**Virtual Water Treatment Tour: Pre-Tour Activity**

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| **Lesson Title:** Introduction to Water Treatment | **Duration: 15-20 minutes** |
| **Introduction:** | |
| This lesson will introduce students to how drinking water is treated in the Region of Peel. This activity will help students understand the rigorous process of water treatment and will ask them to reflect on why conserving water is a necessity. This will prepare students for the follow-up Water Treatment Virtual Tour. | |
| **Resources:** | |
| Refer to the list below for all resources required for the virtual water treatment lesson.   * **Presentation:** PowerPoint that includes all slides, speaking notes and video links required for the lesson   Print the following files before you begin the lesson:   1. **Water Treatment handout** (1 per student) | |
| **Key Messages:** | |
| * The important services that water treatment plants provides that keeps our water safe and healthy for everyone * We need to save water, so it stays clean for everyone in the community and the environment | |
| **Key Topics:** | |
| * Water Treatment * Water Quality * Water Conservation | |
| **Curriculum Connections:** | |
| For a complete list of curriculum connections, refer to the Curriculum Connections in the Teacher’s Guide | |
| **Lesson Outline:** | |
| **Slide 2: The Region of Peel** | |
| * Overview of the Region of Peel:   + Region of Peel includes the Town of Caledon and 2 cities – City of Brampton and City of Mississauga   + The Region of Peel is a level of municipal government and some of the programs and services that the Region of Peel provides to our communities includes:     - Recycling and Waste collections and disposal     - Maintenance of regional roads, including snowploughing in the winter and paving in the summer     - Health services     - Ambulance services     - Peel Regional Police and services and     - **Peel Region also provides you with clean, safe drinking water and wastewater treatment**   + Peel has a population of 1.51 million people, that make up this vibrant community where people live, work and play * Region of Peel has 2 water treatment plants in Mississauga, 3 wastewater treatment plants, 2 for South Peel and 1 in Inglewood, and 15 municipal wells that treat water that we use daily   + Most of these plants are located in Mississauga, close to Lake Ontario as it allows the Region to treat and clean water faster and more efficiently.   **Discussion Questions:**   * Think about how we use water in our every day lives | |
| **Slide 3: Video** | |
| * Video: Investing in Water   <https://www.youtube.com/watch?v=XMr0JqGOX0A>   * Length of video: 1.46 minutes   **Did you know?**   * Did you know that the Region of Peel has over 200 staff who treat and maintain our water to make sure every time you turn on the tap, the water is fresh and healthy to drink?   + Every day the Region of Peel treats 570 million litres of water   + That’s enough fill 228 Olympic sized swimming pools * Region of Peel is committed to ‘Providing Clean Water for Life’ | |
| **Slide 4: Water Cycle** | |
| * Review the water cycle with the students   + Where do we get our water from in the Region of Peel?     - Brampton, Mississauga and Bolton get water from the Lake. Other people who live in Caledon get water from wells, either on their own property, or municipal wells that are owned by the Region     - Water from Lake Ontario is fresh, which means that the water is not salty like the water in oceans and seas * The water cycle is a continuous circulation of water from rivers, lakes and oceans into the atmosphere onto the land and back   + **Sun:** the source of energy that drives the whole cycle   + **Lake Ontario**: this is our water source   + **Evaporation:** the sun heats up the water in lakes, rivers and oceans and turns it onto vapour   + **Condensation:** water vapour in the air gets cold and changes back into liquid form   + **Precipitation:** the clouds get heavy and water falls back to the earth in the form of rain, hail, sleet or snow   + **Runoff:** moves water across land and makes its way to the nearest body of water such as a lake * **This process is called the natural water cycle. But humans also change the path of water** | |
| **Slide 5: Human Water Cycle** | |
| **Introduction to Human Water Cycle:**   * **Ask:** Has anyone ever heard about the human water cycle? What could this be all about?   + Have students share their thoughts * **Ask:** What happens when we use water to brush our teeth, shower, go the bathroom – where does it go? * **Ask:** Do we send it directly to the Lake?   + **Answer:** NO   + NO! Why not?   + Have students share their responses (i.e. water is dirty, not treated, has pet waste, trash in the water, bacteria and germs)   + The water in Lake Ontario might have bacteria, viruses, and germs in it. All those things could make us very sick if not treated. * That is why we have to send the water to get treated so it can be cleaned and made safe for us to drink. The dirty water travels through underground pipes and gets treated again at our wastewater plant before we return it back to Lake Ontario * The next few slides will cover how we treat our water | |
| **Slide 6: Video** | |
| This short video will show footage of the Arthur P. Kennedy water treatment plant  Before watching the short video, discuss with students what is the purpose of a water treatment plant?   * Video: Peel’s tap water from the Arthur P. Kennedy water treatment plant   <https://www.youtube.com/watch?v=J9wY-qMrqZg>   * Length of video: 0.48 seconds   **Discussion points after watching the video:**   * That Arthur P. Kennedy Plant can treat up to 1.2 billion litres per day * Every day the Region of Peel treats 570 million litres per day * In the year, 2041 another 21 years from now, it is estimated that almost 2 million people will live in Peel. That means we will have to continue treating water for even more people in Peel, a task that the Region takes great pride in doing.   **Discussion Questions:**   * Do you think the Region of Peel can treat water for 2 million people? * Explain your reasoning?   + **Answer**: Yes, the Region of Peel can treat up to 1.2 billion litres per day. There’s always room for more capacity to treat water per day. Forecasting for future population growth is something that the Region of Peel plans for * Region of Peel is committed to providing safe and reliable drinking water to everyone | |
