

NL Water Stewardship Lesson Plan



GRENFELL
CAMPUS



Environmental Policy Institute



Ducks Unlimited Canada
Conserving Canada's Wetlands

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Section 1: Introduction

Purpose

This lesson plan has been made in collaboration with Ducks Unlimited and a representative from the Grenfell Campus -Memorial University of Newfoundland (MUN) led research project entitled *Exploring Solutions for Sustainable Drinking Water Systems in Rural NL*. For more information on this project please visit the project website: <http://nlwater.ruralresilience.ca>.

A finding from this research was that outreach and awareness campaigns about drinking water systems could be improved in NL. To fill this gap, Ducks Unlimited Canada and MUN have developed an educational program that targets NL elementary school curriculum (specifically grade 4) and intermediate science/senior high school curriculum (specifically Grade 8 science and Environmental Science 3205). As this program on water and wetlands systems is interdisciplinary in nature, the lessons and games will also have crossovers with topics such as social studies, health, geography and science.

Goals

This program aims to bring awareness to students regarding where their water comes from, and how they can protect their drinking water source. This was a pilot program, so though it was used in the field once, the creators realize there may still be some “kinks” to be worked out. Please use the lesson plan as a place to start and feel free to adapt however is deemed necessary for your purposes.

Logistics

Costs of this program can vary. The watershed model component cost is approximately \$15 and other costs such as transportation and printing of the board game should be considered. Funding for this collaboration was provided by the Harris Centre RBC Water Research and Outreach Fund, the Mitacs Accelerate Internship program and in-kind contributions from Corner Brook Pulp and Paper and Ducks Unlimited Canada.

This program was piloted at Long Range Academy in Cow Head in September 2014 and delivered by Sarah Minnes (EPI, Grenfell Campus-MUN) and April Muirhead (Conservation Programs Specialist, Ducks Unlimited Canada).

Curriculum Links

<u>Activity</u>	<u>Grade 4 Science Curriculum Code</u>	<u>Description</u>
Watershed Model Demonstration	302-2	Describe how a variety of animals are able to meet their basic needs in their habitat
	204-1	Propose questions to investigate and practical problems to solve
	204-3	State a prediction and a hypothesis based on an observed pattern of events
	104-6	Use the terms habitat, population, and community in appropriate context
Thrills and Spills Board Game	108-3	Describe how personal actions help conserve natural resources and care for living things and their habitats
	108-6	Identify their own and their family's impact on natural resources

<u>Activity</u>	<u>Class</u>	<u>Curriculum Code</u>	<u>Description</u>
The Model Watershed Game/ Introductory Presentation	Grade 8 science	112-5	Provide examples of public and private Canadian institutions that support scientific and technological research and endeavours
		306-3	Describe interactions between biotic and abiotic factors in an ecosystem
		311-7	Describe processes that lead to the development of ocean basins and continental drainage systems
	Environmental Science 3205	4.01	Identify the water cycle as an important process.
		4.02	Recognize that water is a finite resource
		4.03	Describe the interconnectedness of fresh water and salt water
		4.05	List the source of fresh water
		4.11	Define water quality
		4.12	Identify physical, biological, and chemical impacts on water quality
		4.13	Evaluate the impacts of human activities on the water resources
		4.19	Outline the risks involved in drinking untreated water.
		4.20	Identify the main components of the multi-barrier approach to ensure safe drinking water.
		1.02	Identify that humans are one part of a complex system of living thing that can have a great impact on the other systems

Section 2: Grade 4/5 Lesson Plan

****This program was designed for a 1-hour period, however it was found to be very rushed and we suggest a 2-hour duration so all topics can be properly covered.**

