BIG IDEAS

Human actions affect the **quality of water** and its ability to sustain life.	Human activities cause **changes in the global climate system**.	**Sustainable land use** is essential to meet the needs of a growing population.	**Living sustainably** supports the well-being of self, community, and Earth.

Learning Standards

Curricular Competencies

Students are expected to be able to do the following:

Questioning and predicting

- Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest
- Make observations aimed at identifying their own questions, including increasingly abstract ones, about the natural world
- Formulate multiple hypotheses and predict multiple outcomes

Planning and conducting

- Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)
- Assess risks and address ethical, cultural, and/or environmental issues associated with their proposed methods
- Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data
- Apply the concepts of accuracy and precision to experimental procedures and data:
  - significant figures
  - uncertainty
  - scientific notation

Processing and analyzing data and information

- Experience and interpret the local environment

Content

Students are expected to know the following:

- **water quality parameters** and **bioindicators**
- **availability** and **water use impacts**
- global water security:
  - laws and regulation
  - **conservation of water**
- **changes to climate systems**
- **impacts of global warming**
- **mitigation** and **adaptations**
- **soil characteristics** and **ecosystem services**
- **land use and degradation**
- **land management**
- personal choices and **sustainable living**
- global **environmental ethics, policy, and law**

Learning Standards (continued)

Curricular Competencies	Content
• Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information • Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies • Construct, analyze, and interpret graphs, models, and diagrams • Use knowledge of scientific concepts to draw conclusions that are consistent with evidence • Analyze cause-and-effect relationships **Evaluating** • Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions • Describe specific ways to improve their investigation methods and the quality of their data • Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled • Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and in primary and secondary sources • Consider the changes in knowledge over time as tools and technologies have developed • Connect scientific explorations to careers in science • Exercise a healthy, informed skepticism and use scientific knowledge and findings to form their own investigations to evaluate claims in primary and secondary sources • Consider social, ethical, and environmental implications of the findings from their own and others' investigations • Critically analyze the validity of information in primary and secondary sources and evaluate the approaches used to solve problems • Assess risks in the context of personal safety and social responsibility	

Learning Standards (continued)

Curricular Competencies	Content
Applying and innovating • Contribute to care for self, others, community, and world through individual or collaborative approaches • Co-operatively design projects with local and/or global connections and applications • Contribute to finding solutions to problems at a local and/or global level through inquiry • Implement multiple strategies to solve problems in real-life, applied, and conceptual situations • Consider the role of scientists in innovation **Communicating** • Formulate physical or mental theoretical models to describe a phenomenon • Communicate scientific ideas and information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations • Express and reflect on a variety of experiences, perspectives, and worldviews through **place**	

Big Ideas – Elaborations

- **quality of water:**
  Sample questions to support inquiry with students:
  - How does the amount and quality of water in our environment affect living things?
  - Which human actions affect the quality of water? Which of your actions eventually affect the quality of water you use?
  - How does stormwater runoff affect water quality?
- **changes in the global climate system:**
  Sample questions to support inquiry with students:
  - How do changes in the composition of the atmosphere lead to changes in the global climate?
  - What are some of the human activities that contribute to climate change? Which of your actions contribute to climate change?
  - How do the emissions of electric vehicles differ from those of internal combustion engine vehicles?
- **Sustainable land use:**
  Sample questions to support inquiry with students:
  - How are your decisions around personal food consumption linked to global food security?
  - How does crop rotation affect nitrogen levels in soil?
- **Living sustainably:**
  Sample questions to support inquiry with students:
  - What safety measures have coastal cities taken to prevent storm-surge damages?
  - How do society and governance contribute to sustainability?
  - What changes could you make in your own life, in terms of sustainable living, that will support the Earth, as well as your own well-being?

SCIENCE – Environmental Science
Grade 12

Curricular Competencies – Elaborations

- **Questioning and predicting:**
  Sample opportunities to support student inquiry:
  - How can you decrease your personal contributions to greenhouse gas emissions?
  - How much of your diet is produced within 100 km of your home?
  - How much waste does your lifestyle generate?
  - How has climate change impacted food sources of Canada's northern First Peoples populations?
- **Planning and conducting:**
  Sample opportunities to support student inquiry:
  - How can the amount of particulate matter produced by a vehicle's exhaust be measured?

