The Polaris Institute is an Ottawa-based non-governmental organization that has been in existence since 1997. Our main goal is to enable citizen movements to develop new methods, strategies and tools in order to bring about democratic social change. As a result, most of our past educational work has focused on helping students to develop the critical thinking and leadership skills necessary to bring about on-the-ground action.

Full resource accessible online at: www.polarisinstitute.org/education

Other water education resources available at this site:
- Investigating Local Water (Gr.9 Science: Biology—Sustainable Ecosystems)
- Water Perspectives: Conflict and Action (Gr.10 Civics and Citizenship)

These lessons are designed to support high school teachers in integrating water issues into their curriculum. This resource was written by Polaris Institute project staff member, Rebecca McQuaid. Expertise and advice was provided by a local steering committee and volunteer resource reviewers. Special thanks to the following individuals for their support in making this resource possible: Daniel Cayley-Daoust, Amanda Ellis, Andy Kerr, Debra Bellevue, and Patricia Larkin (Nature Works Learning). Thanks to everyone else not named here, who have been supportive of this initiative.

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We welcome any and all feedback on this educational resource.
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Section I: Water Use

**Description:** Section I is meant to create an awareness of our own water use—how much is available to us? How much do we use in everyday tasks? How do our perceptions about water availability impact: (1) how we use it; and (2) decisions we make with regards to potential risks to water resources? Activities include: a quiz to gage students’ awareness and perceptions around freshwater supplies and what impacts them; a personal water use inventory (water audit and/or water use habits questionnaire); and a critical thinking assignment in which students consider a scenario where water resources (and their safety) are in conflict with another resource and its production (oil). Section II provides the next steps for looking at water resource availability in Canada, as well as globally.

The three main goals of Section I: Water Use are to develop an awareness of:

1. How we *view* water, both personally and as a society.
2. How we *use* water, both personally and as a society.
3. How our *views*, related to water, impact how we *use* it.

**IMPORTANT NOTE FOR TEACHERS:** Although designed to meet expectations from the *Gr.9: Issues in Canadian Geography* Ontario secondary school curriculum, this resource may also provide useful activities for *Gr.12: Environment & Resource Management*. We encourage you to use this resource as you see fit—that is, to take the activities, ideas and information presented here and make them your own. Good luck!
Activity 1: What About Our Water?

Learning Goal: To develop an awareness of how we view water, both personally and as a society.

Curriculum Expectations (Gr.9 Issues in Canadian Geography, academic, 2013, *CGC1D):

<table>
<thead>
<tr>
<th>Strand B: Interactions in the Physical Environment</th>
<th>B1.1: Analyse environmental, economic, social, and/or political implications of different ideas and beliefs about the value of Canada’s natural environment, and explain how these ideas/beliefs affect the use and protection of Canada’s natural assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1. The Physical Environment and Human Activities: Analyse various interactions between physical processes, phenomena, and events and human activities in Canada</td>
<td></td>
</tr>
</tbody>
</table>

Description: 10-Question quiz to get a sense of students’ awareness and perceptions around:
(a) Global and Canadian freshwater sources/supplies;
(b) The influence of environmental, economic, social and political factors on water supplies in Canada and around the world

Time required: 60-min*  *If you choose to complete all suggested components with your class

Materials & Preparation:
- (BLM 1.0) Quiz: What About our Water? (p.5); 1 copy to display at front of class
- (BLM 1.0) Quiz: What About our Water? *Teacher Key* (p.6-7); 1 copy for teacher
- SMARTboard/ Elmo/ LCD projector

Engagement Strategy: [10-min]
- Before introducing the quiz, read aloud and/or post on the board the following three questions:
  - Do you think it is important to conserve water?
  - Do you think Canadians should be concerned about Canada’s fresh water supplies?
  - Do you know what source the water in your home comes from? (If yes, write it down)
- Have each student record answers, individually, on a sheet of paper (or in a class journal, if they have one).
- **Teacher’s Choice:** You may ask students to answer a simple “Y/N” to the questions, or leave it up to each individual to decide how much thought/effort they want to put into their answer. To provide students with more specific direction, you can ask them to spend more time reflecting on the questions and developing an argument to support their “Y/N” answer. One option may be to have them answer “why/why not?” for the first two questions.

Teaching Strategy: [45-min]

**Introduction** [5-min]
- Plan to do the quiz with the whole class, together (instead of handing it out for individuals to complete).
- Explain to students that they are going to do a short quiz to test their knowledge/awareness and perceptions/beliefs about freshwater resources.
  - [OPTIONAL] Ask each student to make a physical note (on a paper they can later hand in) of any questions/thoughts that come up while doing the quiz. Each person must come up with at least one question or thought for the activity.
• Set up the activity (as per Teacher’s Choice—Quiz Activity Options)

Teacher’s Choice—Quiz Activity Options  [Quiz: 15-min; Answers & Discussion: 15-min]
• Put the quiz questions up (one at a time) on the SMART board/Elmo/LCD projector.
• Going through one question at a time, read aloud and have students either record their answers (1) individually; (2) in pairs; or (3) in small groups.
  ○ Note: If you decide to have students work together in small groups, you could choose to make this activity into a team competition. Have students work together to decide on the correct answers (T/F) to all of the questions. Teams then submit their answers and the one who scores the highest, wins.
• Go over all of the answers at the end of the quiz
  ○ Were any answers surprising? Which ones? Discuss a few as needed. Refer to (BLM 1.0, *Teacher Key*), p.6-7 for detailed information you can share with your students about the quiz answers.

Wrap-up  [10-min]
• Ask students to Think-Pair-Share:
  ○ Think: Allow students who have not done so already to write down one question or thought that came up for them during the quiz activity (related to the questions).
  ○ Pair-Share: Have students pair up to discuss their question or thought with their partner. Ask students to record at least one additional question or thought that came out of their discussion with their partner (either about their own question/thought, or their partner’s).
• Ask each student to submit their questions/thoughts from the Think-Pair-Share activity to you as a “ticket out of the classroom” for the day.

Assessment (as learning):
• Before the activity, ask students to reflect on three questions (see Engagement Strategy).
• During the activity, ask students to jot down a relevant question or thought they have during the completion of the quiz (perhaps a key learning/take-away) (see Teaching Strategy).
• After the activity, have students discuss in pairs the question or thought they jotted down. As a “ticket out of the classroom,” students must submit their original question/thought, along with an additional question/thought that came from the discussion they had with their partner (see Teaching Strategy, Wrap-up).

Differentiated Instruction: Present the quiz by reading aloud the questions and providing the questions in text via the SMART board/Elmo/LCD projector. Reveal each quiz question one at a time so everyone in the class works at the same pace. There is also the option of completing the quiz in pairs or small groups, which may be advantageous for some students.

Extension:
• Have student(s) delve deeper into the questions or thoughts they had during the activity by doing some research and presenting something short to the class about their inquiry/findings.
• Have student(s) research and develop their own questions (that could be used in a similar quiz). Have students swap questions and learn more about freshwater resources through their own research, and that of their peers.
**BLM 1.0) Quiz: What About Our Water?**

Answer *True (T)* or *False (F)* to the following questions:

<table>
<thead>
<tr>
<th>Questions</th>
<th>T/F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fresh water makes up 20% of all water found on earth.</td>
<td></td>
</tr>
<tr>
<td>2. Of the freshwater found on earth, almost 70% is tied up in glaciers and permanent snow.</td>
<td></td>
</tr>
<tr>
<td>3. Water scarcity affects almost 3 billion people each year.</td>
<td></td>
</tr>
<tr>
<td>4. Bottled water is safer and better regulated than tap water.</td>
<td></td>
</tr>
<tr>
<td>5. The Great Lakes make up the largest supply of fresh surface water in the world.</td>
<td></td>
</tr>
<tr>
<td>6. The Great Lakes supply water to ~5% of the population of Canada.</td>
<td></td>
</tr>
<tr>
<td>7. Water can be owned and managed by private corporations.</td>
<td></td>
</tr>
<tr>
<td>8. Only 1% of the waters of the Great Lakes are renewed each year by snow melt and rain.</td>
<td></td>
</tr>
<tr>
<td>9. After experiencing years of declining water levels and pollution, today the Great Lakes are healthier than ever.</td>
<td></td>
</tr>
<tr>
<td>10. The average Canadian uses 275-L of water daily.</td>
<td></td>
</tr>
</tbody>
</table>
(BLM 1.0) Quiz: What About Our Water?  
*Teacher Key*

Answer True (T) or False (F) to the following questions:

<table>
<thead>
<tr>
<th>Questions</th>
<th>T/F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fresh water makes up 20% of all water found on earth.</td>
<td>F</td>
</tr>
<tr>
<td><strong>Answer</strong>: It is actually only a little over 2% (~2.5)! The rest is saltwater. <strong>Source</strong>: <a href="http://www.naturecanada.ca">www.naturecanada.ca</a></td>
<td></td>
</tr>
<tr>
<td>2. Of the freshwater found on earth, almost 70% is tied up in glaciers and permanent snow.</td>
<td>T</td>
</tr>
<tr>
<td><strong>Answer</strong>: This is indeed true, but it may also surprise you to learn that about 30% of freshwater is groundwater; therefore, only a very small percent of water (&lt; 0.5%) accounts for surface water in the form of lakes, rivers and streams. <strong>Source</strong>: <a href="http://www.great-lakes.net">www.great-lakes.net</a></td>
<td></td>
</tr>
<tr>
<td>3. Water scarcity affects almost 3 billion people each year.</td>
<td>T</td>
</tr>
<tr>
<td><strong>Answer</strong>: Around 2.7 billion people experience a period of at least one month of water scarcity, each year. Water availability is impacted by both quantity and quality (and most often, a combination of both). For example, if there is a lesser quantity of water available, this limited amount is put under additional stress (because it is at higher risk for overuse, and also pollution). <strong>Source</strong>: <a href="http://www.waterfootprint.org">www.waterfootprint.org</a></td>
<td></td>
</tr>
<tr>
<td>4. Bottled water is safer and better regulated than tap water.</td>
<td>F</td>
</tr>
<tr>
<td><strong>Answer</strong>: Laws that regulate bottled water are less strict than those that regulate tap water. Bottled water is categorized as a food and regulated under the Food and Drug Act, while tap water is regulated by Guidelines for Canadian Drinking Water Quality. Only 6% of bottled water factories were tested in 2010, and the government now only does surveillance if it gets a complaint (despite the fact that between 2000-2010, 27 out of 49 bottled water products were recalled). Furthermore, about 20% of bottled water is actually taken from municipal tap water instead of spring water sources (including Coke’s Dasani and Pepsi’s Aquafina). <strong>Source</strong>: <a href="http://www.insidethebottle.org">www.insidethebottle.org</a></td>
<td></td>
</tr>
<tr>
<td>5. The Great Lakes make up the largest supply of fresh surface water in the world.</td>
<td>T</td>
</tr>
<tr>
<td><strong>Answer</strong>: The Great Lakes—Superior, Michigan, Huron, Erie and Ontario—and their connecting channels form the largest fresh surface water system on Earth, roughly 20% of the world supply (or 1/5th). They provide 95% of the fresh surface water supply in North America. <strong>Sources</strong>: <a href="http://www.great-lakes.net">www.great-lakes.net</a>, <a href="http://www.naturecanada.ca">www.naturecanada.ca</a>, <a href="http://www.canadians.org">www.canadians.org</a></td>
<td></td>
</tr>
</tbody>
</table>
6. The Great Lakes supply water to ~5% of the population of Canada.  
**Answer:** They provide drinking water to **8.5 million Canadians**; the population of Canada is ~35.1 million. This is ~24% of Canadians who get their water from the Great Lakes (including 8 of Canada’s 20 largest cities), therefore it is almost **one-quarter or 25% of the population**!  
**Source:** [www.naturecanada.ca](http://www.naturecanada.ca), [www.ec.gc.ca/eau-water](http://www.ec.gc.ca/eau-water)

<p>| | |</p>
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<tbody>
<tr>
<td><em>7. Water can be owned and managed by private corporations.</em></td>
<td>T</td>
</tr>
</tbody>
</table>
| **Answer:** Water services categorized as “**private**” are completely owned and managed by a for-profit corporation, who have responsibilities towards their shareholders. This means that private water service providers lack a primary responsibility toward the residents in their jurisdiction who rely on these water sources. “**Public**” water services are owned and operated by a city/ municipality (and their staff). They have a primary responsibility towards the residents who consume these water resources.  

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<th></th>
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<tbody>
<tr>
<td><em>8. Only 1% of the waters of the Great Lakes are renewed each year by snow melt and rain.</em></td>
<td>T</td>
</tr>
</tbody>
</table>
| **Answer:** Therefore, if we consume (& export) more than 1% of the volume of water in the Great Lakes each year, the lake levels decline. Agricultural export is an example of one way that we remove water from a watershed (i.e., water stored in foods is removed when this food is transported elsewhere). Other factors impact lake levels as well, including drought. The water levels in the Great Lakes have been below their long-term averages over the past 14 years, and in 2013, two of the lakes reached record lows.  
**Source:** [www.ec.gc.ca/eau-water](http://www.ec.gc.ca/eau-water), [www.nytimes.com](http://www.nytimes.com) |

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9. After experiencing years of declining water levels and pollution, today the Great Lakes are healthier than ever.</td>
<td>F</td>
</tr>
</tbody>
</table>
| **Answer:** We wish this were the case! Although many measures have been put in place to help protect them, problems such as: pollution, climate change, over-extraction, invasive species, and wetland loss are all taking their toll. The Lakes are particularly sensitive to pollutants because they are retained in the system for a long time, becoming concentrated. In addition, about 7.6 million litres are extracted and “consumed,” daily, from the Great Lakes.  
**Source:** [www.canadians.org](http://www.canadians.org), [www.epa.gov/greatlakes](http://www.epa.gov/greatlakes) |

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10. The average Canadian uses 275-L of water daily.</td>
<td>T</td>
</tr>
</tbody>
</table>
| **Answer:** This is equivalent to ~4.5 baths! In 2009, unmetered households used a daily average of 376 litres per person compared to 229 litres per person by metered households. Breakdown of residential (indoor) **water use in Canada**: toilet – 30%; bathing and showering – 35%; laundry – 20%; kitchen and drinking – 10%; cleaning – 5%. Therefore, bathroom-related water use makes up ~2/3rd of total home indoor use!  
**Source:** [www.ec.gc.ca](http://www.ec.gc.ca) |

**Note:** Questions marked with asterisk* may be worth spending more time on, or exploring in more depth, with your students.
Activity 2: Personal Water Use Inventory

*Note: There are two options available for exploring personal water use with students.

[OPTION 1] Water Audit: Students complete a take-home activity where they record their direct water usage over a 24-hr OR 1-week time period.

| Time required: | [75-min] |
| Class #1 | 30-min (engagement activity; explanation of water audit & data collection) |
| |
| |
| |
| 24-hrs OR 1-week (data collection period) |
| Class #2 | 45-min (Take-up of activity: calculations & class discussion/ debrief) |

[OPTION 2] Water Use Habits Questionnaire: Students complete an in-class activity where they answer a series of questions related to their personal water use habits. Includes an exploration of both direct and indirect (“virtual”) water usage.

| Time required: | [60-min] |
| Class #1 | 45-min (engagement activity; explanation & completion of questionnaire) |
| |
| |
| 15-min (class discussion/ debrief) |

[OPTION 1] Water Audit

Learning Goal: To develop an awareness of how we use water, both personally and as a society.