Components of Lesson

1. Introduction (5-10 minutes)
 - a. Print out a large map of the public water system's drinking water source (for all communities where students could be from). Ask the teacher before hand what communities the students are from. You can find water source information for each community on the Water Resources Portal (<http://maps.gov.nl.ca/water/>).
 - b. Print out a large picture of the water cycle (can find by googling 'water cycle' and picking the one that suits your purposes best).
 - c. Place *Post Its* to put on stages of the water cycle and remove once students are quizzed on components.
2. Watershed model demonstration (10 minutes)
 - a. See Appendix 1 for what is needed for this.
3. Thrills and Spills Board Game (20 minutes)
 - a. The Thrills and Spills board game can be printed off the Region of Waterloo's website, under the section labelled, "Help for teachers and environmental groups",
<http://www.regionofwaterloo.ca/en/aboutTheEnvironment/teacherresources2.asp>.
 - b. Print the game off so it is large enough to play off of. We printed them off 20cm high by 36 cm wide.
 - i. We laminated our games, but that is not needed. It would be ideal if the board game was printed on sign material, but if not make sure to tape to the table so player pieces don't get bumped out of place.
 - c. Make sure to buy at your local dollar store dice (2 per game) and player pieces (we used different coloured eraser heads but you can use anything).
 - d. You will want to have 4-5 students per game, so make sure to print out enough games and have enough dice and player pieces.
4. Debrief (10 minutes/if there is time)
 - a. Have flip chart paper beside each game with markers. Write on each piece of paper the following heading:
 - i. Ways my family can protect and conserve water

Introduction

- Instructor: Introduce why you are there and what organizations you represent.
- Wetland component:

- Introduce concept of a wetland and go through examples of wetlands and why they are important. (Background reading: <http://www.ducks.ca/learn-about-wetlands/what-wetland/>). Wetlands are not only important habitat for wildlife...wetlands are also important to help clean our water. We will discuss that later in our presentation.
- Instructor: Who drinks water?

CLASS ANSWERS

- Instructor: Do you know where your water comes from?

CLASS ANSWERS

- Instructor: Shows maps of source to public water supply and if they are protected public water supplies ask if they know what that means? Ask if there are any activities that you shouldn't do in a protected public water supply area.
- Answers:
 - Needs permit for development
 - Can't put anything in the watershed that will make the quality of drinking water bad
 - No fishing, bathing, boating, swimming or washing
 - Can't divert or take water from the watershed

Instructor:

- Explain why you protect the watershed, not just the source of water. Also, explain what a watershed is and some other basic points. For example:
 - A watershed is the area of land where all of the water that is under it or drains off of it goes into the same place.
 - The thing with watersheds is what happens upstream impacts downstream. Today we want to talk to you about how to protect your drinking water and also the role of wetlands in all of this.
 - Show difference between upstream and downstream. Mention gravities role in the flow of water.
- Ask if anyone knows what the water cycle is.
 - The water cycle describes the continuous movement of water above and below the surface of the earth.
 - Explain the water they drink now is the same water that was around when the dinosaurs were alive. Water just keeps going round and round. So it is really important that we protect the water we have and that we watch our water use and activities so the natural water cycle is still able to function.
- Show poster. Have them describe water cycle. Remove *post-it* when they mention any of those keywords.

- Conversation starters:
 - What are some ways water moves?
 - Down- Precipitation (Rain, Snow, Hail)
 - Across- Runoff
 - Up- Evaporation, evapo- transpiration
 - Where does water get stored?
 - Underground, glaciers, wetlands
- Spray some water on the watershed model and watch it run “downhill”

Instructor: You are all experts at the water cycle. Now let’s see the water cycle in a watershed.

