

# What You Need to Know

**Essential Standard:** 8.E.1 Understand the hydrosphere and the impact of humans on local systems and the effects of the hydrosphere on humans.

**Clarifying Objective:** 8.E.1.1 Explain the structure of the hydrosphere including:

- Water distribution on earth
- Local river basin and water availability

*Students need to know:*

· **that water is one of the most common substances on the surface of the Earth.** They know that water has unique properties that impact the role it plays on the Earth in all the spheres (hydrosphere, lithosphere, atmosphere, and biosphere). These properties include:

- Polarity
  - Cohesion
  - Adhesion
  - High surface tension
  - Density
  - High specific heat
  - High heat of vaporization
- Water is the only substance on Earth that occurs naturally as a solid, a liquid, and a gas. It is often referred to as 'the universal solvent' because so many other substances dissolve in it. This characteristic is one reason that the water encountered on Earth is rarely pure.
  - Water covers approximately 71% of the Earth's surface (USGS). Most of this water (97%) is not drinkable because it is saltwater. The majority of freshwater (3%) exists in ice caps, glaciers, and oceans. 77% of the freshwater is frozen. Of the 23% that is not frozen, approximately a half of a percent is available to supply living organisms with what they need to survive. The availability of water varies with local geography and allows humans to utilize water as a resource.
  - The ocean is salty because of dissolved chemicals eroded from the Earth's crust and washed into the sea. Solid and gaseous ejections from volcanoes, suspended particles swept to the ocean from the land by onshore winds, and materials dissolved from sediments deposited on the ocean floor have also contributed. Salinity in ocean waters is increased by evaporation or by freezing of sea ice and it is decreased as a result of rainfall, runoff, or the melting of ice. The average salinity of seawater is 35 parts per thousand. Salinities are much less than average in coastal waters, in the polar seas, and near the mouths of large rivers.
  - Hydrothermal vents are recently-discovered features on the crest of oceanic ridges that release dissolved minerals into the oceans. These vents are the exit point on the ocean floor from which sea water that has seeped into the

rocks of the oceanic crust (heated and containing dissolved materials from the crust) flows back into the ocean. This super-heated water brings large amounts of dissolved minerals with it. Estimates of the amount of hydrothermal fluids now flowing from these vents show that the entire volume of the oceans could seep through the oceanic crust in about 10 million years. Thus, this process has a very important effect on salinity.

**· that the ocean is an integral component of the world's climate due to its capacity to collect, drive and mix water, heat, and carbon dioxide.**

- The ocean can hold and circulate more water, heat and carbon dioxide than the atmosphere although the components of the Earth's climate are constantly exchanged. Because the ocean can store so much heat, seasons occur later than they would and air above the ocean is warmed. Heat energy stored in the ocean in one season will affect the climate almost an entire season later. The ocean and the atmosphere work together to form complex weather phenomena like the North Atlantic Oscillation and El Niño. The many chemical cycles occurring between the ocean and the atmosphere also influence the climate by controlling the amount of radiation released into ecosystems and our environment. Air temperatures all over the world are regulated by the circulation of heat by the oceans. The ocean stores heat in the upper two meters of the photic zone. This is because seawater has a very high density and specific heat and as a result can store vast quantities of energy in the form of heat. The ocean can then buffer changes in temperature by storing heat and releasing heat. Evaporation cools ocean water which cools the atmosphere. It is most noticeable near the equator and the effect decreases closer to the poles.

**· that the water cycle is the continuous movement of water in and around the Earth.**

- The sun drives the entire water cycle and is responsible for its three major components: evaporation, condensation and precipitation. When the sun heats the surface of water, it evaporates and ends up in the atmosphere as water vapor. It cools and rises, becoming clouds, which eventually condense into water droplets. Depending on the temperature of the atmosphere and other conditions, the water precipitates as rain, sleet, hail or snow.
- Some of this precipitation is captured by tree canopies and evaporates again into the atmosphere. The precipitation that falls to the ground becomes runoff, which courses over the surface of the earth in streams. (Runoff also comes from snowmelt, which occurs when the sun and climate changes melt snow and ice.) Runoff can accumulate and freeze into snow caps or glaciers. Runoff can also infiltrate the ground and accumulate, becoming groundwater. Permeability is a measure of the ability of a rock or sediment to transmit water or other liquids. Water does not pass through impermeable materials. A substantial amount of water is stored in permeable soil and rock

underground. An aquifer is a large deposit of groundwater that can be extracted and used. Finally, runoff makes its way back into lakes and oceans, where it is again evaporated by the sun.

· **that a river basin is the portion of land drained by a river and its tributaries.**

- It encompasses the entire land surface drained by the various streams and creeks that flow downhill into one another, and eventually into one river. The final destination of the water drained by a river basin is an estuary or an ocean. A river basin sends all the water falling on the surrounding land into a central river and out to the sea.

· that for land-dwellers, everyone lives in a river basin.

- Even if they do not live near the water, land-dwellers live on land that drains to a river or estuary or lake, and their actions on that land affect water quality and quantity far downstream. There are 17 river basins in North Carolina. The topography of each basin determines the area that it drains, and whether that water (from creeks, rivers, springs, and aquifers) flows into the Atlantic Ocean or Gulf of Mexico.

**BOTTOMLINE:** *Water is one of the most common substances on Earth. Water is circulated on Earth by a process known as the water cycle. Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans. Most of the Earth's water (80% depending on Climate period) is found in the oceans. The majority of fresh water exists in ice caps, glaciers, and aquifers. Surface water moves into river basins from areas called watersheds. The availability of water varies with local geography and allows humans to utilize water as a resource. In a river basin, all of the water eventually flows to the same place (the ocean). Watersheds are the areas of land that water drains in to when the ground is saturated or impermeable. Ground water is one of earth's most valuable resources. The rate of ground water movement varies based on the rock material through which the water is moving. Wells provide the best source of information about an aquifer. The ocean is connected to major lakes, watersheds, and waterways because all major watersheds on Earth drain to the ocean. Rivers and streams transport nutrients, salts, sediments and pollutants from watersheds to estuaries and to the ocean. The ocean is the dominant physical feature of our planet. There is one ocean with many ocean basins, such as the North Pacific, South Pacific, North Atlantic, South Atlantic, Indian and Arctic.*

Reference: North Carolina Department of Public Instruction, Essential Standards: Grade 8 Science, Unpacked Content, September 2012 Revision, [http://scnces.ncdpi.wikispaces.net/file/view/Unpacked\\_Content\\_Grade8Science\\_Re](http://scnces.ncdpi.wikispaces.net/file/view/Unpacked_Content_Grade8Science_Re)

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