Curriculum Expectations (*Gr.9 Issues in Canadian Geography, academic, *CGC1D)*:

| Strand B: Interactions in the Physical Environment |
| B1. The Physical Environment and Human Activities: Analyse various interactions between physical processes, phenomena, and events and human activities in Canada |
| B1.1: Analyse environmental, economic, social, and/or political implications of different ideas and beliefs about the value of Canada’s natural environment, and explain how these ideas/beliefs affect the use and protection of Canada’s natural assets |

| Strand C: Managing Canada’s Resources and Industries |
| C1. The Sustainability of Resources: Analyse impacts of resource policy, resource management, and consumer choices on resource sustainability in Canada |
| C1.4: Analyse the roles and responsibilities of individuals in promoting the sustainable use of resources (e.g., managing one’s own ecological footprint, making responsible consumer choices, recycling, advocating sustainable resource-use policies and practices) |

Description: Students complete a take-home activity known as a “water audit.” (*BLM 1.1*) is an activity sheet for students to record their daily water usage (p.12-13). For a more detailed water audit, have students complete (*BLM 1.2*), which is a weekly recording sheet for water use (p.14-15).
Materials & Preparation:
- Chalkboard/ whiteboard/ SMARTboard/ chart paper (whatever is available)
- **Direct Water Use Calculations** → print 1 copy per student (double-sided)
  - *(BLM 1.1)* Direct Water Use Calculations—DAILY (p.12-13) OR
  - *(BLM 1.2)* Direct Water Use Calculations—WEEKLY (p.14-15)

Engagement Strategy*: [15-min]

Part A [5-min]
- As a class, create a list of all the ways we use water directly in our daily lives. Record these on the board/ chart paper (or have a student do this). If necessary, prompt students to add water uses that are represented (and calculated) on *(BLM 1.1)/*(BLM 1.2), p.12-15.
  - e.g., dish washing, laundry, toilet, showering/ bathing, cooking, drinking, face/ hand washing, tooth brushing, etc.
- As a class, try to arrange these “Uses of Water” from: uses the least amount of water, to uses the most amount of water

Part B [10-min]
- On their own, have students estimate how much water is needed for each of the recorded “Uses of Water” (e.g., taking a bath ≈ 80L).
- Pair students up to compare their estimates. Have them discuss and modify their estimate to one both partners are comfortable with. Then, have them record their estimate on the board/ chart paper at the front of the class.
- Discuss with students the variety of estimates represented—what can we conclude from this activity?
  - *It is difficult to estimate the quantity of water we use in our everyday tasks!*

*Note: If time is short (or Part A runs long), you may want to simply do Part B as a class and have students guess aloud the approximate amount of water used for each of the “Uses of Water” listed, and then reveal the actual amount of water used for each task [refer to *(BLM 1.1)/*(BLM 1.2), p.12-15].

Teaching Strategy: [60-min]

Introduction [15-min]
- Explain to students that for homework, they will be keeping track of their water use over the next day: *(BLM 1.1)* Direct Water Use Calculation – Daily, or week: *(BLM 1.2)* Direct Water Use Calculation – Weekly.
- Explain the data collection sheet to students (i.e., how & where to record water use). Give practical tips for how to remember to keep track of the information.
  - E.g., Attach the sheet to a clipboard you keep with your phone; leave the collection sheet in the bathroom, where most of your water use is likely to take place
- You will probably need to go over each item on the sheet, answering any questions students have.
  - **Be sure to familiarize yourself with the recording sheet (and activity). It is strongly suggested you try it yourself for a day (or week) to see what your students will be responsible for!**
- Assign activity for homework. Be clear about when the activity will start and finish, when you will be taking it up again as a class, and what the expectations for completion are.
- [OPTIONAL] Explain how to complete the calculations on the sheet (by going over examples with the class). *Note: This should only be assigned to complete as part of the homework if your class is advanced. Otherwise, take it up in class once the data has been collected allowing students in-class time to complete calculations.*
Take-up [30-min]
- Occurs after 24-hrs OR 1-week (depending on data collection period)
  - Note: Make sure students know and are reminded of when the data must be collected by (and calculations completed, if you have assigned this as part of the homework)
- If calculations have not been explained/completed, go over this process with your students. Provide an appropriate amount of in-class time for calculations. Those who have not completed the activity may work with a partner who has completed it or be assigned an alternate task.
- Assign someone in the class to compile the overall data from their classmates (daily or weekly total usage). Have them calculate a class average for water use for the assigned period of time (i.e., one day or one week). Since this is not a small amount of work, offer them extra credit or other incentive to complete the task.

Discussion/debrief [15-min]

- Were you surprised by your daily personal water use? Did you think that you used more or less water in one day/one week? How does your personal total compare to the class average? If it is very different, why might this be (e.g., missing or inaccurate water use data)?
- How much of your total water was actually used, and how much went down the drain without being used? Can you identify some things you could change to use less water during certain activities?
- How much more water do you use on a daily or weekly basis, other than what actually comes from the faucet?
  - Prompt students by asking what other things water is used for (e.g., manufacturing of goods, growing food, resource extraction, etc.)
  - Explain the concept of “virtual” water (for information, see Background Information – Water Footprints & Virtual Water, p.19)
- How do you think your water usage compares to other people in Canada?

- Conditions such as drought, pollution, rising population, and unequal distribution of natural resources threaten our water supply, even in Canada.
- Consider:
  - Access to water: physical geography & climate
    - How do these influence availability of water? (consider: drought, current & future impacts of climate change)
    - What might happen if we were faced with extreme water shortages?
      - Cost would go up, our usage would have to go down, access would be less reliable, conservation practices would become more common, etc.
  - Access to water: urban vs. rural areas; low-income vs. middle-upper class
    - Do you have a well, or is your water metered and paid for?
    - Is water quality monitored and managed?
      - For example, there are still many rural communities in Canada that are on regular boil-water advisories, particularly several Aboriginal communities in the North.
Assessment (as and of learning):

- **Before** the activity, students reflect on their existing knowledge of how much water is used to perform common, daily tasks (see Engagement Strategy).
- **During** the activity debrief (see Teaching Strategy), record observations of student participation. Provide opportunities for students who did not engage in the conversation to record their thoughts and submit them to you, or talk to you one-on-one about their experience doing the water audit.
- **After** the activity and debrief, have students write a short blog post or journal response related to their experience recording and reflecting on personal water use. Have them address the question: “How can/ do I contribute to the sustainable use of water resources in my day-to-day life?”
  - Collect, read and return to students with your feedback.
- Collect students’ data sheets, and using a checklist, assess the following learning skills & work habits:
  - **Responsibility**: Did the student complete the at-home task?
  - **Organization**: Did the student keep an accurate, neat record of water usage?
  - **Independent work**: Was the student successful at completing the at-home task?

Differentiated Instruction: If you do not think students will be willing or able to perform this at-home task, as an alternative you might choose to collect daily or weekly water use data, yourself. Ask students to work together to compile and calculate your personal water use information (in pairs). You could then have students submit a short report to you that includes: (1) a summary of your water use; (2) where your water use was highest/ lowest (e.g., flushing the toilet/ drinking water); and (3) recommendations for reducing your water use.*

*Note: Be sure to caution students that they have to provide thoughtful and realistic recommendations, not silly suggestions (e.g., not showering all week!).

Furthermore, if students are engaged with this activity, then you can assign the water audit to them for the following week (and perhaps set a challenge for them to try to ‘beat’ your tally by using strategies to reduce their water use).

Extensions: Have students further explore their “water footprint” by visiting a computer lab to complete a detailed calculation of their water use at <www.waterfootprint.org>.
## Direct Water Use Calculation - DAILY

<table>
<thead>
<tr>
<th>Activity</th>
<th>Day/ Date:</th>
<th>Water Use per Activity</th>
<th>Your Total Daily Water Use (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dish washing</td>
<td>About how many sinks full of dishes did you dirty, today? <strong>OR</strong></td>
<td>= _______</td>
<td>x 35 litres</td>
</tr>
<tr>
<td></td>
<td>About how many times do you run your dishwasher per week?</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_______ ÷ # people ÷ 7 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laundry</td>
<td>About how many loads of laundry is done each week, at home?</td>
<td>= _______</td>
<td>x 150 litres (top-loading)</td>
</tr>
<tr>
<td>(washing machine)</td>
<td>_______ ÷ # people ÷ 7 days</td>
<td></td>
<td>x 95 litres (front-loading)</td>
</tr>
<tr>
<td>Toilet</td>
<td>How many times did you flush a “regular” toilet?</td>
<td>= _______</td>
<td>x 13 litres (regular)</td>
</tr>
<tr>
<td>(flushing)</td>
<td>How many times did you flush a “low-flow” toilet?</td>
<td>= _______</td>
<td>x 6 litres (low-flow)</td>
</tr>
<tr>
<td>Shower</td>
<td>How many minutes did you spend in the shower, today? <strong>Find out if you have a “low-flow” showerhead</strong></td>
<td>= _____min</td>
<td>x 23 L/min (regular)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>x 7.5 L/min (low-flow)</td>
</tr>
<tr>
<td>Bath</td>
<td>Approximately how many baths do you take each week? <strong>Do you fill the tub halfway, or to full?</strong></td>
<td>= _______</td>
<td>x 75 L (half)</td>
</tr>
<tr>
<td></td>
<td>_______ ÷ 7 days</td>
<td></td>
<td>x 150 L (full)</td>
</tr>
<tr>
<td>Cooking</td>
<td>How many cooked meals did you eat?</td>
<td>= _______</td>
<td>x 23 L</td>
</tr>
<tr>
<td></td>
<td>_______ ÷ # people</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking water</td>
<td>How many full glasses of water did you drink?</td>
<td>= _______</td>
<td>x 0.25 L</td>
</tr>
<tr>
<td>Faucet</td>
<td>About how much time did you spend running the faucet? (e.g., hand-washing, face-washing, tooth-brushing, etc.)</td>
<td>= _______</td>
<td>x 17 L/ min (regular)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>x 5.5 L/min (low-flow)</td>
</tr>
</tbody>
</table>
TOTAL WATER USED TODAY:
*Add up the final column on the previous page.

Other ways I used water today: ____________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

FURTHER INSTRUCTIONS:
*To get an average “weekly” water use calculation, multiply your final total by 7*

TOILET: To determine if your toilet is “low-flow” (generally, newer toilets will indicate the L/flush on them). If it is 6L or less, it is considered “low-flow.” If you’re still not sure, look up the brand and model online to determine L/flush for the unit. If you’re still not sure, consider it a “regular” toilet.

SHOWER: To determine if you have a “low-flow” showerhead. If you are unsure, do a test. Run the shower on full blast for 10 full seconds and catch the water output in a basin. Measure the contents of the basin (in L) and multiply by 6. Round to the nearest half litre. This is your shower’s water use per minute!

FAUCET: Feel free to estimate (e.g., for every time I brushed my teeth or washed my hands/face, the water ran for ~____ seconds/minutes).

Water Stats Sources:
### (BLM 1.2) Direct Water Use Calculation - WEEKLY

Record your water use with tick marks in the appropriate column. See instructions on next page.

<table>
<thead>
<tr>
<th>Activity</th>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
<th>SUN</th>
<th>Weekly total</th>
<th>Water per activity</th>
<th>Total Water Used (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dish washing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>____</td>
<td>x 35 litres</td>
<td>= _______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ # people in household</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td>Laundry (washing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___</td>
<td>x 150 litres</td>
<td>= _______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ top-loading</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___</td>
<td>x 95 litres</td>
<td>= _______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ front-loading</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td>Toilet (flushing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___</td>
<td>x 13 litres</td>
<td>= _______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ regular</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___</td>
<td>x 6 litres</td>
<td>= _______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ low-flow</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td>Shower</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ min</td>
<td>x 23 L/min</td>
<td>= _______</td>
</tr>
<tr>
<td>*record in minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ regular</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ min</td>
<td>x 7.5 L/min</td>
<td>= _______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ low-flow</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td>Bath</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___</td>
<td>x 75 L</td>
<td>= _______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ half</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___</td>
<td>x 150 L</td>
<td>= _______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ full</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td>Cooking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___</td>
<td>x 23 L</td>
<td>= _______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ # people in household</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td>Drinking water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___</td>
<td>x 0.25 L</td>
<td>= _______</td>
</tr>
<tr>
<td>(# glasses/day)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td>Faucet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ min</td>
<td>x 17 L/min</td>
<td>= _______</td>
</tr>
<tr>
<td>*estimate # min per day, record in boxes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ regular</td>
<td>= _______</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ min</td>
<td>x 5.5 L/min</td>
<td>= _______</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>___ low-flow</td>
<td>= _______</td>
<td></td>
</tr>
</tbody>
</table>
**TOTAL WEEKLY WATER USE:**

*Add up the final column on the previous page.

= ________

**INSTRUCTIONS:**

1. **DISH WASHING:** Record a tick mark for each load of dishes washed in your home, each day.
   *Divide your final number (water use in L) by the total number of people in your home.*

2. **LAUNDRY:** Record a tick mark for each load of laundry washed in your home this week.
   *Divide your final number (water use in L) by the total number of people in your home.*

3. **TOILET:** Record a tick mark for each time you flushed the toilet, each day.
   *Determine if your toilet is “low-flow” (generally, newer toilets will indicate the L/flush on them). If it is 6L or less, it is considered “low-flow.” If you’re still not sure, look up the brand and model on the internet to determine L/flush for the unit. If you’re still not sure, consider it a “regular” toilet.*

4. **SHOWER:** Record how many minutes you spent in the shower each day. If you forget to record it, make an estimate of your shower time.
   *Determine if you have a “low-flow” showerhead. If you are unsure, do a test. Run the shower on full blast for 10 full seconds and catch the water output in a basin. Measure the contents of the basin (in L) and multiply by 6. This is your shower’s water use per minute!*

5. **BATH:** Record a tick mark each day you had a bath this week. *Consider: Did you fill the tub halfway, or to full?*

6. **COOKING:** Record a tick mark for each full, cooked meal you ate (each day).

7. **DRINKING WATER:** Record a tick mark for each full glass of water you drank (each day).

8. **FAUCET:** Record approximately how many minutes you spent running the faucet (each day). Feel free to estimate (e.g., for every time I brushed my teeth or washed my hands/face, the water ran for ~___seconds/minutes).

---

**Water Stats Sources:**


[OPTION 2] Water Use Habits Questionnaire

Learning Goal: To develop an awareness of how we use water, both personally and as a society.

Curriculum Expectations (Gr.9 Issues in Canadian Geography; academic, 2013, *CGC1D):

<table>
<thead>
<tr>
<th>Strand B: Interactions in the Physical Environment</th>
<th>Strand C: Managing Canada’s Resources and Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1. The Physical Environment and Human Activities: Analyse various interactions between physical processes, phenomena, and events and human activities in Canada</td>
<td>C1. The Sustainability of Resources: Analyse impacts of resource policy, resource management, and consumer choices on resource sustainability in Canada</td>
</tr>
<tr>
<td>B1.1: Analyse environmental, economic, social, and/or political implications of different ideas and beliefs about the value of Canada’s natural environment, and explain how these ideas/beliefs affect the use and protection of Canada’s natural assets</td>
<td>C1.4: Analyse the roles and responsibilities of individuals in promoting the sustainable use of resources (e.g., managing one’s own ecological footprint, making responsible consumer choices, recycling, advocating sustainable resource-use policies and practices)</td>
</tr>
</tbody>
</table>

Description: Students complete an in-class activity where they answer a series of questions related to their personal water use habits (BLM 1.3), p.21. During the activity, they create a visual representation of their water use—for each question, students are asked to add a certain number of paperclips to a chain to represent their personal impact in terms of water usage [e.g. Question: Do you leave the water running while brushing your teeth? Yes (add 2 clips)/ Sometimes (add 1 clip)/ No (add 0 clips)]. This activity also incorporates some questions about “virtual” water use (our indirect uses of water), as well as accompanying discussion (see Background Information, p.19-20).

