

## Unit E: Freshwater and Saltwater Systems (Social and Environmental Emphasis)

**Overview:** Earth is sometimes described as the water planet: over two-thirds of Earth's surface is covered by oceans and freshwater features. By exploring examples of aquatic systems, students come to appreciate the dynamic nature of these systems and learn about the interaction of landforms, sediments, water and climate. Students also investigate factors that affect the distribution and health of living things in aquatic environments and the supply and quality of water for human use.

**Focusing Questions:** How do water, land and climate interact? What are the characteristics of freshwater and saltwater systems, and how do they affect living things, including humans?

### Key Concepts

The following concepts are developed in this unit and may also be addressed in other units at other grade levels. The intended level and scope of treatment is defined by the outcomes below.

- water quality
- water-borne materials
- erosion and deposition
- stream characteristics
- continental drainage systems
- ocean basins
- climate
- glaciers and icecaps
- adaptations to aquatic ecosystems
- human impact

### Outcomes for Science, Technology and Society (STS) and Knowledge

*Students will:*

1. Describe the distribution and characteristics of water in local and global environments, and identify the significance of water supply and quality to the needs of humans and other living things
  - describe, in general terms, the distribution of water in Alberta, Canada and the world; and interpret information about water characteristics (*e.g., identify glaciers, snow, polar icecaps, ground water and oceans as components of Earth's water; interpret graphical information on the availability of potable water*)
  - recognize that fresh water and salt water contain varying amounts of dissolved materials, particulates and biological components; and interpret information on these component materials
  - identify major factors used in determining if water is potable, and describe and demonstrate tests of water quality (*e.g., investigate and describe the physical characteristics of a sample of water, such as clarity, salinity and hardness; investigate biological tests*)
  - describe, in general terms, methods for generating fresh water from salt water, based on evaporation, distillation and reverse osmosis
2. Investigate and interpret linkages among landforms, water and climate
  - describe the processes of erosion and deposition resulting from wave action and water flow, by:
    - identifying dissolved solids and sediment loads, and identifying sources and endpoints for these materials
    - describing how waves and tides are generated and how they interact with shorelines
  - investigate and describe stream characteristics (*e.g., describe the slope, flow rate and stream profile characteristics of a model stream on a stream table*)
  - describe processes leading to the development of ocean basins and continental drainage systems (*e.g., describe the formation of geological features on the ocean floor, such as continental shelves and trenches*)

- identify evidence of glacial action, and analyze factors affecting the growth and attrition of glaciers and polar icecaps (*e.g., identify factors that affect the size of polar ice sheets and the Columbia Icefield*)
  - describe the movement of ocean currents and its impact on regional climates (*e.g., effects of the Gulf Stream, Labrador Current, El Niño, La Niña*)
3. Analyze factors affecting productivity and species distribution in marine and freshwater environments
    - investigate life forms found in fresh water and salt water, and identify and interpret examples of adaptations to these environments (*e.g., describe and interpret examples of fish and invertebrate species found in a local freshwater environment*)
    - analyze factors that contribute to the development of adaptations in species found in saltwater and freshwater environments
    - investigate and interpret examples of seasonal, short-term and long-term change in populations of living things found in aquatic environments (*e.g., algal blooms, changes in local freshwater fish populations, cod and salmon stock depletion*)
    - analyze relationships between water quality and living things, and infer the quality of water based on the diversity of life supported by it
  4. Analyze human impacts on aquatic systems; and identify the roles of science and technology in addressing related questions, problems and issues
    - analyze human water uses, and identify the nature and scope of impacts resulting from different uses (*e.g., identify pollutants in ground water and surface water systems resulting from domestic and industrial use; analyze the effects of agriculture and forestry practices on stream flow and water quality*)
    - identify current practices and technologies that affect water quality, evaluate environmental costs and benefits, and identify and evaluate alternatives (*e.g., research and analyze alternatives for ensuring safe supplies of potable water; research, analyze and debate alternatives for a specific water quality issue, such as the location and design of a landfill, the protection of a natural waterway, the use of secondary and tertiary wastewater treatment, the salinization of soils due to irrigation, the eutrophication of ponds and streams due to excess use of phosphates in fertilizers and detergents, or a proposal to export water resources*)
    - illustrate the role of scientific research in monitoring environments and supporting development of appropriate environmental technologies (*e.g., describe a local example of aquatic monitoring, and describe how this research contributes to watershed management*)
    - provide examples of problems that cannot be solved using scientific and technological knowledge alone (*e.g., the need to prevent pollutants from entering aquatic environments, the need to avoid damage from ice sheets and icebergs*)