| **Slide 7: Arthur P. Kennedy Water Treatment Schematic (Optional Slide)** | |
| * Introduction to Water Treatment   + Ask students to keep this video in mind for when we move on to the virtual tour * If you wish not to proceed with this slide, please right click the slide in PPT, and select ‘Hide Slide’ before the lesson * **Note**: there is a PDF version of this diagram online you can reference as well. * **Recommendation:** refer to this slide (or the PDF) during or after the virtual tour. Ask students to identify the stages they have learnt.   **Stages of Water Treatment**   * **1. Water source is Lake Ontario**: A large intake pipe extends 2km out into Lake Ontario. The intake pipe is so big, you could drive an SUV inside it. This is how we get water from the Lake to get treated. * **2. Travelling Screens**: Large rotating mechanical screens remove materials such as branches, fish, garbage, and zebra mussels * **3. Low Lift Pumps**: brings water into the facility from the Lake to begin the stages of treating water * **4. Liquid Oxygen**: Ozone is used to disinfect the water. Ozone gas is unstable and therefore cannot be transported, so Ozone is generated on site from liquid oxygen and electricity * **5. Ozone Generator**: we use a process called electrolysis to convert O2 to O3 where an electrical current is passed through the oxygen to create ozone gas.   **6. Ozone Contactors**: The ozone is bubbled through the water in ozone contactors. Ozone kills the bacteria and breaks down large particles   * **7. BACC – Biologically Activated Carbon Contactors**: after ozone, the water passes through the BACC. Here removal of organic materials from water takes place * **8. UV – Ultraviolet Light**: is where filtered water passes through a lighting unit which uses the UV rays to inactivate microorganisms like bacteria, so they can’t make people sick, or be able to reproduce their DNA * **9. Membrane Filters**: is an ultra-filtration membrane system. During this stage, removal of small particles and microorganisms takes place * **10. Weir Chamber**: Filtered water is directed to the weir box where water is stored and is also the location where chlorine and fluoride are added. Chlorine is used to disinfect bacteria and Fluoride is added for dental health * **11. Storage Reservoir:** treated water flows by gravity into the water storage reservoirs * **12. High Lift Pumps**: treated water leaves the reservoir by way of high lift pumps and enters the distribution system. * **13. Distribution System**: before treated water reaches our homes, schools and businesses in Peel, water is sampled from various stages of the treatment process. Water is sampled 4 times a day, for over 150 parameters and sent to an independent laboratory for testing. These laboratories must be certified by the Ministry of Environment. Treated water flows by gravity into the water storage reservoir. Total time for water treatment is 2-3 hours. | |
| **Slide 8: Water Distribution (Optional Slide)** | |
| How water gets to our schools, homes and businesses  **Blue lines:** represents treated water moving from the water treatment plants to our communities   * Water needs to reach many homes, schools and businesses all across Peel. High lift pumps are used to pump it across the Region, and we need them to be straight for the water pressure to reach all the way to Caledon   **Discussion Questions:**   * **Ask:** What do you notice about Caledon compared to Brampton and Mississauga?   **Answer:** Caledon is rural, and many homes use wells for drinking water | |
| **Slide 9: Water as a Finite Resources** | |
| **Discussion Question:**   * **Ask:** What is a finite resource? (or non-renewable)   **Answer:** a natural resource that cannot be replaced   * **Ask:** Can you think of any other examples of finite resources?   **Answer:** minerals like diamonds, oil, natural gas etc  Ask students why they think water conservation is important?  Ask students some of the ways they think they use water? The responses are likely to fall under the **physical water.**  **Physical Water**   * Direct uses of water, water that we can use for drinking, showering, washing hands and flushing toilets   **Virtual Water**   * Non-direct uses of water, water that we can’t see, touch, taste or feel, and it makes up a big part of our water footprint   + We wear water, it takes 8500L of water to make 1 pair of jeans   + Furniture, houses, cars, roads, all these things we build, also needs water   + We also spend money on generating electricity with our phones and watching TV which also uses water and   + Farming uses huge amounts of water and   Many other uses of water that we use daily  **Discussion Questions:**   * Can anyone guess the average water usage per Canadian?   + The average water usage per **Canadian is about 250 L per day**, **and 218 L in Peel,** and this is physical water, like taking a shower, washing our hands before we eat a meal, but when we consider our virtual water usage, **our average jumps to 6400 L per day!**   + That’s a lot of water! In fact, **Canadians are among the highest consumers of water in the world!** * Remember that our freshwater we have available is 1.2%. So, it’s important that we conserve the water we have for future generations to be able to enjoy. * What does conserve water look or mean to you?   + Think about some adjustments in your own life that you can make to help conserve our water?   + Just a 10-minute shower can use up to 85 L of water   + Think of water and wastewater treatment and all the energy used to treat water, pump water, heat water in your home and schools   **Discussion Questions**   * How much freshwater is available on earth?   + **Answer:** 2.5% of the world’s water makes up freshwater * What makes up the total amount of surface water?   + **Answer:** 1.2% * What amount of water makes up the agricultural industry?   + **Answer:** 70% | |
| * **Slide 10: Conclusion** | |
| End of the lesson, ask students   * What have you learned today about water?   + Have students share their findings   Share with students that everyone including them, have a part in protecting and conserving water | |
| **Next Steps: Virtual Water Tour** | |
| Ask students to refer to the **handout** in preparation for the virtual tour.  There are two options: **teacher-led, or student self-exploration.**  Refer to the **Teacher Handbook** for the tour outline and additional discussion points. | |