Materials & Preparation:
- Chalkboard/ whiteboard/ chart paper (whatever is available)
- SMART board/ Elmo/ LCD projector
- (BLM 1.3) Chain Reaction—How Much Water Do You Use? (p.21)
  - 1 copy to project for class
- (BLM 1.4) Teacher Reference Information – ‘Chain Reaction’ (p.22-23)
  - 1 copy for teacher
- Large paperclips (preferably coloured, blue suggested), ~40 per student
- Envelope packets (1 per pair of students, containing ~80 paperclips each)

Engagement Strategy*: [15-min]

Part A  [5-min]
- As a class, create a list of all the ways we use water directly in our daily lives. Record these on the board/ chart paper (or have a student do this). If necessary, prompt students to add water uses they haven’t yet thought of (e.g., dish washing, laundry, toilet, showering/ bathing, cooking, drinking, face/ hand washing, tooth brushing, etc.).
As a class, try to arrange these “Uses of Water” from: uses the least amount of water, to uses the most amount of water. Refer to (BLM 1.2) for guidance.

Part B  [10-min]
- On their own, have students estimate how much water is needed for each of the recorded “Uses of Water” (e.g., taking a bath = ~80L).
- Pair students up to compare their estimates. Have them discuss and modify their estimate to one both partners are comfortable with. Then, have them record their estimate on the board/ chart paper at the front of the class.
- Discuss with students the variety of estimates represented—what can we conclude from this activity?
  - It is difficult to estimate the quantity of water we use in our everyday tasks!

*Note: If time is short (or Part A runs long), you may want to simply do Part B as a class and have students guess aloud the approximate amount of water used for each of the “Uses of Water” listed, and then reveal the actual amount of water used for each task [refer to (BLM 1.2)].

Teaching Strategy:  [45-min]

Water Use Habits, Questionnaire  [30-min]
(BLM 1.3) Chain Reaction—How Much Water Do You Use? (p.21)
- Explain that in order to examine how we use water every day, students will be answering a few questions related to their water use habits.
- Go through question #1 on (BLM 1.3) with students. Explain the use of the paperclips with each question; depending on their answer, students will add a certain number of paperclips to their ‘chain’ to represent their individual water use.
- Distribute paperclips to students (~40 per student or ~80 per pair → use envelope to distribute)
  - Note: You will want to ask students to refrain from bending the extra clips out of shape, as you’d like to re-use them.
- Continue with the questionnaire as a class activity, revealing one question at a time.
- Discuss with students the implications of certain questions, as needed (this will be particularly important with the final 5 questions regarding “virtual,” or indirect water uses).*
  - *Refer to (BLM 1.4) – Teacher Reference Info: ‘Chain Reaction’ (p.22-24)

Note 1: If acquiring enough paperclips for this activity is too much of an expense or hassle, you can simply have students record and tally their ‘score.’ However, having some alternative visual representation can be a good way for students to actually ‘see’ the different impacts of their choices when it comes to water use.

Note 2: While setting up this activity, be careful to emphasize that everyone is starting from different places/ capabilities in terms of their personal water use, and that this activity is not meant as a comparison between students but rather a personal awareness activity.

Discussion/ debrief  [15-min]
- Explain that you will make a statement, and then ask students to position themselves on either side of the room depending on whether they “agree” or “disagree” with the statement. Students who are undecided may remain in the middle of the room. You may want to place a sign on each side of the room (on opposite walls)—one saying “AGREE,” and the other, “DISAGREE”
- After each statement is read, and students have positioned themselves, ask one or more students from each ‘section’ (agree/ disagree/ undecided) to explain their position or response.
Here are a few **possible statements** you may want to make. You can also make up some of your own:

- I was surprised by: *(a)* the score I received on the questionnaire related to my water habits; **OR** *(b)* the length of my paperclip chain representing my water use habits
  - Follow-up Q (for individuals): **Why/ why not? Why do you think your score was high/low?**
- I identified uses of water in my everyday life I had never thought about before*
  - *This will most likely be represented in “virtual” or indirect water uses; feel free to open up a short discussion with students about virtual water (refer to **Background Information: Water Footprints & Virtual Water**, p.19-20)
  - Follow-up Q (for individuals in “AGREE” section):
    - **Which uses of water had you never considered before? Were they surprising? Why/ why not?**
- I identified areas of my life where I could reduce my water use
  - Follow-up Q (for individuals): **Where could you reduce your water use? OR Why can’t you further reduce your water use?**
    - *Prompt these students to think critically about their virtual water use (such as in transportation or other consumer choices)

**Assessment (as and for learning):**

- **Before** the activity, students reflect on their existing knowledge of how much water is used to perform common, daily tasks (see **Engagement Strategy**).
- **During** the activity, students are provided an opportunity to reflect on their own behaviour and thinking, and how this relates to their personal water use (see **Teaching Strategy, Water Use Habits Questionnaire**).
- **During** the activity debrief (see **Teaching Strategy**), record observations of student participation. Provide opportunities for students who did not engage in the conversation to record their thoughts and submit them to you, or talk to you one-on-one about their experience doing the questionnaire.
- **After** the activity and debrief, have students write a short blog post or journal response related to their experience reflecting on personal water use. Have them address the question: “How can/ do I contribute to the sustainable use of water resources in my day-to-day life?”
  - Collect, read and return to students with your feedback

**Differentiated Instruction:** If you think your students lack the maturity to take this seriously in a group format (where comparisons between students may get out of hand), distribute the questionnaire to complete individually (*BLM 1.3*) and have them record their score. In a class journal or on a piece of paper, have students write down any questions or thoughts they have about the questionnaire (e.g., students may have questions about how eating meat increases their indirect water use). As a class, take up these questions and discuss/ explain as needed [referring to (*BLM 1.4*) **Teacher Reference Info: ‘Chain Reaction’**].

**Extension:** For [OPTION 1]: Water Audit, take daily or weekly totals of water use (in L) and try to compare this with something of equal volume that is easy to visualize (e.g., size of a closet, 4 full bathtubs, etc.)
**Background Information – Water Footprints & Virtual Water**

**Virtual water:** The amount of water consumed in the production process of a good or service is called “virtual water.”\(^1\) It includes both water consumed and polluted.

*E.g., COTTON T-SHIRT:* Virtual water is present in…
- water needed to grow the cotton crops
- water needed to process the cotton into useable fibre in a factory
- water needed in the manufacturing process of the t-shirt itself
- water needed to extract the fossil fuels used to run the machinery, transport the cotton and t-shirts, *etc.*

**Water Footprint:** The measure of both direct and indirect (*i.e.*, virtual) water use. Can be calculated for many purposes and scales (*e.g.*, for an individual, a corporation, a product, or even an entire country!).\(^2\)

The main difference between a “virtual water” use calculation and a “water footprint” calculation is that the latter takes into account where the used water is located (geographically) and the water source. Therefore, this information provides more insight into assessing the impacts of production on water resources in specific regions.\(^2\)

<table>
<thead>
<tr>
<th>Sources:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(^2) Water Footprint Network. (2014). University of Twente, the Netherlands. &lt;[<a href="http://www.waterfootprint.org">www.waterfootprint.org</a>]&gt;</td>
</tr>
</tbody>
</table>

For more information, refer to:
&lt;[http://www.iawaterwiki.org/xwiki/bin/view/Articles/WaterFootprint]&gt;

**Water Footprint Calculator:**

**Water Footprint Assessment Tool:**
&lt;[http://www.waterfootprint.org/tool/about-the-tool]/&gt;
## Examples of Virtual Water

### Examples of Agricultural Uses of Water

<table>
<thead>
<tr>
<th>Item</th>
<th>Water Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kg beef</td>
<td>15,000-50,000 L**</td>
</tr>
<tr>
<td>1 dozen eggs</td>
<td>2,060 L</td>
</tr>
<tr>
<td>1 loaf bread</td>
<td>570 L</td>
</tr>
<tr>
<td>1 kg apples</td>
<td>180 L</td>
</tr>
<tr>
<td>1 cup coffee</td>
<td>140 L</td>
</tr>
<tr>
<td>1 kg potatoes</td>
<td>90 L</td>
</tr>
<tr>
<td>1 cup tea</td>
<td>35 L</td>
</tr>
</tbody>
</table>

### Examples of Industrial Uses of Water

<table>
<thead>
<tr>
<th>Item</th>
<th>Water Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 L gasoline</td>
<td>10 L</td>
</tr>
<tr>
<td>1 kg steel</td>
<td>210 L</td>
</tr>
<tr>
<td>1 kw electricity</td>
<td>300 L</td>
</tr>
<tr>
<td>1 kg paper</td>
<td>840 L (4x than for steel)</td>
</tr>
<tr>
<td>1 kg synthetic rubber</td>
<td>2,520 L (3x than for paper)</td>
</tr>
<tr>
<td>1 kg aluminum</td>
<td>8,400 L</td>
</tr>
<tr>
<td>1 car</td>
<td>378,500 L</td>
</tr>
</tbody>
</table>

### Sources:
- Water Footprint Network. (2014). University of Twente, the Netherlands. <www.waterfootprint.org>
  - This website also contains downloadable resources
  - http://www.waterfootprint.org/tool/home/; Go to teaching tools (Resources section)

**There is a huge variation around the globe, as the water footprint depends on variable factors, such as: the type of production system, and the composition and origin of the animal feed.**
(BLM 1.3) Chain Reaction—How Much Water Do You Use?

MY DIRECT WATER USE:

1. When I shower, I take:
   Less than 5 min  1 paperclip
   5-10 min        2 paperclips
   More than 10 min 3 paperclips

2. The shower at home has a low-flow showerhead:
   Yes               0 clips
   I don’t know      1 clip
   No                2 clips

3. I ________ shut the water off when brushing my teeth:
   Always/usually   0 clips
   Sometimes        1 clip
   Rarely/never     2 clips

4. I use the toilet to flush unnecessary things (like used Kleenex, bugs, etc.):
   Rarely/never     0 clips
   Sometimes        1 clip
   Always/usually  2 clips

5. At home we practice “if it’s yellow, let it mellow…if it’s brown, flush it down!”
   Always/usually   0 clips
   Sometimes        1 clip
   Rarely/never     2 clips

6. My house has a low-flow (<6L/ flush) toilet:
   Yes                  0 clips
   I don’t know         1 clip
   No                   2 clips

7. After wearing an outfit, I wash it:
   Only when dirty     0 clips
   After I wear it two or more times 1 clip
   Every time, even when it’s not dirty 2 clips

8. My family keeps a jug of cold tap water in the fridge:
   Yes                  0 clips
   No                   1 clip

9. At home, we drink bottled water rather than tap water (but we don’t have to):
   Yes                4 clips
   No                 0 clips

10. We only run the dishwasher or washing machine when they’re full:
    Don’t have either machine 1 clip
    Always/usually          1 clip
    Sometimes              2 clips
    Rarely/never            3 clips

MY INDIRECT WATER USE:

1. In my diet, I am:
   Vegetarian           2 clips
   Omnivore (I eat meat!) 5 clips

2. I get a drive to school, instead of taking the bus:
   Rarely/never         0 clips
   Sometimes            1 clip
   Always/usually      2 clips

3. I buy my clothes new:
   Rarely/never         0 clips
   Sometimes            1 clip
   Always/usually      2 clips

4. I use paper unnecessarily:
   Rarely/never         0 clips
   Sometimes            1 clip
   Always/usually      2 clips

5. I eat fast-food/ processed foods:
   Rarely/never         0 clips
   Once a month         1 clip
   Once a week          3 clips
   More than once a week 5 clips

My score: ___________ clips
(BLM 1.4) Teacher Reference Info – ‘Chain Reaction’

Direct Water Uses

1. **Shower time:** Depending on the type of showerhead (standard vs. low-flow) and the amount of time spent showering, you could save up to 8x the amount of water used! At the lower end, a 2-min shower with a low-flow showerhead could “cost” you ~15L* of water (based on a flow rate of 7.5L/min*), whereas a 10-min shower with a standard showerhead dispenses upwards of ~230L* (with a flow rate of 23 L/min*).

*Note: These numbers are based on estimated rates of flow, combined from a variety of sources [see Water Stats Sources in (BLM 2.1) and (BLM 2.2)]. It should be noted that there was a high degree of variability between some sources, and the numbers provided here are approximations. Have your students do their own at-home investigations for more precise data!*

2. **Low-flow showerhead:** You can save up to one half of your water use with a low-flow showerhead. These generally have an aerating function, which adds air to the running water to reduce flow, and therefore water consumption. Some also have a “shut-off” button which allows you to easily stop water flow without having to shut off the tap and re-regulate the water temperature when you’re ready to rinse off!

3. **Brushing teeth** (unnecessary running of water): If you were to brush your teeth for the recommended 2-min without shutting off the tap, this could run you 10-40L per brushing (based on a flow of 5L/min for an aerated faucet, and 20L/min for a non-aerated faucet).

4-6. **Toilet flushing:** Toilet flushing accounts for 30% of water use in the home, second only to showering/bathing. A low-flow toilet, at the high end, uses ~6L/flush. A standard toilet typically uses ~13L. Again, this is a water savings of >50% with a low-flow model. Therefore, to avoid water waste, it is in your best interest to avoid unnecessary flushing…in your household, you can decide what this looks like (i.e., a mellow, yellow toilet)!

7. **Laundry:** A lot of unnecessary clothes-washing can really add up in terms of your weekly water usage. Not only does it wear down clothes faster, it uses somewhere between 95-150L water per cycle (front-loading washers are more water-efficient than top-loading ones).

8. **Drinking water:** Running the water from the tap to make it cold can result in unnecessary water waste. Keep a jug of water in the fridge, making sure to rinse it periodically when you empty it (every 3-days or so).

9. **Bottled water:** It takes 3-L of water to produce 1-L of bottled water (not to mention, it costs 2000x more energy to produce bottled water than tap water!)

10. **Full loads:** Both washers and dishwashers run more efficiently with full loads, vs. half ones. It is also believed that dishwashers (when run at full) are more water efficient than hand-washing dishes (just think of the amount of water that could be wasted while running the tap to make it hot, not to mention during rinsing).
Indirect Water Uses

**Virtual water:** the volume of water consumed or polluted in creating a *product* (measured over the entire production process).

1. **Eating meat:** There is water involved in growing crops (*e.g.*, grains & vegetables), and animals eat these crops to grow, themselves. Therefore, a diet that includes meat will generally have a higher “virtual” water content (or “water footprint”) than one that does not.

There is a huge variation with respect to the estimated amount of water it takes to raise and produce animals for consumption. For beef cattle, the water footprint depends on factors that vary, such as: the type of production system, and the composition and origin of the animal feed. However, estimates range from 15,000-50,000L of water needed to produce 1 kg of beef.