  - How can you measure the ecological footprint of your food choices?
  - How can you measure the amount of landfill trash that you generate in one year?
  - How can you measure the effects of idling vehicles on air quality?
- **Processing and analyzing data and information:**
  Sample opportunities to support student inquiry:
  - What type of graph best illustrates the relationship between LEED building designs and energy use?
  - How can the relationship between population growth and reduction of agricultural land be shown?
  - How has the amount of garbage generated per person changed over the past 200 years?
  - How does satellite imagery or aerial photography reveal changes in landscapes over time?
- **Evaluating:**
  Sample opportunities to support student inquiry:
  - What are the differences between anthropogenic and natural sources of CO_2 emissions?
  - How can community gardens reduce the ecological footprint of our diet?
  - How can you make more sustainable choices to reduce the amount of waste you generate?
  - How does traditional ecological knowledge (TEK) confirm what you can deduce from climate change data?
- **Applying and innovating:**
  Sample opportunities to support student inquiry:
  - Which bylaws would you recommend for your community to reduce greenhouse gas production?
  - How could you establish a school or community garden?
  - How could the design of packaging be improved to reduce the amount of waste generated?
  - How do local trends in land use align with and respond to global climate change?
- **Communicating:**
  Sample opportunities to support student inquiry:
  - How would you advocate for additional bike lanes in your community as a mechanism to reduce greenhouse gas emissions?
  - How would you increase people's awareness of the importance of using locally grown produce?
  - How could you demonstrate to your city council the need to ban plastic bag use in your community?
  - How could you share with your peers the positive impact of a properly maintained vehicle?
- **place:** Place is any environment, locality, or context with which people interact to learn, create memory, reflect on history, connect with culture, and establish identity. The connection between people and place is foundational to First Peoples perspectives.

Content – Elaborations

- **water quality parameters:** alkalinity, acidity, pH, dissolved oxygen, phosphate, temperature, turbidity, total dissolved solids, nitrate, hardness, conductivity
- **bioindicators:** plants, animals, microorganisms, indicator species, biological integrity, species range of tolerance, species richness, diversity indices
- **availability:** holding capacity, surface water, groundwater, water cycle, scarcity, drought, snowmelt, runoff, rainfall, flow data, water level, floods, glaciers
- **water use impacts:** point and non-point source pollution, eutrophication, personal care products and pharmaceuticals, waste water, water audit
- **conservation of water:** mitigation, preservation, stream and shore cleanups, invasive species removal, rain harvesting water gardens, xeriscaping, wastewater recycling
- **changes to climate systems:** sinks and sources of greenhouse gases, snow and ice coverage, land surface coverage, solar radiation, energy balance, ocean temperatures, sea levels
- **impacts of global warming:** increase in extreme weather events, flooding, desertification, ocean acidification, permafrost melting, drought, wildfires, hurricanes, migratory changes, human health, food security, traditional ways of being and doing
- **mitigation:** addresses the causes of climate change (e.g., emission reductions, renewable energy, green building and construction, urban green spaces, laws and regulations, organic agriculture, closed-loop production systems, recycling and upcycling)
- **adaptations:** address the impacts of climate change (e.g., infrastructure changes, drought-tolerant crops, land corridors for species migration, flood prevention)
- **soil characteristics:** types, texture, structure, moisture, pH, percolation, nutrient levels, microbes
- **ecosystem services:** water filtration, temperature moderation, nutrient exchange, waste decomposition, carbon cycling
- **land use and degradation:** landfills, deforestation, erosion, desertification, habitat loss, urbanization, food production, harvesting, mining, forestry, recreation
- **land management:** agriculture, green spaces, urban development, forests, waterways, shorelines, protected areas and parks
- **sustainable living:** diet (e.g., 100-mile diet, organic farming, community gardens, reducing meat consumption), sustainable building products, reduce household energy use, consumerism (reduce, reuse, repurpose, recycle, upcycle), conserve water, alternate transportation methods, traditional ecological knowledge (TEK)
- **environmental ethics, policy, and law:** trade agreements, wildlife trafficking laws, Kyoto Agreement, fishing and hunting licences, traditional ecological knowledge (TEK), United Nations Declaration on the Rights of Indigenous Peoples, species at risk, Canadian laws