**Skill Outcomes** (focus on the use of research and inquiry skills to inform the decision-making process)

#### Initiating and Planning

*Students will:*

Ask questions about the relationships between and among observable variables, and plan investigations to address those questions

- identify science-related issues and problems
- identify questions to investigate, arising from science-related issues
- select appropriate methods and tools for collecting relevant data and information (*e.g., plan and conduct a search, using a wide variety of electronic sources*)

- design an experiment, and identify the major variables (*e.g., design an experiment to compare the characteristics of two water samples*)

### Performing and Recording

#### *Students will:*

Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data

- research information relevant to a given issue
- select and integrate information from various print and electronic sources or from several parts of the same source (*e.g., summarize information on a river basin*)
- identify strengths and weaknesses of different methods of collecting and displaying data (*e.g., identify strengths and weaknesses of technologies used to monitor and map changes in stream flow*)

### Analyzing and Interpreting

#### *Students will:*

Analyze qualitative and quantitative data, and develop and assess possible explanations

- apply given criteria for evaluating evidence and sources of information (*e.g., assess the authenticity and reliability of electronic sources*)
- predict the value of a variable, by interpolating or extrapolating from graphical data (*e.g., predict future stocks of fish based on long-term data*)
- interpret patterns and trends in data, and infer and explain relationships among the variables (*e.g., relate climates to proximity to oceans and to the characteristics of ocean currents*)
- identify new questions and problems arising from what was learned (*e.g., identify questions, such as: “Can ocean currents be modified?”, “Is kelp a viable source of food?”, “How would icecap melting change Canadian coastlines?”*)

### Communication and Teamwork

#### *Students will:*

Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results

- use appropriate vocabulary, including correct science and technology terminology, to communicate ideas, procedures and results (*e.g., use such terms as salinity, currents and basins when describing oceans and their characteristics*)
- communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means (*e.g., create a concept map, linking the different stages of the water cycle; prepare a multimedia presentation on changing climatic conditions and the effects on glaciers, ice sheets and water levels, incorporating graphics, audio, visuals and text gathered from remote sources*)
- evaluate individual and group processes used in planning, problem solving, decision making and completing a task (*e.g., discuss advantages and disadvantages of different research methods and sources used to gather information on an ocean basin*)
- defend a given position on an issue, based on their findings

## Attitude Outcomes

### Interest in Science

*Students will be encouraged to:*

Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (*e.g., express interest in conducting scientific investigations of their own design; take an interest in media reports on environmental issues, and seek out further information from a variety of sources; take an interest in observing and interpreting their environment during personal and group excursions*)

### Mutual Respect

*Students will be encouraged to:*

Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (*e.g., show awareness of and respect for the contributions of indigenous peoples to knowledge of the environment*)

### Scientific Inquiry

*Students will be encouraged to:*

Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (*e.g., seek data that is accurate and based on appropriate methods of investigation; consider observations and ideas from a number of sources before drawing conclusions*)

### Collaboration

*Students will be encouraged to:*

Work collaboratively in carrying out investigations and in generating and evaluating ideas (*e.g., share observations and ideas with other members of a group, and consider alternative ideas suggested by other group members; share the responsibility for carrying out decisions*)

### Stewardship

*Students will be encouraged to:*

Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (*e.g., consider immediate and long-term consequences of personal and group actions; objectively identify potential conflicts between responding to human wants and needs and protecting the environment*)

### Safety

*Students will be encouraged to:*

Show concern for safety in planning, carrying out and reviewing activities (*e.g., select safe methods and tools for collecting evidence and solving problems; readily alter a procedure to ensure the safety of members of the group*)