2. **Drive to school:** It takes 10-L of water to produce 1-L of gasoline…more water than you would need to consume after, say, walking to school! Taking the bus, however, means the fuel consumed (and the associated water costs) is spread out over all of the other people taking the bus with you. Everyone reduces their impact!

3. **Buying new clothes:** Cotton accounts for 40% of the global textile industry. It takes about 2,720-L of water to grow and produce one cotton t-shirt. This is equivalent to what one person might drink over 3 years! By buying used clothing, you are reducing the demand for new t-shirts to be manufactured.

4. **Paper waste:** It takes 840-L water to grow and manufacture 1-kg paper, so make sure paper use is necessary, and use both sides!

5. **Fast/processed food:** There are water costs involved in the production and packaging of fast/processed foods.

**Sources:**


6. The Polaris Institute (Ottawa, ON). *Bottled Water Facts and Stats* <www.insidethebottle.org>


8. Water Footprint Network. (2014). University of Twente, the Netherlands. <www.waterfootprint.org>
Activity 3: Water Resources in Conflict

Learning Goal: To develop an awareness of how our views, related to water, impact how we use it.

Curriculum Expectations (Gr.9 Issues in Canadian Geography; academic, 2013, *CGC1D):

<table>
<thead>
<tr>
<th>Strand A: Geographic Inquiry and Skill Development</th>
<th>Strand B: Interactions in the Physical Environment</th>
<th>Strand C: Managing Canada’s Resources and Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1. Geographic Inquiry: use the geographic inquiry process and the concepts of geographic thinking when investigating issues relating to Canadian geography</td>
<td>B1.1: Analyse environmental, economic, social, and/or political implications of different ideas and beliefs about the value of Canada’s natural environment, and explain how these ideas/beliefs affect the use and protection of Canada’s natural assets</td>
<td>C1.3 Analyse the influence of governments, advocacy groups, and industries on the sustainable development and use of selected Canadian resources</td>
</tr>
<tr>
<td>C1: Analyse impacts of resource policy, resource management, and consumer choices on resource sustainability in Canada</td>
<td>C1.4: Analyse the roles and responsibilities of individuals in promoting the sustainable use of resources (e.g., managing one’s own ecological footprint, making responsible consumer choices, recycling, advocating sustainable resource-use policies and practices)</td>
<td></td>
</tr>
</tbody>
</table>

Description: In Activities 1 & 2, we explored our assumptions and views on water, as well as how we use water in our day-to-day lives. Activity 3 consists of a brief wrap-up discussion about the influence of our views (ideas/beliefs) on the use and protection of water resources. There is also an assignment that can be used to further contextualize this discussion (addressing Overall Expectations B.1 and C.1, above).

Time required: 30-min

Materials & Preparation:
- Guiding questions for discussion (see Engagement Strategy)
- (BLM 1.5) Water Resources in Conflict—Assignment; 1 copy per student (3-pgs)
- (BLM 1.6) Water Resources in Conflict—Assignment *Teacher Key*, 1 copy for teacher

Engagement Strategy: [15-min]

Guiding question for discussion: Does how we view water resources impact how we use them?
Q1: Before completing Activities 1 & 2, did you make any assumptions about water… in Canada? In Ontario? In your city/town/community?
   E.g., Did you assume water would always be “available” to you? Why/why not? Did you think about your water use differently at certain times of the year? Why/why not? Have your views (about water availability) changed? Why/why not?

Q2: Do you think Canadians, as a whole, make certain assumptions about water resources? If so, what are they? What evidence leads you to believe Canadians make these assumptions?
   E.g., Canadians appear to assume Canada is a “water-rich” country. Canada is portrayed as such in the global media, and we don’t experience enough water availability shortages in our country for it to be considered a priority to protect and conserve water resources.

Q3: How might these assumptions affect our water use in Canada…now? In the future?
   E.g., Put simply, if we abuse our water now, we will likely experience a water future where even more caution around water resources will be necessary (not only at an environmental level, but also relating to political, economic and social issues).

Teaching Strategy: [15-min]
- Introduce the assignment on p.26-28 (BLM 1.5). Your class will probably need you to go through each question with them, to make sure they are clear on what is being asked. For those questions that are more opinion-based, give students an example of what type of response they might give. Refer to (BLM 1.6) Teacher Key (p.29-31) for this purpose.
- Be sure students are clear about the expectations around the assignment (e.g., you are collecting them for marking, students may ask for your assistance/guidance during the process, the assignment due date, etc.)

Assessment (of learning):
- Collect the assignment (BLM 1.5) for marking. There is no rubric provided, but you may wish to make your own.
- Consider whether: (1) students have demonstrated critical thinking skills in their answers; (2) it is evident students have put a lot of thought into their responses; (3) students who struggled with the assignment sought out your help and asked good questions, etc.

Differentiated Instruction:
- Some of your students may struggle with this assignment in written form. You could conduct a verbal assessment with these students, or pair weaker students with stronger ones for this assignment.

Extension:
- Have students do some more research on this case study issue by typing “Line 9 pipeline” in an internet search engine.
- Have students explore the context of Aboriginal rights and issues as associated with resource extraction (e.g. the Alberta Tar Sands and the Athabasca River) and transportation (i.e., pipelines, tankers).
  - Searches to try: “First Nations + tar sands;” “First Nations + line 9 pipeline;” “Northern gateway pipeline + BC First Nations”
Throughout our investigations on “water use,” you have explored the idea of how our views on water resources can influence how we use (and protect) these resources.

This assignment will be for homework. You will have ___ days to complete it. You may come to me for assistance if needed, but you must be able to demonstrate that you have done some research about the topic, already. Good luck!

ASSIGNMENT

1. Consider the following scenario.
   In point form, write down the key points in the box below.

An oil and gas company has put in a proposal to Canada’s National Energy Board to move heavy crude oil through one of their existing pipelines. The pipeline, which runs through a number of communities in Southern Ontario, was not built to move this type of substance. Studies suggest that it is only a matter of time before a leak or spill occurs, due to the corrosive properties of this oil. One of the biggest concerns is the impact to local water quality if a spill happens. Cleaning up oil from a spill will be challenging, as this form of oil generally sinks in water, instead of floating on the top. In addition, chemicals need to be mixed with the oil to allow it to flow through the pipeline. If a spill were to occur, these chemicals would evaporate into the air, creating a toxic cloud of vapours that would affect local air quality and could make people sick. However, this project also has the potential to create revenue from the oil exports that it would allow.

Key points:
2. Which two natural resources are in conflict in this scenario?

________________ and ________________

3. Describe the major conflict, as you see it, in one sentence:

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

4. What sort of beliefs about the value of each of these resources (see Q#2) do you think is reflected by the...

(a) Oil and gas company:

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

(b) People opposed to the project:

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
5. In point form, list some of the potential impacts (both positive and negative) you see from this project:
*Hint: Consider not only environmental, but also economic, social and political impacts!

<table>
<thead>
<tr>
<th>Negative</th>
<th>Positive</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

6. What actions and/or processes might help resolve the conflict?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

7. Do you think your personal choices help promote the responsible use of water resources? Name one thing that you could do to make a difference.

______________________________________________________________________
______________________________________________________________________
Throughout our investigations on “water use,” you have explored the idea of how our views on water resources can influence how we use (and protect) these resources.

This assignment will be for homework. You will have ____ days to complete it. You may come to me for assistance if needed, but you must be able to demonstrate that you have done some research about the topic, already. Good luck!

*Note: There are very few “right” or “wrong” answers. The student must demonstrate that they have put in sufficient thought and utilized critical thinking skills.

ASSIGNMENT

1. Consider the following scenario.
   In point form, write down the key points in the box below.

   An oil and gas company has put in a proposal to Canada’s National Energy Board to move heavy, crude oil through one of their existing pipelines. The pipeline, which runs through a number of communities in Southern Ontario, was not built to move this type of substance. Studies suggest that it is only a matter of time before a leak or spill occurs, due to the corrosive properties of this oil. One of the biggest concerns is the impact to local water quality if a spill happens. Cleaning up oil from a spill will be challenging, as this form of oil generally sinks in water, instead of floating on the top. In addition, chemicals need to be mixed with the oil to allow it to flow through the pipeline. If a spill were to occur, these chemicals would evaporate into the air, creating a toxic cloud of vapours that would affect local air quality and could make people sick. However, this project also has the potential to create revenue from the oil exports that it would allow.

   Key points:
   - Pipeline moves through several communities (in Southern Ontario)
   - Pipeline is not built to move heavy, crude oil
     - Studies show a spill is likely
   - The oil is hard to clean-up if it gets in the water
   - There will be impacts to both water and air quality if a spill occurs
   - This project would allow for additional oil exports, creating revenue for the economy

2. Which two natural resources are in conflict in this scenario?
   OIL and WATER
3. Describe the major conflict, as you see it, in one sentence:
This proposal creates a risk to local water resources, but if allowed to go ahead, it would contribute to the economic advancement of the oil and gas industry in Canada.

4. What sort of beliefs about the value of each of these resources (see Q#2) do you think is reflected by the…

(a) Oil and gas company:
They believe that oil/gas is more important than protection of water resources. And/or, there’s a belief that money can mitigate any harm to water resources that comes from the project.

(b) People opposed to the project:
Perceive that the risk of the project exceeds the rewards; some may believe that oil and gas are not a natural resource that we should continue to exploit at all costs, particularly to the potential destruction of local water resources.

5. In point form, list some of the potential impacts (both negative and positive) you see from this project:
*Note: I would expect students to touch on only a handful of these.

<table>
<thead>
<tr>
<th></th>
<th>Negative</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>If a spill were to occur:</strong></td>
<td><strong>Using an existing pipeline means another line does not need to be built (reduced environmental impact/footprint)</strong></td>
</tr>
<tr>
<td>Environmental</td>
<td>• Impacts to local ecosystem (and all life that depends on it)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Impacts to drinking water quality</td>
<td></td>
</tr>
<tr>
<td>Economic</td>
<td><strong>If a spill were to occur:</strong></td>
<td><strong>Economic gain due to easier export of in-demand resource (oil) critical thinking: who gains?</strong></td>
</tr>
<tr>
<td></td>
<td>• Potential lawsuits from people (families, businesses) affected</td>
<td><strong>Using an existing pipeline means another line does not need to be built, which would be costly</strong></td>
</tr>
<tr>
<td></td>
<td>• Extremely costly and time-consuming clean-up</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cost of repair to pipeline to maintain operations</td>
<td></td>
</tr>
</tbody>
</table>
(BLM 1.6) Water Resources in Conflict—Assignment  (p.3 of 3)

*Teacher Key*

| Social | • Social backlash and protests due to controversial/ high-risk nature of project (and potential impacts to environment, people)  
  
  *If a spill were to occur:*  
  • Possibility of severe illness or even death (people, wildlife)  
  • Damage to company name/ reputation  
  • Media attention |
|---|---|
| Political | • Incongruity between environmental protection and economic gain creates political tension, divides constituents  
  • Lack of political will/ attention to project concerns could result in violence  
  
  *If a spill were to occur:*  
  • More attention brought to issue (leverage more public support against project)  
  • Canada gains international recognition and power as a larger player in the economic export of oil  
  • Local action groups become established, to lobby for or against the project |

6. What actions and/or processes might help resolve the conflict?

- Consultation process to hear and address public concerns about the project
- Subjecting the project to an environmental assessment before giving it the “go-ahead”
- Demonstrating proof of “due diligence” (in inspecting the pipeline and making any necessary alterations/ repairs), ensuring that every possible safety precaution has been taken
- Creating a comprehensive spill-response plan; if it does not demonstrate a clear ability to mitigate negative impacts to water quality, the project should be rejected

7. Do your personal choices promote the responsible use of water resources?
Name one thing that you could do differently to make a positive impact.

- Pay more attention to my “virtual” water consumption (i.e., transportation, local vs. imported foods, production & manufacturing, etc.)
- Get involved in local water issues; know what is happening and seek ways to promote responsible use and protection of water resources
- Start at home—find ways to help reduce my household’s water consumption, and learn about ways to protect water quality through the products we buy (e.g., biodegradable dish detergents, laundry soaps, and shampoos)
- *Etc...*
Section II: Water Availability

Description: In Section I: Water Use, we created a picture of water in Canada and explored how the way we use water is influenced by how we view it. Section II: Water Availability provides the next step for looking at water resources in Canada and around the world. It examines the impact of human activity on the Great Lakes (and other surface water sources), as well as a further exploration of other factors affecting water availability in various countries, globally. This resource also includes a student research project for examining the impacts of climate change on water availability in Canada.

The four main goals of Section II: Water Availability are to:

1. Describe the significance of the Great Lakes as a source of freshwater in Canada
2. Identify some common impacts of human activity on the Great Lakes
3. Develop an appreciation for the different factors affecting water availability, in Canada and around the world
4. Understand & describe the effect of climate change on water resources in Canada

IMPORTANT NOTE FOR TEACHERS: This section of the resource contains some information “backgrounders,” including: The Great Lakes (p.33), Water Availability Around the World (p.43), and Climate Change & Water Availability (p.55). Although designed to meet expectations from the Gr.9: Issues in Canadian Geography, Ontario secondary school curriculum, this resource may also provide useful activities for Gr.12: Environment & Resource Management. We encourage you to use this resource as you see fit—that is, to take the activities, ideas and information presented here and make them your own. Good luck!
**Background Information:** The Great Lakes

The Great Lakes (sometimes referred to as the Laurentian Great Lakes) contain the largest supply of freshwater in the world—around 1/5th of globally available freshwater (and more than 4/5th of the North American supply). They are made up of a series of five large, interconnected lakes, one small lake (Lake St. Clair), four connecting channels and the St. Lawrence Seaway.

<table>
<thead>
<tr>
<th>Lake</th>
<th>Ranking by Size (among Great Lakes)</th>
<th>Ranking by Size (worldwide)</th>
<th>Population in Lake Basin (Canada + U.S.)</th>
<th>Retention time (# of years required to get rid of pollutants)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Ontario</td>
<td>Smallest</td>
<td>17th largest</td>
<td>5.6 million</td>
<td>6</td>
</tr>
<tr>
<td>Lake Erie</td>
<td>4th largest</td>
<td>13th largest</td>
<td>12.4 million</td>
<td>~2.5</td>
</tr>
<tr>
<td>Lake Huron</td>
<td>2nd largest</td>
<td>4th largest</td>
<td>3 million</td>
<td>22</td>
</tr>
<tr>
<td>Lake Michigan</td>
<td>3rd largest</td>
<td>5th largest</td>
<td>12 million (U.S. only)</td>
<td>99</td>
</tr>
<tr>
<td>Lake Superior</td>
<td>Largest</td>
<td>2nd largest</td>
<td>673,000</td>
<td>~170-200</td>
</tr>
</tbody>
</table>

During the last ice age, the Great Lakes were formed as a continental glacier retreated (~20,000 years ago). It was so heavy and powerful that the lake basins were gouged by the movement of the glacier over the Earth, which later filled up with meltwater from the retreating ice sheet. The Great Lakes attained their current water levels about 4,000 years ago.

