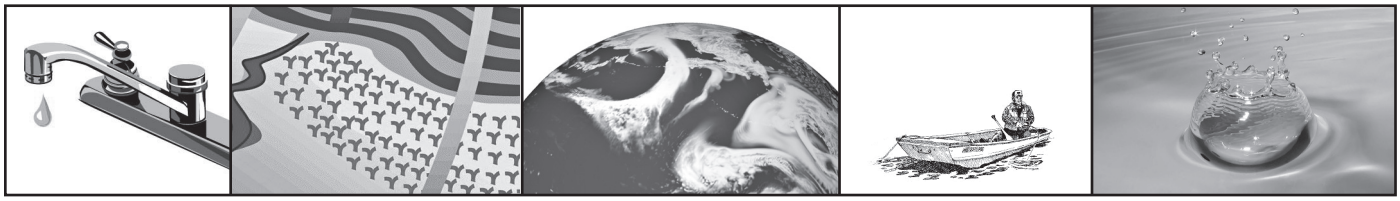


Unit 6) Water Overview

Credit: Roger McLassus, Wikimedia Commons

All known forms of life depend on water. Although water covers nearly 70 percent of the Earth's surface, less than three percent of the Earth's water is freshwater and much of that is frozen in glaciers and polar ice caps. Freshwater is critical to human survival, which is why it is important to protect the quality of groundwater and surface water resources.

As water circulates through the Earth's hydrosphere in a process known as the "water (hydrologic) cycle," the overall volume of the Earth's water changes very little. Specific locations may experience dramatic fluctuations in water availability but overall, the amount of water in the Earth's hydrosphere does not change.

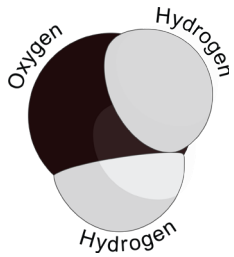
Since water is such an important natural resource, conflicts may arise over its availability or use. Resolving those conflicts will not be quick or easy but it is critical that they are resolved in ways that provide for today's needs, as well as those of future generations.

Water

"If there is magic on this planet, it is contained in water."
Loren Eiseley, American scientist and author

Water is a tasteless, odorless substance that is essential to all known forms of life. In small quantities, it appears colorless to the naked eye. Water covers nearly 70 percent of the earth's surface and is an important natural resource in Kansas.

Water has the chemical formula H_2O, meaning that one molecule of water is composed of two hydrogen atoms



Water Molecule
Source: Wikipedia

Chemical and Physical Properties

Water

Alternative Names	aqua dihydrogen monoxide hydroxic acid hydrogen hydroxide
Molecular Formula	H_2O
Freezing Point	32° F or 0°C
Boiling Point	212˚F or 100˚C
Density*	
liquid – pure water	1.00 g/cc**
liquid – ocean water	1.03 g/cc**
frozen	0.92 g/cc**

*The density of water is affected by temperature and mineral content. Unlike other substances, the density of water increases as the water temperature rises above 32˚F – just the opposite of all other substances which achieve maximum density when they change from the liquid to solid phase.

** grams per cubic centimeter

Water Words
Hydro– from the ancient Greek prefix meaning "water."
Hydrologic cycle– the continuous circulation of water around, over, and through the earth; also known as the water cycle.
Hydrosphere– portion of the earth's surface that is water; includes atmosphere and underground aquifers.

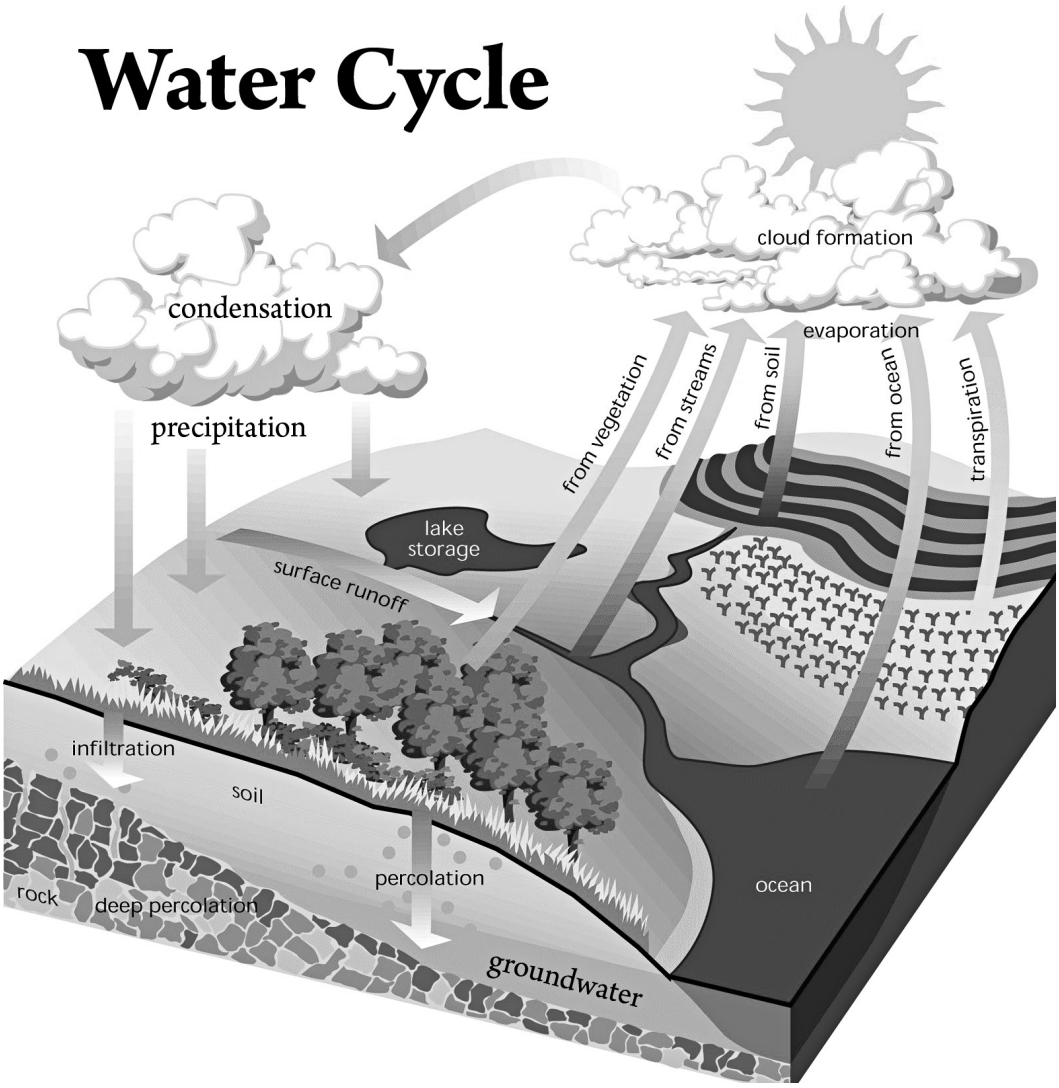
and one oxygen atom. It can be described ionically as HOH, with a hydrogen ion (H+) that is bonded to a hydroxide ion (OH-). Water molecules are attracted to each other and attach themselves together because of the negative and positive ionic charges.