Watershed Model

Mimic a rainstorm

- First ask class what they think will happen
- Have fertilizer (jello powder) upstream, and put manure (hot chocolate powder) beside outhouse/cabin
- Use a toy dump truck to dump jello powder upstream
- Use the spray bottle to show rain moving pollutants into the water source
- Use the ATV toy to drive into the sewage and water source
- You can also mimic a flood and show the difference with the outhouse, if your cabin is right by the pond or a few feet back during flooding. You can also put a riparian zone/wetland by the source and show how it will absorb excess water

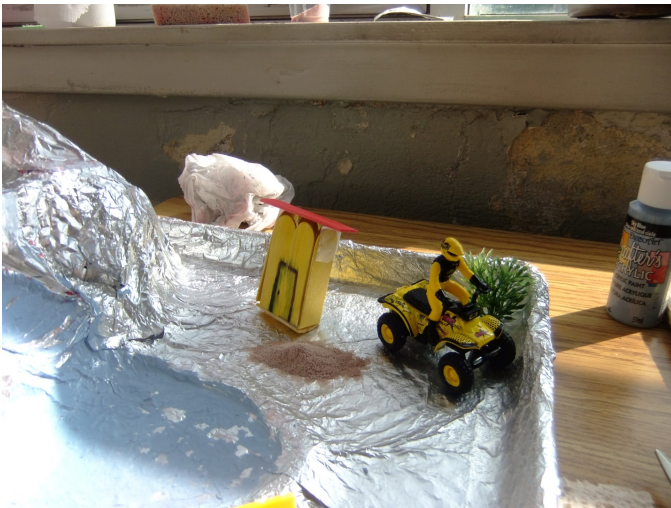
Remediate

- What are ways we can do to reduce this negative impact?
- Use less or no chemicals
- Ask what is a riparian zone/buffer zone
 - An area left untouched between a wetland or other water body.
- Wetlands are also important:
 - Did you know wetlands are nature’s water filters? The plants, bacteria and animals that live in wetlands help clean your water long before it reaches your taps.
 - Wetlands trap sediments and reinforce soil to help prevent erosion. Along the coast, wetlands also protect communities from waves and currents.
 - A wetland is like a giant sponge. During wet periods, wetlands absorb and store excess water, which reduces the risk and severity of flooding.
- Add a wetland, buffer zone, move outhouse and show the difference in makes in flooding and mitigating pollution.

Debrief

- Why do we treat drinking water? As you see what happens upstream does into your drinking water source downstream

- Why would it be potentially risky to drink untreated water, like roadside springs?
- Why is it dangerous to boat or skidoo in drinking water supplies?
- Why is ATVing an issue?
- **Talk about Stewardship:**
 - Stewardship means the careful and responsible management of something entrusted to one's care.



Thrills and Spills Board Game

- Have the board game already set up, and split the group up into groups of 4-5 to play the game. Make sure to go around the room and probe the students on the different

squares and statements in the game (e.g. why certain actions make you go backwards or forwards).

Debrief

- When a group finishes a game, have them discuss and write down their answers to ways their family can protect and conserve water.
- Thank them for their time and make sure to thank the teachers. Also, if possible leave the Thrills and Spills board game with the class.

Section 3: Grade 8 Lesson Plan

****This program was designed for a 1-hour period, however it was found to be very rushed and we suggest a 2-hour duration so all topics can be properly covered.**

Components of Lesson

1. Introduction (5-10 minutes)
 - a. Print out a large map of the public water system's drinking water source (for all communities where students could be from). Ask the teacher before hand what communities the students are from. You can find water source information for each community on the Water Resources Portal (<http://maps.gov.nl.ca/water/>).
 - b. Print out a large picture of the water cycle (can find by googling 'water cycle' and picking the one that suits your purposes best).
 - c. Place *Post Its* to put on stages of the water cycle and remove once students are quizzed on components.
2. Watershed model demonstration (10 minutes)
 - a. See Appendix 1 for what is needed for this.
3. Breakout Session (15-20 minutes)
 - a. Have flip chart paper and markers. Have the following headings (and room to write) already written on each piece of paper:
 - i. Ways my family can conserve water at home.
 - ii. Activities that have a negative impact on watersheds.
 - iii. Things I can do to reduce negative impacts on watersheds and drinking water.
4. Debrief (15-20 minutes)

Introduction

- Instructor: Introduce why you are there and what organizations you represent.
- Wetland component:

- Introduce concept of a wetland and go through examples of wetlands and why they are important. (Background reading: <http://www.ducks.ca/learn-about-wetlands/what-wetland/>) Wetlands are not only important habitat for wildlife...wetlands are also important to help clean our water. We will discuss that later in our presentation.
- Instructor: Who drinks water?