The Great Lakes basin provides water for 40 million people in Canada (2 provinces) and the U.S. (8 states), as well as more than 200 billion litres of water per day for municipal, agricultural and industrial use. In fact, early settlers were drawn to the region around the Great Lakes for the agricultural land; today, the Great Lakes support 25% of Canada’s farm production. Industrialization of the Great Lakes basin began in the early 20th century, including industries such as: steel, paper, chemicals, cars and other manufactured goods. The Great Lakes are still dealing with many harmful environmental impacts resulting from industry. Shipping is another important economy on the Great Lakes, with over 200 million tons of cargo (primarily iron ore, coal and grain) being shipped annually throughout the region.

Commercial and sport fishing are also important to the economy of the Great Lakes: each year, around 65 million pounds of fish are caught (the equivalent worth of one billion dollars!). However, challenges such as pollution, habitat destruction, over-fishing and the presence of invasive species have all contributed to a decline in the fisheries.

In the last century, the Great Lakes have been subjected to heavy pollution and increased withdrawals and diversions, often leading to adverse ecological and community impacts. The Great Lakes Water Quality Agreement was first signed in 1972 between Canada and the U.S. It is intended to work toward restoring and protecting water quality and ecosystem health in the Great Lakes. Through this agreement, both countries enforce marine environmental protection laws, observe water quality and monitor and protect wildlife and fish species in the Lakes. The agreement outlines strict protocols for dealing with accidental spills, as well as for dealing with the problem of invasive species through strict monitoring of ballast and other cargo discharges.

References…see p.67
Activity 1: Fresh Water in Canada—A Great Lakes Case Study

Learning Goals:

- Describe the significance of the Great Lakes as a source of freshwater in Canada
- Identify some common impacts of human activity on the Great Lakes

Curriculum Expectations (Gr.9 Issues in Canadian Geography; academic, 2013, *CGC1D):

<table>
<thead>
<tr>
<th>Strand A: Geographic Inquiry and Skill Development</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1. Geographic Inquiry</strong>: use the geographic inquiry process and the concepts of geographic thinking when investigating issues relating to Canadian geography</td>
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<table>
<thead>
<tr>
<th>Strand B: Interactions in the Physical Environment</th>
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<tbody>
<tr>
<td><strong>B1</strong>: Analyse various interactions between physical processes, phenomena, and events and human activities in Canada</td>
</tr>
<tr>
<td><strong>B3</strong>: Describe various characteristics of the natural environment and the spatial distribution of physical features in Canada, and explain the role of physical processes, phenomena, and events in shaping them</td>
</tr>
<tr>
<td><strong>B1.2</strong> Analyse interrelationships between Canada’s physical characteristics and various human activities that they support</td>
</tr>
<tr>
<td><strong>B1.4</strong> Explain how human activities can alter physical processes and contribute to occurrences of natural events and phenomena</td>
</tr>
<tr>
<td><strong>B3.2</strong> Explain how geological, hydrological, and climatic processes formed and continue to shape Canada’s landscape</td>
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</tbody>
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<thead>
<tr>
<th>Strand C: Managing Canada’s Resources &amp; Industries</th>
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</thead>
<tbody>
<tr>
<td><strong>C2</strong>: Analyse issues related to the distribution, availability, and development of natural resources in Canada from a geographic perspective</td>
</tr>
<tr>
<td><strong>C2.1</strong> (1) Explain how the availability and spatial distribution of key natural resources in Canada are related to the physical geography of the country (including water), and (2) assess the significance of their availability and distribution, nationally</td>
</tr>
</tbody>
</table>

Description: This two-part activity allows students to consider the significance of the Great Lakes as a major source of freshwater on the planet. Students will explore: (1) how they were formed & how much is available; (2) the impact of human activities on the Great Lakes.

Time required: 1 class period (65-70 min)

Materials & Preparation:

- Map of the Great Lakes (classroom map and/or image for SMARTboard or projector)
- *(BLM 2.0)* Great Lakes Matching Activity—1 print-out per pair (p.36)
- *(BLM 2.1)* Human Activity & the Great Lakes—1 double-sided print-out per pair (p.39-40)
Engagement Strategy: [25-30 min]

- **Note:** The purpose of this engagement activity is to help students learn more about the importance of the Great Lakes as a source of freshwater in Canada.
- Show students a map of the Great Lakes
- Explain that, in pairs, students are going to complete a matching activity. Distribute *(BLM 2.0)* Great Lakes Matching Activity (p.36).
  - Students must match the statements (on the left) to the correct answers (on the right)
- Take-up the answers as a class. Use the **Background Information** on p.33 to discuss as needed.

Example Great Lakes Map [Source: [https://www.ec.gc.ca/grandslacs-greatlakes/](https://www.ec.gc.ca/grandslacs-greatlakes/)]
(BLM 2.0) Great Lakes Matching Activity

*Teacher Key*

Match the statement on the left with the correct answer on the right:

1. The Great Lakes were formed by… (4) 40 million
2. The Great Lakes, as we now know them, are about _____ years old (8) Sports fishing
3. The amount of water found in the Great Lakes is equivalent to _____ cubic kilometres! (5) Agriculture
4. The Great Lakes supply drinking water to _____ people in Canada and the U.S. (9) Lake Ontario
5. Settlers were drawn to the Great Lakes region due to its potential for… (3) 23,000
6. About _____ Canadians live in Lake Ontario’s watershed, representing >20% of the province’s population. (10) Lake Superior
7. In the early 20th century, the health of the Great Lakes was significantly impacted by ___________. (2) 4,000
8. This industry, supported by the Great Lakes, is worth $4 billion each year: (1) Retreat of a continental ice sheet (glacier) during the last Ice Age.
9. More Canadians live in this Great Lakes watershed than any other watershed in Canada. (6) 2.8 million
10. This Great Lake borders two Ontario cities and takes almost 200 years to rid itself of pollutants! (7) Industry

1 Great Lakes Environmental Research Laboratory (Michigan). National Oceanic and Atmospheric Administration, Department of Commerce (U.S.) <http://www.glerl.noaa.gov/pr/ourlakes/facts.html>
2 http://www.glerl.noaa.gov/pr/ourlakes/facts.html
3 http://www.glerl.noaa.gov/pr/ourlakes/economy.html
4 Lake Ontario Waterkeeper (Toronto). <http://www.waterkeeper.ca/lake-ontario/>
5 http://www.glerl.noaa.gov/pr/ourlakes/intro.html
6 http://www.glerl.noaa.gov/pr/ourlakes/facts.html
7 http://www.glerl.noaa.gov/pr/ourlakes/background.html
8 http://www.glerl.noaa.gov/pr/ourlakes/background.html
9 http://www.glerl.noaa.gov/pr/ourlakes/lakes.html
10 http://www.glerl.noaa.gov/pr/ourlakes/economy.html
### (BLM 2.0) Great Lakes Matching Activity

*Student Activity Sheet*

Match the statement in the *left* column with the correct answer in the *right* column (fill in the correct number in the blanks provided):

1. The Great Lakes were formed by…
   - ______ 40 million

2. The Great Lakes, as we now know them, are about ______ years old
   - ______ Sports fishing

3. The amount of water found in the Great Lakes is equivalent to ______ cubic kilometres!
   - ______ Agriculture

4. The Great Lakes supply drinking water to ______ people in Canada and the U.S.
   - ______ Lake Ontario

5. Settlers were drawn to the Great Lakes region due to its potential for…
   - ______ 23,000

6. About ______ Canadians live in Lake Ontario’s watershed, representing >20% of the province’s population.
   - ______ Lake Superior

7. In the early 20th century, the health of the Great Lakes was significantly impacted by ______.
   - ______ 4,000

8. This industry, supported by the Great Lakes, is worth $4 billion each year:
   - ______ Retreat of a continental ice sheet (glacier) during the last Ice Age

9. More Canadians live in *this* Great Lakes watershed than any other watershed in Canada.
   - ______ 2.8 million

10. This Great Lake borders two Ontario cities and takes almost 200 years to rid itself of pollutants!
    - ______ Industry
**Teaching Strategy:** [40 min]

- Students will complete a second activity, designed to help them learn about different impacts of human activity on the Great Lakes. The activity can be completed in pairs or as individuals.
- Distribute *(BLM 2.1)* Human Activity & the Great Lakes, p.39-40
- Read the instructions for the activity aloud to students
  - There are four impacts described (on p.1 of the activity sheet). Each represents a harmful impact to the Great Lakes as a result of human activity.
  - Students should read these four descriptions carefully, before moving on to examine the tables (p.2 of the activity sheet).
  - Each table represents one of the impacts described. Using the information provided (and critical thinking skills), students must match the information provided in the tables (on p.2) to the correct impact (on p.1).
  - Collect student activity sheets [after 20-25 min]
  - Go over each table with the class as a large group

**Assessment**

- Students complete the **Engagement Strategy** activity to assess their understanding of the importance of the Great Lakes as a source of fresh water. A class discussion at the end provides students with feedback and further context for the information presented in the activity.
- Collect the **Teaching Strategy** activity sheet. Review the correct answers for the tables with students, ensuring that they understand the linkages between human activities and their impacts on the Great Lakes. Discuss approaches and solutions for mitigating against these impacts. What can we do as individuals? As a society?

**Differentiated Instruction:**

- Have students complete both activities in pairs, matching students with stronger literacy skills with those who need additional assistance.
- Be sure to leave ample time to discuss the activities and answers aloud as a class.

**Extension:**

- Have students research and write a short, one-paragraph reflection on another human activity that impacts the Great Lakes. Have students describe: (a) the activity; (b) its impacts (both direct and indirect); and (c) possible solutions (to mitigate against the impact)
- Students could follow the same format as in *(BLM 2.1)* Human Activity & the Great Lakes (shown below)

<table>
<thead>
<tr>
<th>Possible human activities responsible</th>
<th>“Ripple” effects</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Did you Know?**

Many cities along the Great Lakes make use of them for both sourcing their drinking water and disposing of their wastewater...

Now, if this doesn’t make us think differently about what we put down the drain, I don’t know what will!

---

**Instructions:**

- Each table on page 2 represents a negative impact to the Great Lakes, resulting from human activity.
- Read the **Description of Impacts** below.
- Using the clues provided, **match each of the impacts below with the appropriate table on p.2**.

**Description of Impacts:**

**High bacteria levels:** If bacteria counts are high enough that there is a risk of causing human illness, this will result in beach closings and/or advisories. The most common bacterial pollution is E. coli, which indicates the presence of human or animal waste in the water.

**Harmful Algal Bloom:** Algal blooms occur when algae (a microscopic plant) grows to a point where a microscope is no longer needed to see it. Blue-green algae, known as cyanobacteria, cause algal blooms that are known to produce toxins (these are called “Harmful Algal Blooms”). These blooms are typically caused by high levels of nutrients (nitrogen and phosphorus), which may come from sources such as fertilizers or sewage.

**Invasive Species:** These are non-native species introduced from another body of water. They can outcompete native species for resources (such as food and habitat). Historically, a common way invasive species were introduced to the Great Lakes was in the ballast water of ships (used by large vessels for stability).

**Low water levels:** Since 1997-98, the Great Lakes basin has experienced the longest extended period of low water levels since tracking began in 1918. Although there are natural influences that impact this phenomenon, there are also several human activities that contribute to it. Read the tables on p.2 to determine which human activities might contribute to low water levels.

**Table (answer key):**

#1 = Invasive species; #2 = Harmful Algal Bloom; #3 = High bacteria levels; #4 = Low water levels

**YOUR TASK:**

On page 2, write the appropriate impact (below) in the space provided for each table. Use the descriptions above to help you!

- High bacteria levels
- Harmful Algal Bloom
- Invasive Species
- Low water levels
### Impact #1: Invasive species

<table>
<thead>
<tr>
<th>Possible human activities responsible</th>
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</tr>
</thead>
<tbody>
<tr>
<td>- Recreational boating</td>
<td>- Loss of other plant or fish species</td>
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</tr>
<tr>
<td>- Commercial shipping</td>
<td>- Impacts to the fishery and economy</td>
<td>- Continue to uphold the terms of the U.S.-Canada Great Lakes Water Quality Agreement</td>
</tr>
<tr>
<td>- Aquaculture (fish-raising operations)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Impact #2: Harmful Algal Bloom

<table>
<thead>
<tr>
<th>Possible human activities responsible</th>
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<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Improper septic maintenance</td>
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<td>- Proper septic maintenance</td>
</tr>
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<td>- Runoff from lawns, gardens, and farms</td>
<td>- Unsuitable water for human activity (e.g., swimming, drinking)</td>
<td>- Implement on-site water management practices (to reduce stormwater runoff)</td>
</tr>
<tr>
<td>- Overflow from wastewater management systems during high rainfall events (storm sewers, treatment plants)</td>
<td>- Toxic to humans and animals</td>
<td>- Reduction in use of fertilizers and soaps/detergents with phosphates</td>
</tr>
<tr>
<td>- Use of soaps &amp; detergents that have phosphates</td>
<td>- Earthy or musty smell</td>
<td></td>
</tr>
</tbody>
</table>

### Impact #3: High bacteria levels

<table>
<thead>
<tr>
<th>Possible human activities responsible</th>
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<th>Solutions</th>
</tr>
</thead>
<tbody>
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<td>- Human health effects</td>
<td>- Implement on-site water management practices (to reduce stormwater runoff), particularly on farms</td>
</tr>
<tr>
<td>- Overflow from wastewater management systems during high rainfall events (storm sewers, treatment plants)</td>
<td></td>
<td>- Effective waste treatment plants</td>
</tr>
</tbody>
</table>

### Impact #4: Low water levels

<table>
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<tr>
<th>Possible human activities responsible</th>
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<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Dredging/diversions</td>
<td>- Economic impacts (fishing, commercial shipping, recreational boating, hydroelectric generation, etc.)</td>
<td>- Regulation</td>
</tr>
<tr>
<td>- Water withdrawals</td>
<td></td>
<td>- Conservation (energy and water)</td>
</tr>
<tr>
<td>- Climate change</td>
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Did you Know?
Many cities along the Great Lakes make use of them for both sourcing their drinking water *and* disposing of their wastewater...
Now, if this doesn’t make us think differently about what we put down the drain, I don’t know *what* will!

*Student Activity Sheet*

**Instructions:**
- Each table on page 2 represents a negative impact to the Great Lakes, resulting from human activity
- Read the Description of Impacts below
- Using the clues provided, *match each of the impacts below with the appropriate table on p.2*

**Description of Impacts:**

**High bacteria levels:** If bacteria counts are high enough that there is a risk of causing human illness, this will result in beach closings and/or advisories. The most common bacterial pollution is E. coli, which indicates the presence of human or animal waste in the water.

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**YOUR TASK:**
*On page 2, write the appropriate impact (below) in the space provided for each table. Use the descriptions above to help you!*
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- Harmful Algal Bloom
- Invasive Species
- Low water levels
**Impact #1: __________________**

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**Impact #4: __________________**

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</tbody>
</table>
**Background Information:** Water Availability Around the World

“Water scarcity is an abstract concept to many and a stark reality for others. It is the result of myriad environmental, political, economic and social forces.”

By 2025, an estimated 1.8 billion people will live in water scarce areas. Two-thirds of the world’s people will be living in water-stressed regions as a result of overuse of resources, population growth and climate change. Other factors which will influence water availability include technology & engineering, as well as the presence of regulations to monitor the use and abuse of water systems.

**Water availability** must be assessed by virtue of both water quality and quantity.

**Quality:** Water must be considered safe to drink in order to be “available.” According to the World Health Organization, safe drinking water is treated surface water, and treated or untreated groundwater (such as from protected springs, boreholes and wells).

