperature: the amount of thermal energy the water holds; it is largely determined by the amount of solar energy absorbed by the water, but other factors can also have a significant influence.

Materials:

Cell phone, whistle, and first aid kit

Student page; Creek Water Stewards, 1 per group

Student page; Creek Monitoring Data & Creek Observations, 1 per student
Pencils and erasers for field observations for each student

Clipboards or similar for holding paper in field

Water quality sampling equipment: pH paper, transparency tube, thermometer

Creek measurement equipment: 10m tape, cork, stopwatch

Often a local NGO, such as Streamkeepers or Salmon Enhancement will have this equipment for loan. Otherwise it can be purchased from scientific equipment outlets such as Forestry Suppliers. (We borrowed equipment and bought some and were able to equip four groups of students.)

Methods - as per Water Quality Measurements:

pH – Test the accuracy of the ph paper by first dipping it in a cola drink (pH 2.5) and also tap water (pH ~ 7); dip a piece of pH paper in the water for 5 seconds, compare the colour to the colour scale and record the value (NOTE: do not average the values of pH – it must be a whole number if using paper, take the most common value, i.e. 2/3).

Transparency – use a transparency tube; one student works the stopper, one fills the tube completely full of water, one student looks down into the tube to view the black and white pattern at the bottom as the water leaves the tube at the bottom through the stopper, it is important that the sun is at the observer's back, the point at which the pattern is visible is the measurement to record being the height of water in the tube and when the stopper should be closed.

Temperature – measured with a calibrated thermometer (place the thermometer in a glass of water and ice cubes and make sure the thermometer reads within a .5 degree of 0, if not, find another thermometer that does; read the thermometer to the nearest 0.5 degree if possible.

Wetted channel width – the maximum distance between the two edges of the water flow of the creek – measured with a long tape measure (5-10 m).

Cork races – measuring the speed of the surface water of the creek; run a 10 metre length along the side of the creek edge, assign a student to remain at the end to catch the cork and to shout stop when the cork crosses an imaginary finish line, assign a student to be the timer with the stopwatch, assign a student to drop the cork into the centre of the creek channel above the imaginary start line, assign a student to shout "go" when the cork crosses the imaginary start line.

Introduction Discussion:

Have a class dialogue making some predictions about what students expect for creek conditions: pH, temperature, transparency, speed, wetted channel width; and include reasoning for these predictions. No one prediction is correct. The predictions are individual and may change as different logic is offered.

Depending on which session of monitoring it is, it may be useful to review the specific protocols, asking student volunteers to describe each of the protocols. Review the ethics of behaviour for being outside and at the creek.

Reflection Discussion:

Return to class after monitoring to record results into a master table where all results from all sampling dates will be archived. Return equipment to its place, accounting for all equipment.

Students note their findings and relate them back to their initial predictions on the Creek Monitoring Page. Compare observations of the creek and riparian area. Dialogue as a class on these findings: what was a surprise? How can these findings be explained? Does it make sense?

Student Page:

Creek Water Stewards
Creek Monitoring Data & Creek Observations

Resources:

The GLOBE Program: - see GLOBE's hydrology protocols and learning activities
http://www.globe.gov/web/hydrology/protocols

see also Elementary GLOBE for K-4
http://www.globe.gov/web/elementary-globe

Streamkeepers – The Streamkeepers Handbook: A Practical Guide to Stream and Wetland Care
http://www.pac.dfo-mpo.gc.ca/education/secondary-secondaire/index-eng.htm

GLOBE Water Protocols make a fit between Nature-Based Learning with Constructivist Learning

Globe Canada

Constructivist Learning Design

Principle: *"Give puzzles and problems, not answers"*

B. Sharp and K. O'Connor

Elements[1]:

1 Situation	2 Groupings	3 Bridge
4 Questions	5 Exhibit	6 Reflections

([1] from Gagnon Jr and Collay, 2003, Constructivist Learning Design)

1. Situation
(problem or puzzle)

What is the water quality and condition of Ganges Creek?

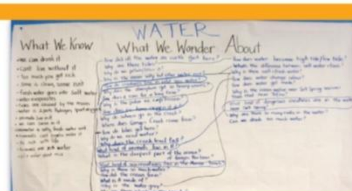
Kathy Reimer, of Island Stream and Salmon Enhancement, presents the situation to the students:

Ganges Creek is a salmon bearing creek, and it needs care and protection

2. Groupings
How many groups?
This is determined by a number of criteria, such as:
How many students are workable within a group for this field activity?
How much equipment do we have, in replicate, for groups? (we bought and borrowed)
How many parents are available?

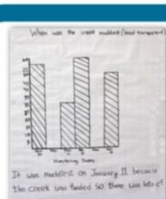
Parents make for many groups

3. Bridge
Any activity to bridge students' prior knowledge to what they might learn
This could be achieved by: concept maps; webbing; software mapping like Inspiration or Cmap; and KWL



What we Know and Wonder about Water (and want to Learn)

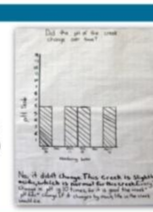
4. Questions -
Puzzling questions, and learner-initiated questions -
Our questions led us through a process:
Predicting - What do we expect (or guess)?
Measuring - How do we measure pH, temperature, transparency, creek depth and width?
Recording and Comparing - How do one group's records compare with another's?
Hypothesizing - What could explain these results?