CLASS ANSWERS

- Instructor: Do you know where your water comes from?

CLASS ANSWERS

- Instructor: Shows maps of source to public water supply and if they are protected public water supplies ask if they know what that means? Ask if there are any activities that you shouldn't do in a protected public water supply area.
- Answers:
 - Needs permit for development
 - Can't put anything in the watershed that will make the quality of drinking water bad
 - No fishing, bathing, boating, swimming or washing
 - Can't divert or take water from the watershed

Instructor:

- Explain why you protect the watershed, not just the source of water. Also, explain what a watershed is and some other basic points. For example:
 - A watershed is the area of land where all of the water that is under it or drains off of it goes into the same place.
 - The thing with watersheds is what happens upstream impacts downstream. Today we want to talk to you about how to protect your drinking water and also the role of wetlands in all of this.
 - Show difference between upstream and downstream. Mention gravities role in the flow of water.
- Ask if anyone knows what the water cycle is.
- Show poster. Have them describe water cycle. Remove *post-it* when they mention any of those keywords.
- Conversation starters:
 - What are some ways water moves?
 - Down- Precipitation (Rain, Snow, Hail)
 - Across- Runoff
 - Up- Evaporation, evapo- transpiration

- Where does water get stored?
 - Underground, glaciers, ponds
- The water cycle describes the continuous movement on water above and below the surface of the earth.
- The water cycle, also known as the hydrologic cycle or the H₂O cycle, describes the continuous movement of water on, above and below the surface of the Earth. The mass of water on Earth remains fairly constant over time but the partitioning of the water into the major reservoirs of ice, fresh water, saline water and atmospheric water is variable depending on a wide range of climatic variables. The water moves from one reservoir to another, such as from river to ocean, or from the ocean to the atmosphere, by the physical processes of evaporation, condensation, precipitation, infiltration, runoff, and subsurface flow. In so doing, the water goes through different phases: liquid, solid (ice), and gas (vapor).
- The water cycle involves the exchange of energy, which leads to temperature changes. For instance, when water evaporates, it takes up energy from its surroundings and cools the environment. When it condenses, it releases energy and warms the environment. These heat exchanges influence climate.
- The evaporative phase of the cycle purifies water which then replenishes the land with freshwater. The flow of liquid water and ice transports minerals across the globe. It is also involved in reshaping the geological features of the Earth, through processes including erosion and sedimentation. The water cycle is also essential for the maintenance of most life and ecosystems on the planet.
- Spray some water on the watershed model and watch it run “downhill”

Instructor: You are all experts at the water cycle. Now let's see the water cycle in a watershed.

Watershed Model

Mimic a rainstorm

- First ask class what they think will happen
- Have fertilizer (jello powder) upstream, and put manure (hot chocolate powder) beside outhouse/cabin
- Use a toy dump truck to dump jello powder upstream
- Use the spray bottle to show rain moving pollutants into the water source.
- Use the ATV toy to drive into the sewage and water source
- You can also mimic a flood and show the difference with the outhouse, if your cabin is right by the pond for a few feet back. You can also put a riparian zone/wetland by the source and show how it will absorb excess water

Remediate

- What are ways we can do to reduce this negative impact?
- Use less or no chemicals
- Ask what is a riparian zone/buffer zone

- An area left untouched between a wetland or other water body.
- Wetlands are also important:
 - Did you know wetlands are nature's water filters? The plants, bacteria and animals that live in wetlands help clean your water long before it reaches your taps.
 - Wetlands trap sediments and reinforce soil to help prevent erosion. Along the coast, wetlands also protect communities from waves and currents.
 - A wetland is like a giant sponge. During wet periods, wetlands absorb and store excess water, which reduces the risk and severity of flooding.
- Add a wetland, buffer zone, move outhouse and show the difference in makes in flooding and mitigating pollution.