**Quantity:** Definitions of water availability must also include the ability to access a certain quantity of safe drinking water, within a certain distance from the household. In July 2010, the UN General Assembly voted in favour of a non-legally binding resolution recognizing the right to water and sanitation. The Assembly recognized the right of every human to have access to sufficient water for personal and domestic uses (50-100 litres of water/person/day), which must be safe, acceptable and affordable (not exceeding 3% of household income), and physically accessible (within 1 km of the home, with a collection time not exceeding 30 minutes).” The reality is that almost half of the world’s population does not have access to water in their homes; they must rely on wells, communal spigots, water trucks, lakes and/or rivers to collect their water. On average, women in developing countries walk 6km/day to collect water for the household. In addition, about 300 million people worldwide depend on desalination technology to provide them with freshwater.

Currently, 1 in 8 people worldwide (900 million) lack access to clean water, and we are adding 83 million people to the world annually. In developing countries, the lack of basic waste disposal infrastructure poses a huge threat to water availability. More than 40% of the world’s population lives without hygienic toilets. Water-bourne diseases such as cholera, leptospirosis and botulism cause 4,800 deaths per day and cause suffering to 2.3 billion people per year. Most of these diseases cause diarrheal illness, which is the number one killer of children under age five in the world.

Not only is safe, accessible drinking water important for keeping us healthy as humans, water is also essential to producing our sustenance. Farming and ranching account for 64% of water use worldwide. Water irrigation grows 40% of the world’s food and makes it possible to feed the people on this planet!

**References:**
1 National Geographic. *Freshwater Crisis.*  
<https://www.foodandwaterwatch.org/water/world-water/>
5 Sierra Club BC. *Water: Going Global Lesson Plans and Activities.*  
<http://www.sierraclub.bc.ca/education/resources-tools>
Activity 2: Water Availability Around the World

Learning Goal:
- Develop an appreciation for the different factors affecting water availability, in Canada and around the world

Curriculum Expectations (Gr.9 Issues in Canadian Geography; academic, 2013, *CGC1D):

<table>
<thead>
<tr>
<th>Strand A: Geographic Inquiry and Skill Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1. Geographic Inquiry: use the geographic inquiry process and the concepts of geographic thinking when investigating issues relating to Canadian geography</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand E: Liveable Communities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>E1: Analyse issues relating to the sustainability of human systems in Canada</td>
<td>E1.5 Propose courses of action that would make a community more sustainable</td>
</tr>
<tr>
<td>E2: Analyse impacts of urban growth in Canada</td>
<td>E2.1 Assess the impact of urban growth on natural systems and capacity (e.g., water availability)</td>
</tr>
<tr>
<td>E2.2 Analyse how various economic, social, and political impacts of urban growth distribution affect the community</td>
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</tr>
</tbody>
</table>

Description: Students are presented with fictional “water profiles” from two characters living in different countries. The profiles highlight what might constitute a typical water reality for a person living in that country. The activity asks students to read the profiles, and fill in a Venn diagram comparing and contrasting the two different water availability scenarios. The follow-up assignment (see Assessment) asks students to investigate and answer questions related to water availability in Canada.

Time Required:
- Activity: 1 class period [65-70 min]
- Assessment: 2-3 class periods [OPTIONAL]

Materials & Preparation:

Activity
- (BLM 2.2) Water Availability Profiles (p.47)
  - 3 copies (x 4 pgs) = < 24 students
  - 4 copies (x 4 pgs) = < 32 students
- (BLM 2.3) Water Availability Around the World – 1 per pair (p.52)
  - *Note: There are two Venn Diagrams per page. If, for example, there are 12 groups of 2 working on the activity, you need only print 6 copies of (BLM 2.3). Alternatively, have students draw their own Venn diagram on a sheet of paper.
  - Chalkboard/ whiteboard/ SMARTboard or chart paper

Assessment [OPTIONAL]
- At least 2 class periods in the computer lab
**Engagement Strategy**: [10-15 min]

- Start a discussion with students on the different factors which influence people’s ability to have access to safe, clean water. Write the words “Quality” and “Quantity” on the board. Explain to students that both of these factors have the ability to influence water availability (that is to say, access to safe, clean water).
- With students, brainstorm different factors which might influence water “quality” and water “quantity.” For further information, refer to Background Information: Water Availability (p.43). See also table below.
- **Note**: You do not need to discuss each of the points below with students; simply enough to get an understanding of the breadth of factors which contribute to water availability. Many of these factors will be examined in context during the main activity (see Teaching Strategy).

### Quality
- **Pollution** (biological, chemical, physical)
  - Lack of sanitation infrastructure (influences ability to provide clean water sources)
  - Deforestation (siltation of water sources due to erosion)
  - Salination (freshwater contaminated with seawater sources)
  - Others: lack of waste disposal systems, presence of industry, littering, road run-off, etc.
- **Lack of water treatment** (facilities or in-home devices)
  - Due to cost and/or availability of technology

### Quantity
- **Geography** (distance from source to home; related to this are transportation and family unit—what/who is available to help collect/carry water?)
- **Climate** (lack of water due to regional weather trends; related to this is the exacerbating effects of climate change on water availability)
- **Lack of water infrastructure** (to pump water from source)
- **Population** (# of people relying on source)
- **Water withdrawals** (for agriculture, industry, etc.)
- **Cost** (often the cost of accessing safe, clean water is too high for the income level of those seeking access; a related issue is water privatization)

**Teaching Strategy**: [60-min]

**Description**
- You should have 3-4 copies (12 to 16 pages) of (BLM 2.2) Water Availability Profiles. Each page lists two profiles which students will read and compare using a Venn diagram (BLM 2.3).
  - There are 8 Water Availability Profiles in total (four pages)
  - **Note**: In one class, there will be 3-4 different student pairs working on the same profiles at the same time.
- Each water availability profile* represents a fictional character living in a different country from around the world. The profiles highlight what might constitute a typical water reality for a person living in that country.
- **Note**: Please emphasize to students that these profiles are meant to provide examples, and by no means represent the living conditions or “water realities” faced by all people in these countries. We want to be careful to avoid stereotypes, and concentrate on identifying some of the key threats to accessing safe water, worldwide.
**Activity** [40 min]
- Have students work in pairs
- Distribute one page of the water profiles (*BLM 2.2*) to each pair, along with one copy of (*BLM 2.3*) Water Availability Around the World (Venn Diagram, p.52)
- Working together, ask students to read the profiles and fill in the Venn diagram by comparing the two different profiles with regards to *what factors* affect water availability in each
  - See **ANSWER KEY** (p.51)
- Debrief the activity as a class, either at the end if time permits, or during the next class. If you are going to take-up the activity during the next class, collect the Venn Diagrams from students before they leave. Be sure to have students put their names on their work.

**Debrief** [10-15 min]
- Write the country “pairings” from the water availability profiles on the chalkboard/ whiteboard/ SMARTboard
  - Haiti/ Bangladesh
  - Bolivia/ India
  - Afghanistan/ Ethiopia
  - Australia/ United States
- One at a time (under the appropriate heading), have each student pair write down one of the factors affecting water availability in both countries they worked with (*i.e.*, from the centre of their Venn diagram)
- Once there is a good list compiled, compare across the four lists—what appears to be the most common factor affecting water availability, worldwide?
  - *Possible answers*—Access to sanitation, poverty
  - *Ask*—Are these issues likely to cause problems for water availability in Canada? Why/ why not?
- In the follow-up assignment for this activity (see **Assessment**), students will examine more closely the Canadian context of water availability, as well as Canada’s role in addressing the world water crisis.

**Assessment:** [2-3 class periods]
- Using the information gathered from the activity, as well as some independent research, students will complete an assignment from a list of pre-determined options. This type of assignment is known as RAFT (Role, Audience, Form, Topic). See (*BLM 2.4*) RAFT Assignment, p.53.
- The assignment will be formally assessed—see (*BLM 2.5*) RAFT Rubric, p.54.
- Have students submit their research notes and/or rough draft as these will be part of the grading rubric.

**Differentiated Instruction:**
- Provide students with a list of factors that impact water availability (see table on p.45) for the main activity. Pair up students with stronger literacy skills with those needing additional assistance.
Using your Venn Diagram, compare and contrast the following two water profiles. Concentrate on the factors that affect water availability in each country.

<table>
<thead>
<tr>
<th>Haiti</th>
<th>Bangladesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emmanuel lives in Haiti, a Caribbean country. He and his family, along with almost 40% of Haitians, lack clean water. In his rural community, the water treatment facility does not function properly. Another problem is that in Haiti, one in four people do not have a sanitary toilet, which is both an urban and rural issue. This basic lack of sanitation services means that water quality is affected. Emmanuel and his country are considered poor, with about 80% of Haitian people living in poverty. While underground water resources may exist (especially in mountainous and coastal areas), Haiti is considered a water-stressed country because of a lack of money to provide infrastructure to access this water. On top of all this, rainfall patterns mean too much water is provided during certain parts of the year, while too little falls in the dry season. Soil erosion as a result of deforestation is also causing a decrease in water quality.</td>
<td>Sadia lives in the capital city of Bangladesh, a country in South Asia. Her younger sister, Chandni, recently fell ill with a diarrheal disease from drinking poor quality water. About 100,000 children in Bangladesh die each year from drinking contaminated water. One of the main problems is that many living in poverty (about 30% of Bangladeshis) do not have access to a safe toilet—almost half of the population lacks access to sanitation services. In addition, the urban population continues to increase rapidly, causing the slums to become overcrowded and placing a strain on already scarce water resources. Sadia and her family used to live in rural, western Bangladesh. However, in the 1990s, the drilled well in their community was found to be high in arsenic, a toxic metal which can cause death (1 in 5 deaths in Bangladesh are attributed to arsenic in drinking water). These water sources were closed off, forcing people to return to contaminated surface sources (ponds and ditches), or walk great distances to get to safe wells. On top of all this, Bangladesh’s climate means that the country experiences drought in the cooler seasons, placing even more stress on water resources.</td>
</tr>
</tbody>
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Using your Venn Diagram, compare and contrast the following two water profiles. Concentrate on the factors that affect **water availability** in each country.

<table>
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<th>Bolivia</th>
<th>India</th>
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<tbody>
<tr>
<td>Juan lives in the city of Cochabamba, Bolivia (South America). In the spring of 2000, he and many others embarked in a high-profile struggle against water privatization, which came to be known as the “Water Wars.” The movement was based on the idea that access to water should be a basic human right; however, in a district known for its poverty, water prices were making access to water possible only for the wealthy. Despite political improvements after the “Water Wars,” Juan knows that Bolivia still suffers from limited access to water and sanitation. Over 70% of the country lacks access to proper sanitation, and in Cochabamba, at least 40% of residents still lack piped water. Those without it are forced to pay more (for trucking in water), and even users on the piped system still experience periods with no water service. Existing water infrastructure is old, and precious water resources are slipping through the cracks—quite literally! As a mountainous country, Bolivia also experiences geographic barriers to providing a centralized water service. Over the past number of years, Juan has been reading articles on climate change, which is quickening the pace of glacial melt (a primary source of water in Bolivia). Seasonal droughts, exacerbated by a changing climate, also play into his country’s struggle to meet their water needs.</td>
<td>Mahesh lives in India, a South Asian country. It is the 7(^{th}) largest country by area and 2(^{nd}) largest by population—a fact which is placing a strain on the country’s water resources. One of the challenges is the level of poverty in India—over half of the population is considered poor. Lack of sanitation remains one of the main problems with water availability. Agricultural runoff into surface waters is a close second. Industrial waste also poses a chemical threat to water quality. Mahesh lives in rural India, where water problems are considered worse. Although India has made improvements over the past decades in providing quality drinking water through centralized systems, the result has been over-privatization of water resources—drawing into question the affordability of water. India is also a major grain producer—the combined agriculture and population needs are causing groundwater to be used at a rate faster than it can be replaced. Fortunately, many parts of India are blessed with a wet climate, even in dry regions—one of the keys to addressing water scarcity is to work on catching and storing this rainwater for future use.</td>
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Using your Venn Diagram, compare and contrast the following two water profiles. Concentrate on the factors that affect water availability in each country.

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<tbody>
<tr>
<td>Fahran is from rural Afghanistan. In a country where only a little over 10% of people have immediate access to clean drinking water, she is not one of the lucky ones. Although some areas of Afghanistan are water scarce due to climate and geography, most people don’t have access to clean water because of: (1) a lack of water infrastructure; and (2) contaminated water from lack of sanitation—only 1% of people in rural areas of the country have access to sanitation. In a country with a long history of conflict, natural water supplies and existing infrastructures have been badly damaged or destroyed. Investing in clean water hasn’t exactly been made a priority for the country, either. Fahran’s family are farmers; although agriculture is an important economic activity in the country, international aid money has not gone toward developing water infrastructure. Fahran also knows that there have been increasing tensions between Afghanistan and its neighbours, Iran and Pakistan. Near the border, she and her family see water from mountain rivers (Afghanistan’s main source) flow across the border, without being able to use it on their fields. Water tensions seem likely to cause yet more danger and violence for her and her people.</td>
<td>Winta is from the African country of Ethiopia. She and her three young daughters must gather water for their family, while her husband and sons work in the fields. They are luckier than some—it only takes them 2-hours roundtrip to gather the water they need for the day, but if Winta were on her own, she would have to make three trips. Even so, their water source doesn’t always provide them with clean drinking water—the same pond is shared with cattle and other animals. Last year, Winta lost her infant child to diarrheal disease. Sanitation is only accessible to about 20% of the population in Ethiopia (estimated at over 90 million), and contributes significantly to the lack of clean water sources. Winta’s country is also plagued by recurring drought, which sometimes causes local ponds, lakes, and shallow wells to dry up. Climate change is causing the rainy season to become shorter, which means water (for people and agriculture) is a scarcer resource. Farmers are fighting for the water they need to grow their crops—in the horn of Africa, where Somalia borders Ethiopia, tribal conflicts over water occur. Winta worries for the safety of her and her daughters as they make the trek to gather water each morning.</td>
</tr>
</tbody>
</table>
Using your Venn Diagram, compare and contrast the following two water profiles. Concentrate on the factors that affect water availability in each country.