5. Exhibit ~ Show what you know!

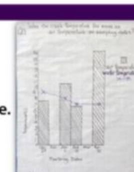
Exhibit as a demonstration of student understanding

In the field: What are you doing? How do you do it? Why are you doing it? = classic questions for evaluating experiential learning (B. Sharp, personal communication)
In class - We made graphs



6. Reflection
What do students take away from the learning experience?
Creating the space for students to reflect on their understandings and connections, and those of others.
Time for sharing through dialogue and presentations.

a) team building skills
b) critical thinking skills
c) observation and recording skills
d) making connections, i.e. between the creek with local weather patterns
e) experiences



RBC
TD Friends of the Environment Foundation
private sponsor: John Lefebvre

Stella Weinert
teacher,
sweinert@sd64.bc.ca

Marie Mullen
principal & teacher
mmullen@sd64.bc.ca

Catherine McEwen
eco-mentor, educator
cmcewen@saltspring.com

Tanya Grant
student teacher
Vancouver Island University

www.sd64.bc.ca

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Product of Waterdrops project (2009/2010) of Salt Spring Elementary School; BC School District 64
web.me.com/saltspringelementary/SSE/Water_Project.html
Created by C. McEwen and Ampersand Graphics

Creek Water Stewards

Group: ____

Date: ______________________________ **Time:** ____________________

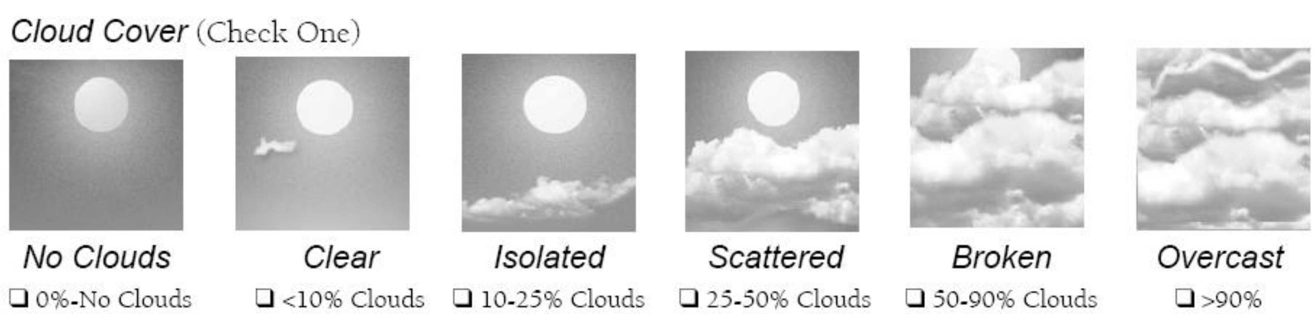
Site Name: ____

Water State (check one)

- ☐ Normal
- ☐ Flooded
- ☐ Dry
- ☐ Frozen

Water Quality

Cloud Cover (check one)



Transparency Tube

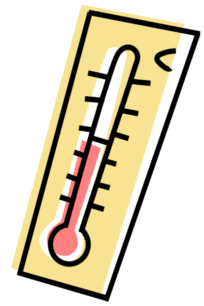

1. ____________________ cm or greater than tube
2. ____________________ cm or greater than tube
3. ____________________ cm or greater than tube

Total: ____________________ cm ÷ 3 = ____________________________ cm
Average Transparency (cm)

 http://waterdropswaterstewards.weebly.com/index.html

Name: ______________________________ **Date:** ___________________

Water Temperature



1. _______________

2. _______________

3. _______________

Total: _______________ ÷ 3 = ____________________________

Average Temperature °C

pH of Water

1. ________ 2. ________ 3. ________ ________

pH

1	2	3	4	5	6	7	8	9	10	11	12	13	14

Water Flow

Wetted Channel Measurements

Wetted Channel width: ______________ cm

Cork Races

Average Time (seconds)

_________ + _________ + _________ = _________ ÷ 3 = _______________

1st 2nd 3rd Total Avg. time (sec)

Average Stream Speed (m/sec)

_________________ ÷ _________________ = _________________ (m/sec)

distance (m) average time (sec) Average Stream Speed

Name: ________________________________ Date: ____________________

Creek Water Monitoring & Creek Observations

Make predictions for today’s measurements at your creek site.

Use symbols to indicate your predictions: “>” greater than; “<” less than; “=” same

LOCATION/ GROUP	DATE	Transparency (cm)	Temperature (^{o} C)	pH	Wet Width (cm)	Cork Speed (m/s)
GROUP 1						
GROUP 2						
GROUP 3						
GROUP 4						

REFLECTIONS on results:

How do your prediction compare with your measured results? Explain this.

____

____

What do you think are the reasons for the differences in values between the two sampling dates?

____

____

Name: ______________________________ **Date:** ____________________

Creek Water Monitoring & Creek Observations

I predict the creek will be higher/lower than the last time we visited because…

____

____

Draw your observations of the creek: note: plants in bloom; creek height; bugs out; anything else! Note at least 5 different things.

NOTES: ____

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