Debrief

- Why do we treat drinking water? As you see what happens upstream flows into your drinking water source downstream
- Why would it be potentially risky to drink untreated water, like roadside springs?
- Why is it dangerous to boat or skidoo in drinking water supplies?
- Why is ATVing an issue?
- **Talk about Stewardship:** Stewardship means the careful and responsible management of something entrusted to one's care.)

Breakout Session

Split class into groups of 3 (or whatever makes sense) and get them to brainstorm and write down ways that they can mitigate negative impacts to either the quality or quantity (explain difference between quality and quantity) of their drinking water. Students will discuss and write down their answers to the following questions, which will be already written on flip chart paper:

- Ways my family can conserve water at home.
- Activities that have a negative impact on watersheds.
- Things I can do to reduce negative impacts on watersheds and drinking water.

*Make sure the instructor(s) are going around to each group and probing questions and discussion where it is needed.

Debrief

- Each groups presents on what they have and the instructors probe questions.
- Thank them for their time and make sure to thank the teachers.

Section 4: Conclusions

Overall, we feel this program went well. The content was well suited for the 4/5 and 7/8 grades. These activities could be done in a variety of communities in the province. The program does involve some preparation (10-15hours) which includes: printing and buying supplies, contacting teachers/schools, making watershed models and researching drinking water sources in the communities that the students belong to. However, the instructors felt for the minimal time and money put into this lesson plan, there was a great deal of benefit for the participants. This program could be modified in many ways for many contexts. It was discussed that it would be interesting to introduce groundwater models and filtration simulations to the program in the future.

Some learning points:

- Both presentations were held in the library at the pilot school. This location was great because then we didn't have to move the model around for the two different groups.
- The presentations were an hour each. This was not enough time to get all messages across considering it we lost about 5 minutes at the beginning and end of class rotations. 2 hours would allow for more comprehensive explanations and debriefing at the end.
- When using jargon like conservation and infrastructure, make sure you cover what they mean.

Appendix 1: Watershed Model Creation

The watershed model was adapted from an article in Outdoor America entitled, “How To: Build a Model Watershed”. This article can be found at:

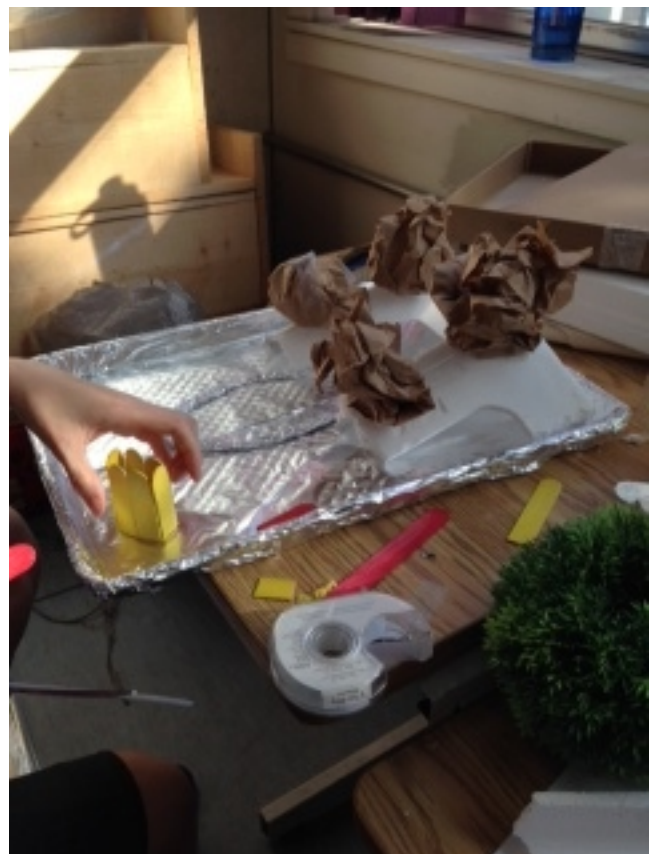
<http://www.iwla.org/index.php?ht=a/GetDocumentAction/i/2194>