<table>
<thead>
<tr>
<th><strong>Australia</strong></th>
<th><strong>United States</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracy is from Perth, Australia. Australia is a developed country, and ranks in the top 15 wealthiest on the planet. Nevertheless, water scarcity is a growing concern, especially in Western Australia. Perth’s climate is hot and dry, and climate change is believed to be causing a shift in weather patterns. Perth used to get a lot of winter storms, but these seem to be moving further south. Over the past three decades, the result has been much less surface water runoff to recharge the water reservoirs. Of the nearly 2 million people in Perth, most now draw their water from the ground; with a growing population, this water future is not sustainable. The groundwater will eventually run out, and the rains won’t come to bring more. Luckily, Perth is able to plan ahead—they are building desalination plants (that turn seawater into freshwater) to deal with current and future water needs. However, the coal-powered desalination plants are contributing MORE to the problem by releasing large amounts of greenhouse gases into the atmosphere (which in turn contribute to climate change).</td>
<td>John lives in San Diego, California. He is working in with a team of experts to develop a 50-year water strategy for the city. In the Western U.S., surface water sources such as lakes, rivers, and reservoirs are diminishing due to an ongoing drought, which is believed to be a result of climate change. Important agricultural lands are going out of production because there isn’t enough water to produce crops. Large cities such as San Diego have been forced to rely almost solely on groundwater, and the future of this is unsustainable. The average domestic water use per person in the United States is over 4 times that of India, and almost 8 times that of Bangladesh. With close to 1.5 million people in San Diego (a similar number to Perth), population and lifestyle choices (<em>i.e.</em>, how water is used, and in what quantities) will continue to affect California’s water shortages. John’s team knows that water restrictions, with enforcement and fines for violation, may be the only way forward in dealing with the city’s water crisis.</td>
</tr>
</tbody>
</table>
ANSWER KEY (Venn Diagram):

<table>
<thead>
<tr>
<th>Country</th>
<th>Quality</th>
<th>Both countries</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haiti</td>
<td>- Lack of functioning water treatment facility</td>
<td>- Lack of sanitation services</td>
<td>- Poverty</td>
</tr>
<tr>
<td></td>
<td>- Lack of sanitation services</td>
<td></td>
<td>- Climate</td>
</tr>
<tr>
<td></td>
<td>- Deforestation (soil erosion)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Lack of infrastructure to access water resources (related to country’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>poverty level)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Climate (rainfall patterns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td>- Lack of sanitation services (leading to contaminated surface water</td>
<td>- Lack of sanitation services</td>
<td>- Groundwater toxic metal contamination (geographic, arsenic)</td>
</tr>
<tr>
<td></td>
<td>sources)</td>
<td></td>
<td>- Urban overcrowding</td>
</tr>
<tr>
<td></td>
<td>- Groundwater toxic metal contamination (geographic, arsenic)</td>
<td></td>
<td>- Climate (drought in cooler seasons)</td>
</tr>
<tr>
<td></td>
<td>- Urban overcrowding</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Lack of infrastructure to access water resources (related to country’s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>poverty level)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Climate (rainfall patterns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bolivia</td>
<td>- Lack of sanitation services</td>
<td>- Lack of sanitation services</td>
<td>- Poverty</td>
</tr>
<tr>
<td></td>
<td>- Cost (privatization, but historically, poverty)</td>
<td></td>
<td>- Climate</td>
</tr>
<tr>
<td></td>
<td>- Aging infrastructure (water loss)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Geography (mountains)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Climate (glacial melt, drought)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>- Lack of sanitation services</td>
<td>- Lack of sanitation services</td>
<td>- Agricultural &amp; industrial pollution</td>
</tr>
<tr>
<td></td>
<td>- Cost (privatization; poverty)</td>
<td></td>
<td>- Overpopulation</td>
</tr>
<tr>
<td></td>
<td>- Climate (changing weather patterns, lack of rainfall)</td>
<td></td>
<td>- Cost (privatization; poverty)</td>
</tr>
<tr>
<td></td>
<td>- Agricultural withdrawals</td>
<td></td>
<td>- Agricultural withdrawals</td>
</tr>
<tr>
<td></td>
<td>- Climate (rainfall &amp; catchment systems)</td>
<td></td>
<td>- Climate (rainfall &amp; catchment systems)</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>- Lack of sanitation services</td>
<td>- Lack of sanitation services</td>
<td>- Climate (changing weather patterns, lack of rainfall)</td>
</tr>
<tr>
<td></td>
<td>- Cost (privatization, but historically, poverty)</td>
<td></td>
<td>- Conflict</td>
</tr>
<tr>
<td></td>
<td>- Aging infrastructure (water loss)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Geography (mountains)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Climate (changing weather patterns, lack of rainfall)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Lack of investment in water supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Geography (water supply that crosses country borders)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Climate (earlier snowmelt from mountains)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td>- Lack of sanitation services</td>
<td>- Lack of sanitation services</td>
<td>- Conflict</td>
</tr>
<tr>
<td></td>
<td>- Contamination from animals</td>
<td></td>
<td>- Over water resources</td>
</tr>
<tr>
<td></td>
<td>- Distance to source</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- # of family members to gather water</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Climate (drought)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Conflict (over water resources)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>- Desalination technologies</td>
<td>- Climate (changing weather patterns, lack of rainfall)</td>
<td>- Population</td>
</tr>
<tr>
<td></td>
<td>- Climate (changing weather patterns, lack of rainfall)</td>
<td></td>
<td>- Lifestyle/ water use habits</td>
</tr>
<tr>
<td></td>
<td>- Population</td>
<td></td>
<td>- Water restrictions</td>
</tr>
<tr>
<td>United States</td>
<td>- Climate (changing weather patterns, lack of rainfall)</td>
<td>- Climate (changing weather patterns, lack of rainfall)</td>
<td>- Population</td>
</tr>
</tbody>
</table>
(BLM 2.3) Water Availability Around the World

In the space below, write down the factors affecting water availability in each of your two scenarios.
In the centre, list those factors that were common to both characters.

Country:

Country:

In the space below, write down the factors affecting water availability in each of your two scenarios.
In the centre, list those factors that were common to both characters.

Country:

Country:
(BLM 2.4) RAFT Assignment

Choose one of the following assignments

You will be assessed on how well you: (1) Answer the Key Questions outlined for your assignment; (2) Gather information and ideas relevant to the assignment; (3) Express and organize your ideas; (4) Form a concluding statement; (5) Communicate to your assigned audience (Ask: What do they know? What do you want them to know?)

Assignment #1

<table>
<thead>
<tr>
<th>Role</th>
<th>Audience</th>
<th>Form</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water campaigner for the Council of Canadians</td>
<td>Canadian public</td>
<td>Letter to the editor (i.e., opinion piece in the newspaper)</td>
<td>Improving water availability for indigenous people in Canada</td>
</tr>
</tbody>
</table>

Key Questions: What is the state of water availability for indigenous people in Canada? How could the sustainability of water resources be improved for indigenous communities?

Note: It may be easier to use a case study (i.e., discuss water availability in a specific community)

Assignment #2

<table>
<thead>
<tr>
<th>Role</th>
<th>Audience</th>
<th>Form</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Member of the United Nations Water Security Taskforce</td>
<td>United Nations delegates</td>
<td>Speech (political address)</td>
<td>The impact of population growth on water availability</td>
</tr>
</tbody>
</table>

Key Questions: What is the current and future world population? How will an increasing world population affect future water availability? As water resources become scarcer worldwide, what will be some of the economic, social and/or political impacts? Will these be felt in Canada? How?

Assignment #3

<table>
<thead>
<tr>
<th>Role</th>
<th>Audience</th>
<th>Form</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water utility expert</td>
<td>Urban municipality</td>
<td>Video teleconference</td>
<td>Preparing to meet increasing water demands in urban Canada</td>
</tr>
</tbody>
</table>

Key Questions: How might urbanization (the move of people out of rural areas into urban ones) impact the availability of water? How will water infrastructure hold up to increasing demands? Who will pay for upgrades? Consider the privatization of water utilities—what happens when the cost of providing water services goes up? (hint: refer to recent example of Detroit, Michigan)
## (BLM 2.5) RAFT Rubric

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Level 1 (50-59%)</th>
<th>Level 2 (60-69%)</th>
<th>Level 3 (70-79%)</th>
<th>Level 4 (80-100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addresses the assignment topic (including <strong>Key Questions</strong> )</td>
<td>Demonstrates <strong>limited</strong> understanding of assignment topic</td>
<td>Demonstrates <strong>some</strong> understanding of assignment topic</td>
<td>Demonstrates <strong>considerable</strong> understanding of assignment topic</td>
<td>Demonstrates <strong>thorough</strong> understanding of assignment topic</td>
</tr>
<tr>
<td>Planning skills <em>(e.g., gathers research evidence &amp; information effectively)</em></td>
<td>Uses planning skills with <strong>limited effectiveness</strong></td>
<td>Uses planning skills with <strong>some effectiveness</strong></td>
<td>Uses planning skills with <strong>considerable effectiveness</strong></td>
<td>Uses planning skills with a <strong>high degree of effectiveness</strong></td>
</tr>
<tr>
<td><strong>Expressing &amp; organization of ideas and information</strong> <em>(e.g., clear expression, logical organization)</em></td>
<td>Expresses and organizes ideas &amp; information with <strong>limited effectiveness</strong></td>
<td>Expresses and organizes ideas &amp; information with <strong>some effectiveness</strong></td>
<td>Expresses and organizes ideas &amp; information with <strong>considerable effectiveness</strong></td>
<td>Expresses and organizes ideas &amp; information with a <strong>high degree of effectiveness</strong></td>
</tr>
<tr>
<td>Processing skills <em>(e.g., interprets information &amp; formulates concluding statement)</em></td>
<td>Uses processing skills with <strong>limited effectiveness</strong></td>
<td>Uses processing skills with <strong>some effectiveness</strong></td>
<td>Uses processing skills with <strong>considerable effectiveness</strong></td>
<td>Uses processing skills with a <strong>high degree of effectiveness</strong></td>
</tr>
<tr>
<td>Communication for different audiences or purposes <em>(e.g., inform, persuade)</em></td>
<td>Communicates for different audiences or purposes with <strong>limited effectiveness</strong></td>
<td>Communicates for different audiences or purposes with <strong>some effectiveness</strong></td>
<td>Communicates for different audiences or purposes with <strong>considerable effectiveness</strong></td>
<td>Communicates for different audiences or purposes with a <strong>high degree of effectiveness</strong></td>
</tr>
</tbody>
</table>

*Where “effectiveness” may represent: appropriateness, clarity, accuracy, precision, logic, relevance, significance, fluency, flexibility, depth, and/or breadth.*

**Notes for Student:**
**Background Information: Climate Change & Water Availability**

**Climate Change** is one of the greatest challenges facing our planet. What is causing it? Greenhouse gases are released by burning fossil fuels for energy. Fossil fuels include: coal, oil and natural gas. We call these gases “greenhouse gases” (GHGs) because of their ability to trap heat from the sun. Although alternative sources of energy exist (such as sun, wind and hydro), the world still relies heavily on these ancient “fossil” fuel stores as our main power source. Although GHGs are needed to trap enough heat on our planet for life to exist, too many GHGs are building up in the atmosphere. This has led to an increase in the earth’s average global temperature, at a rate unlike anything seen before in our planet’s history. This change has led to a number of large-scale impacts, one of which has been to the availability of water in parts of the world.

**Water Availability** is being influenced by climate change in the following ways:

1. **Changing weather patterns:** Climate refers to the long-term weather patterns of an area. People (and other animals) build their lives around the climate they live in. For example, a change in rainfall patterns could lead to different extremes—drought or flooding. Drought influences water availability in terms of **quantity** (how much is available), whereas flooding can actually affect the **quality** of surface water sources (through contamination).

2. **Global warming trends:** The average global temperature is now ~1-1.5°C warmer than it was a century ago. Although this doesn’t seem like much, remember that this average is calculated from warming across the *entire planet*! This has had an impact on freshwater that is stored in ice—that is to say, *glacier and snow melt*. Many areas of the world rely on these sources to provide them with a steady source of freshwater supplies throughout the year.
Activity 3: Climate Change & Water Availability

Learning Goals:

- Understand the effect of climate change on water resources in Canada.
- Describe the connection between climate change and water availability in Canada in terms of the environment, economy, society and politics.

Curriculum Expectations (Gr.9 Issues in Canadian Geography; academic, 2013):

<table>
<thead>
<tr>
<th>Strand A: Geographic Inquiry and Skill Development</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1. Geographic Inquiry</strong>: use the geographic inquiry process and the concepts of geographic thinking when investigating issues relating to Canadian geography</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand B: Interactions in the Physical Environment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B1</strong>: Analyse various interactions between physical processes, phenomena, and events and human activities in Canada</td>
<td></td>
</tr>
<tr>
<td><strong>B1.3</strong> Assess environmental, economic, social, and/or political consequences for Canada of changes in some of the Earth’s physical processes</td>
<td></td>
</tr>
<tr>
<td><strong>B1.4</strong> Explain how human activities can alter physical processes and contribute to occurrences of natural events and phenomena</td>
<td></td>
</tr>
<tr>
<td><strong>B2</strong>: Analyse characteristics of various physical processes, phenomena, and events affecting Canada and their interrelationship with global physical systems</td>
<td></td>
</tr>
<tr>
<td><strong>B2.2</strong> Describe patterns and trends in the occurrence of a variety of natural phenomena and events in Canada (e.g., mapping areas of drought, precipitation trends)</td>
<td></td>
</tr>
</tbody>
</table>

Description: An electronic media project that has students gather, examine and analyze evidence of how climate change is influencing water availability in Canada.

Time Required: 2-4 class periods (spread over 1-2 weeks)

Materials & Preparation:

- Chalkboard/ whiteboard/ SMARTboard or chart paper
- One copy per student—*(BLM 2.6)* E-Portfolio Project (3-pgs), p.59-61
  - Alternatively, print only p.60 & have students complete the questions from the table (p.59-61) on the computer and submit them electronically with the e-portfolio.
- *(BLM 2.7)* Example E-Portfolio Project (2 pages), p.62-63
  - Digital copy to post online as example for students (or paper copy to post in classroom for reference)
- [Optional] *(BLM 2.8)* E-portfolio Assessment Rubric, p.64
- 2 classes booked in the computer lab
Engagement Strategy: [15-20 min]

- Explain to students that for this assignment, they will be exploring some of the ways that climate change influences water availability
  - Note: If you have completed Activity 2: Water Availability Around the World with your class, students will have already been introduced to a few climate-related factors affecting water availability

- Using the knowledge already existing in the class, discuss some of the foundational information about climate change**:
  - What/who is causing it?
  - What are some of the impacts? How do these influence water availability?
  - Given what you know about climate change, do you think it is influencing water resources in Canada? Why/why not?

**Note:** Refer to the Background Information on p.55 for more information on climate change and water availability to help lead this short discussion.

Teacher’s Choice: Many online teaching tools and lessons exist to introduce climate change to students of all ages. If you feel it more appropriate to spend additional time on this introduction, refer to the wealth of media that exists on this subject. Try <www.r4r.ca> (Resources for Rethinking) for a start.

Teaching Strategy:

- Students will be conducting their own research by putting together a portfolio of media evidence that creates a portrait of the impact of climate change on water availability in Canada.

- For the electronic portfolio, or “e-portfolio,” evidence* may take the form of:
  - Articles from reputed newspapers or magazines
  - Excerpts or case studies from books or blogs written by experts
  - Videos or film clips made by expert bodies (e.g., National Geographic, National Film Board of Canada)
  - Photos, images, slides, maps, cartoons, etc.

*Note: To help students decide if a piece of media evidence is appropriate, they will consult Determining Credible Sources in (BLM 2.6) E-Portfolio Project

- Students must find at least four credible pieces of evidence on the internet, depicting each of the following:
  - (1) the impact of human activity on climate change in Canada
    - E.g., Image of factory with smokestack; article on the Alberta Tar Sands; etc.
  - (2) an impact of climate change on glaciers (or the Arctic) in Canada
    - E.g., Article on trends of summer ice break-up in the Arctic; picture showing “then and now” of the reach of the Athabasca glacier; etc.
  - (3 & 4) a current or projected impact of climate change on water availability in Canada
    - E.g., chart showing average temperature rise in Canada over last century; article on crop failures in prairies due to drought; recent extreme flooding events in Alberta and Ontario; map of expected areas of drought; etc.
• See *(BLM 2.6)* E-Porfolio Project (p.59) for instructions and information for students to complete this assignment. It also includes example wording for internet searches and guiding questions for determining source credibility.