Materials needed:

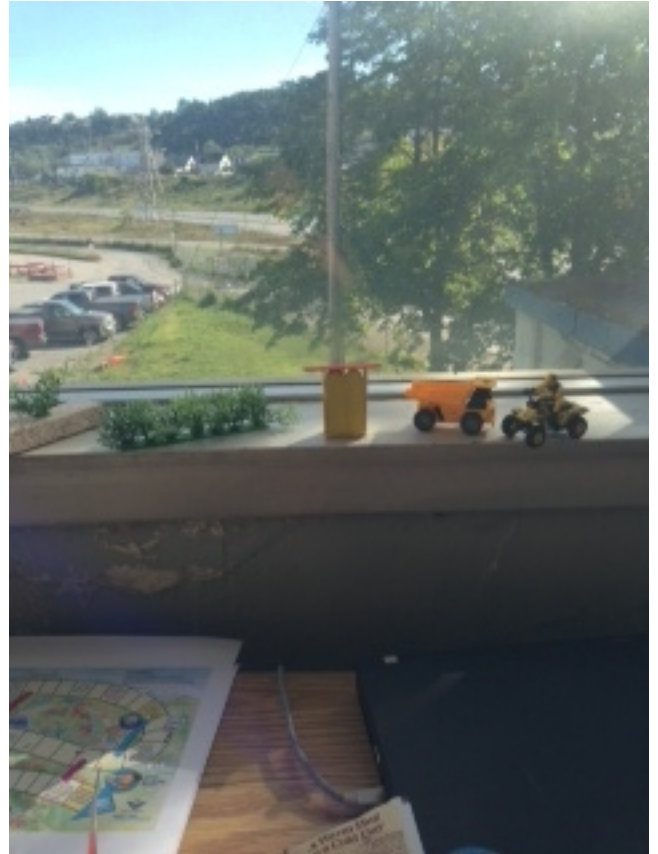
- Spray Bottle
- Hot chocolate mix (to be used as a pollutant)
- Jello (to be used as a pollutant)
- Cake pan or plastic bin
- Tin foil
- Tape
- Glue gun
- Foam/paper/something to make mountains out of
- Small models of ATVer, an outhouse, dump truck, and vegetation
- Sponge
- Paper towel
- Blue paint
- Anything else you want to put in your watershed, get creative!

Step 1:

1. Take cookie sheet/cake pan and cover in plastic foil and tape in place. Then put Styrofoam as mountains, build up with paper, and model where you want your “pond” to be out of tin foil.
2. Hot glue everything in place and leave to dry.
3. Put another layer of tin foil over everything and mould the tin foil to look like the watershed.
4. Paint the water blue with paint that won’t dilute with water.
5. Prepare props, for example we bought an ATV and a dump truck. We hot glued green plastic shrub pieces onto popsicle sticks to make a riparian zone that we could put in or take off during the demonstration. We also used a sponge with some plastic shrubs glued to it to represent a wetland.



6. Items used to show negative impacts on drinking water sources:
 - a. ATV toy, dump truck, jello powder (pollution in truck), outhouse (popsicle sticks glued together), hot chocolate powder (sewage).
7. Mitigation techniques:
 - a. Sponge – wetland,
 - b. Popsicle sticks with plastic vegetation – riparian zone
 - c. Moving out house farther from source.
8. Paper towel was used to wipe the water up in-between scenarios. Perhaps, a towel could be used to save resources.



Contacts

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