• For each piece of evidence, students will also need to fill out a section of the table in *(BLM 2.6)* E-Porfolio Project (p.60-61). The purpose of this is to demonstrate that students have reflected on their reasons for including a particular piece of media in the portfolio, and can explain how each piece fits with the descriptions, above (for evidence to be gathered).

• [OPTIONAL] Go through the example e-portfolio table answers in *(BLM 2.7)*, p.62-63

**Assessment:**

• Collect the e-portfolio assignment. This includes two parts:
  o (1) E-portfolio evidence—4 pieces
    ▪ This may be collected: via USB key, email (attachments and/or hyperlinks), or an online classroom learning environment (see: &lt;GreenLearning’s Cool 2.0&gt;)
  o (2) Table from *(BLM 2.6)* E-Porfolio Project (p.60-61)

• Use the rubric in *(BLM 2.8)* to grade the assignment (p.64)

**Differentiated Instruction:**

• To shorten this project, have students choose one of the four topic areas listed and find 2-3 pieces of evidence for that topic area. Then have students complete one table from *(BLM 2.6)*, p.60-61, using all of the pieces of evidence gathered.
Instructions:

(A) For this assignment, you must gather pieces of evidence from the internet demonstrating each of the following:
(1) The impact of human activity on climate change in Canada
(2) An impact of climate change on glaciers (or the Arctic) in Canada
(3 & 4) A current or projected impact of climate change on water availability in Canada

(B) Complete the attached table describing each of your four pieces of evidence. You must hand in this table, along with a copy of your e-portfolio (which you may submit digitally).

(C) Remember, your evidence must be credible! Look for the following: articles from reputed newspapers or magazines; excerpts or case studies from books or blogs written by experts; videos or film clips made by expert bodies; photos, images, slides, maps, cartoons, etc.

(D) Refer to the information below for further help with this assignment. Good luck!

Determining Source Credibility:

- Who is the author/creator? What are their credentials—e.g., are they considered an expert in their field?
  - Consider: University professors, researchers, science writers, journalists with well-known publications, etc.
  - For non peer-reviewed* sources, consider whether the content seems balanced and objective, or only one-sided. Does the author/creator have any vested interest in portraying a certain story? (e.g., money, reputation, avoiding a public response to the issue, etc.)
- Does it have more than one author/contributor? If so, do they work for the same or different organizations?
  - *Note: The same evidence coming from two or more different sources adds to its credibility.
- Is the source current? (What is the date that it was written/created? Is it within the last 5 years?)

*What does peer-reviewed mean?
Peer-reviewed means an article has been evaluated by other researchers or subject specialists in an academic community, prior to being published.

Example Internet Searches:

Some search parameters will not yield the results you are looking for. The trick is to find a balance between being specific enough, and not overly specific. The following search terms can get you started:

- Glacier melt + climate change + Canada
- Drought + climate change + Canada
- Flooding + climate change + Canada
1) Impact of human activity on climate change in Canada

Describe the evidence & why you chose it: ____________________________________________
________________________________________________________________________________

How did you decide it is credible? __________________________________________________
________________________________________________________________________________

Describe the impact (i.e., what does the evidence show?): ____________________________
________________________________________________________________________________

Describe a social, political, or economic consequence of this impact: _________________
________________________________________________________________________________

2) Impact of climate change on glaciers (or the Arctic) in Canada

Describe the evidence & why you chose it: ____________________________________________
________________________________________________________________________________

How did you decide it is credible? __________________________________________________
________________________________________________________________________________

Describe the impact (i.e., what does the evidence show?): ____________________________
________________________________________________________________________________

Describe a social, political, or economic consequence of this impact: _________________
________________________________________________________________________________
<table>
<thead>
<tr>
<th>3) <strong>Current or projected impact of climate change on water availability in Canada</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe the evidence &amp; why you chose it: ___________________________________</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>How did you decide it is credible?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Describe the impact (<em>i.e.</em>, what does the evidence <em>show</em>?):</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Describe a social, political, or economic consequence of this impact:</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4) <strong>Current or projected impact of climate change on water availability in Canada</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe the evidence &amp; why you chose it: ___________________________________</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>How did you decide it is credible?</td>
</tr>
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<td></td>
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<tr>
<td>Describe the impact (<em>i.e.</em>, what does the evidence <em>show</em>?):</td>
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<td></td>
</tr>
<tr>
<td>Describe a social, political, or economic consequence of this impact:</td>
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# (BLM 2.7) Example E-Porfolio Project

Example E-Porfolio for Students—to post online or in the classroom for reference

## 1) Impact of human activity on climate change in Canada

**Describe the evidence & why you chose it:** This is an article on the impact of the Alberta tar sands on the Athabasca River. It includes an image of smokestacks next to the river. I chose it because as Canadians, we are contributing to climate change through our dependence on oil, which is a fossil fuel.


**How did you decide it is credible?** The source in an international weekly journal of science. It lists two references at the end, both of which are peer-reviewed journal articles from a science journal.

**Describe the impact (i.e., what does the evidence show?):** The article describes how Canada’s oil-mining operations are releasing toxic heavy metals into the Athabasca river.

**Describe a social, political, or economic consequence of this impact:** Seven pollutants were found at high enough concentrations to pose risk to aquatic life. The findings of the study were also a concern to human health.

## 2) Impact of climate change on glaciers (or the Arctic) in Canada

**Describe the evidence & why you chose it:** News article entitled: “Athabasca Glacier melting at ‘astonishing’ rate.” I chose it because it is a recent article from May 2014 about a shrinking glacier in Canada.


**How did you decide it is credible?** Maclean’s magazine is a popular Canadian magazine and the article was by the Canadian Press.

**Describe the impact (i.e., what does the evidence show?):** The article talks about how the glacier will likely be gone within a generation, and that it has been shrinking over the last 150 years. It says glacial melt is a major climate change issue, and that this phenomenon will impact: hydro-power production, ocean circulation patterns, fisheries, and global sea-level rise.

**Describe a social, political, or economic consequence of this impact:** The Athabasca glacier is a popular tourist destination in Jasper National Park in the Rocky Mountains. Visits to the glacier bring in a lot of money, and the tourism attraction creates jobs in Jasper.
### 3) Current or projected impact of climate change on water availability in Canada

**Describe the evidence & why you chose it:** News article from 2009 entitled: “Climate change in the land of great drought.” I chose it because it talks about how climate change will make drought in the prairies more commonplace.  

**How did you decide it is credible?** I decided it is credible because it is a fairly recent article in a well-respected Canadian newspaper (the Globe and Mail). The author, Barry Smit, is the Canada Research Chair in Global Environmental Change at the University of Guelph and co-editor of a publication called “Farming in a Changing Climate.”

**Describe the impact (i.e., what does the evidence show?):** The article describes how frequency and severity of drought has been increasing in the prairies, and how people and governments need to start preparing for impacts to farms as a result of water shortages.

**Describe a social, political, or economic consequence of this impact:** This will impact the agricultural sector’s economy, as well as insurance companies and governments who provide support to farmers. It could become a hugely political issue as well, given that farming is a key economy in the Canadian prairies.

### 4) Current or projected impact of climate change on water availability in Canada

**Describe the evidence & why you chose it:** Webpage post from July 2013 by Environmental Defence entitled: “Making Canada Resilient to Climate Change.”  
[http://environmentaldefence.ca/blog/making-canada-resilient-climate-change]

**How did you decide it is credible?** Environmental Defence is an NGO that has been around for 30 years and their aim is to protect the environment and human health. It is a recent posting.

**Describe the impact (i.e., what does the evidence show?):** The page discusses the need for Canada, and especially Canadian cities, to adapt to the increase and severity of flooding events because they will only become more common. It talks about Canada’s aging infrastructure as one of the key challenges.

**Describe a social, political, or economic consequence of this impact:** Being unprepared for flooding can impact water quality because freshwater sources can become contaminated during flooding events (the water picks up debris and pollutants and carries them into the surface water sources).
### (BLM 2.8) E-Portfolio Assessment Rubric

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Level 1 (50-59%)</th>
<th>Level 2 (60-69%)</th>
<th>Level 3 (70-79%)</th>
<th>Level 4 (80-100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge &amp; Understanding</td>
<td>Provides no justification of evidence selected</td>
<td>Provides limited justification of evidence selected</td>
<td>Provides appropriate justification of evidence selected</td>
<td>Provides considerable justification of evidence selected</td>
</tr>
<tr>
<td></td>
<td>(justification of media evidence selected)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning skills</td>
<td>Gathers inappropriate evidence</td>
<td>Gathers appropriate evidence, with some exceptions</td>
<td>Gathers appropriate evidence with no exceptions</td>
<td>Gathers appropriate evidence with a high degree of effectiveness*</td>
</tr>
<tr>
<td>(gathers appropriate evidence effectively)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing skills</td>
<td>Unable to detect bias in research sources</td>
<td>Detects bias in some research sources</td>
<td>Detects bias in most research sources</td>
<td>Detects bias in research sources with a high degree of effectiveness</td>
</tr>
<tr>
<td>(detecting bias in research sources)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>Communicates with limited effectiveness</td>
<td>Communicates with some effectiveness</td>
<td>Communicates with considerable effectiveness</td>
<td>Communicates with a high degree of effectiveness</td>
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<tr>
<td>(clearly synopsizes and expresses ideas)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>Makes connections and applies critical thinking skills with limited effectiveness</td>
<td>Makes connections and applies critical thinking skills with some effectiveness</td>
<td>Makes connections and applies critical thinking skills with considerable effectiveness</td>
<td>Makes connections and applies critical thinking skills with a high degree of effectiveness</td>
</tr>
<tr>
<td>(makes connections and applies critical thinking skills)</td>
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*Where “effectiveness” may represent: appropriateness, clarity, accuracy, precision, logic, relevance, significance, fluency, flexibility, depth, or breadth.

**Notes for Student:**
## Appendix A: Curriculum Expectations

### Issues in Canadian Geography (Gr.9), CGC1D – academic

<table>
<thead>
<tr>
<th>Strand A: Geographic Inquiry and Skill Development</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1. Geographic Inquiry:</strong> use the geographic inquiry process and the concepts of geographic thinking when investigating issues relating to Canadian geography</td>
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<table>
<thead>
<tr>
<th>Strand B: Interactions in the Physical Environment</th>
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</thead>
<tbody>
<tr>
<td><strong>B1:</strong> Analyse various interactions between physical processes, phenomena, and events and human activities in Canada</td>
</tr>
<tr>
<td><strong>B2:</strong> Analyse characteristics of various physical processes, phenomena, and events affecting Canada and their interrelationship with global physical systems</td>
</tr>
<tr>
<td><strong>B3:</strong> Describe various characteristics of the natural environment and the spatial distribution of physical features in Canada, and explain the role of physical processes, phenomena, and events in shaping them</td>
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<table>
<thead>
<tr>
<th>Strand C: Managing Canada’s Resources &amp; Industries</th>
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</thead>
<tbody>
<tr>
<td><strong>C1:</strong> Analyse impacts of resource policy, resource management, and consumer choices on resource sustainability in Canada</td>
</tr>
<tr>
<td><strong>C2:</strong> Analyse issues related to the distribution, availability, and development of natural resources in Canada from a geographic perspective</td>
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</tbody>
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<tr>
<th>Strand E: Liveable Communities</th>
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</thead>
<tbody>
<tr>
<td><strong>E1:</strong> Analyse issues relating to the sustainability of human systems in Canada</td>
</tr>
<tr>
<td><strong>E2:</strong> Analyse impacts of urban growth in Canada</td>
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</table>

<table>
<thead>
<tr>
<th>Strand D: Managing Canada’s Resources &amp; Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1:</strong> Analyse impacts of resource policy, resource management, and consumer choices on resource sustainability in Canada</td>
</tr>
<tr>
<td><strong>D2:</strong> Analyse issues related to the distribution, availability, and development of natural resources in Canada from a geographic perspective</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Strand E: Liveable Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E1.5</strong> Propose courses of action that would make a community more sustainable</td>
</tr>
<tr>
<td><strong>E2.1</strong> Assess the impact of urban growth on natural systems and capacity (e.g., water availability)</td>
</tr>
<tr>
<td><strong>E2.2</strong> Analyse how various economic, social, and political impacts of urban growth distribution affect the community</td>
</tr>
</tbody>
</table>
Appendix B: Engaging Students in Action Projects

There are several good reasons for engaging your students in action projects. For example:

- They cater to different learning styles (because they are experiential in nature)
- They offer relevant and meaningful learning opportunities (which is motivating for students)
- These projects allow students to relate to the trans-disciplinary nature of real-world issues, and encourage holistic thinking and problem-solving.

Learning for a Sustainable Future (LSF) has created a guide for educators entitled: “Engaging Students in Sustainable Action Projects.” It can be accessed via LSF’s Resources for Rethinking website: <http://resources4rethinking.ca/en/professional-development/resources>. The document outlines 12 steps for facilitating the creation of meaningful action projects with your students.

One of these steps outlines how to facilitate choosing a project idea with students. The guide also makes available a 9-page Project Planning Template, which takes students through a step-by-step thought process for designing the most effective action project (using their initial project idea). Another step in the guide addresses building motivation for student engagement in the project. It involves exercises for exploring the diverse reasons for students to care about something, as well as activities for exploring the difference between emotional and rational responses to an issue.

There are various types of action projects students can engage in. Some examples include:

- Projects to educate and inform (often with the intent to persuade others to initiate change)
- Projects for political or civic action (and/or to influence policy)
- Projects that support the needs of organizations (already working for change)

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Common Types of Action Projects

**Educate/ inform/ persuade**

- Awareness campaigns (e.g., posters/ pamphlets, videos, public service announcements, advertisements, school fairs, etc.)
- Community education programs (e.g., workshops, presentations, special events, etc.)
- Written communication (e.g., newspaper articles, letters to the editor, short stories, poems, etc.)
- Oral communication (e.g., plays, street theatre, public debates, mock town halls, etc.)

**Political/ civic action & public policy**

- Meeting with elected officials
- Speaking at public meetings or hearings (e.g., making presentations to city hall or town council)
- Circulating petitions
- Supporting political candidates (e.g., volunteering with a campaign)
- Engaging in peaceful dissent (e.g., parades with protest signs, gatherings in public places [with a permit], etc.)

**Supporting “change-maker” organizations**

- Assisting with community clean-ups
- Engaging in citizen science monitoring projects
- Beautification projects (e.g., tree plantings, public space naturalizations)

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Appendix C: References

Background Information: The Great Lakes (p.33)

Great Lakes Environmental Research Laboratory (Michigan). National Oceanic and Atmospheric Administration, Department of Commerce (U.S.) <http://www.glerl.noaa.gov/pr/ourlakes/>


Water Availability Profiles (p.47-50)

The following countries are featured in the Water Availability Profiles:

A. Haiti (Port-au-Prince)  E. Ethiopia (Addis Ababa)
B. Bangladesh (Dhaka)    F. Afghanistan (Kandahar)
C. Bolivia (Cochabamba)  G. Australia (Perth)
D. India (Tamil Nadu)    H. United States (California)

Map of Countries in Water Availability Profiles [Source: Google maps]
Afghanistan

Australia

Bangladesh

Bolivia

Ethiopia

Haiti

India

United States