Water is the only pure substance found in nature in all three states of matter–liquid, solid, and gas. One unique property of water is that in its solid form (ice), it floats above its liquid form.

The Water Cycle

"The world turns softly
Not to spill its lakes and rivers,
The water is held in its arms
And the sky is held in the water."
Hilda Conkling, American poet

The movement of water around, over, and through the Earth is called the water cycle. The water cycle – technically known as the hydrologic cycle – is the continuous circulation of water within the Earth's hydrosphere (all the water found on, under, and over the surface of the planet, including water in the atmosphere). As water moves through the hydrologic cycle, it changes form between liquid, solid, and gas phases. Water moves from one area to another, such as from the oceans to land or rivers, by the physical processes of precipitation, infiltration, runoff, subsurface flow (groundwater), evaporation, and condensation. Precipitation is the falling of water in any form (i.e. rain, hail, or snow) to the Earth's surface. Infiltration is the process in which water is absorbed into the soil to become groundwater or flows off the surface of the land, in which case



Source: FISRWG

Water Processes
Percolation– process that occurs when gravity pulls excess water down through the soil and rock layers.
Precipitation– any form of water that falls to the earth's surface; for example, hail, rain, and snow.
Infiltration– process by which water is absorbed into the soil or runs across the land's surface until it reaches a body of water.
Evaporation– process that occurs when water is heated and turns into water vapor; i.e. changes from liquid to gas state.
Transpiration– the evaporation of water from plants, mainly through leaves.
Condensation– the cooling of water vapor.

it is called runoff. Evaporation or transpiration occurs when water is heated and turns into water vapor or when plants use water and lose water vapor through extremely small surface pores. Condensation takes place when the water vapor cools and forms clouds, which carry the water, moving it to a different location and releasing it in the form of precipitation.

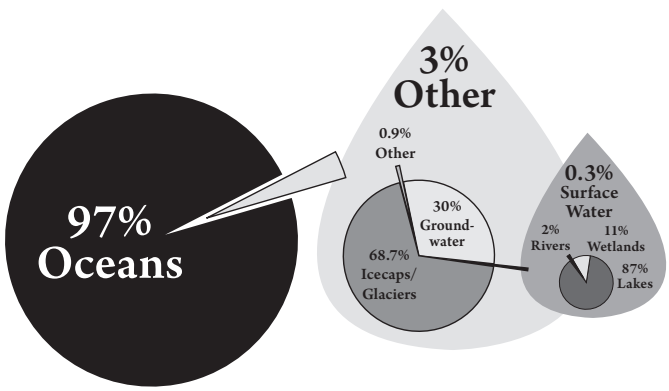
There is no definable start or finish to the water cycle. Water evaporates from the oceans, forms clouds that precipitate back to Earth, and begins to evaporate again. It is a continuous process. Water that evaporates from the ocean and falls over land may evaporate, precipitate, become runoff, and condense multiple times before it returns to the ocean.

Planet Earth
Source: NOAA/GFDL

In the context of the water cycle, a reservoir represents the water stored at a specific point within the cycle. The largest reservoir in the water cycle is the collection of oceans, accounting for 97 percent of the Earth's water. The remaining 3 percent of the Earth's water is frozen in ice caps and glaciers, stored in underground aquifers (groundwater), stored in lakes or rivers (surface water), or temporarily stored in the Earth's atmosphere (water vapor). The total amount, or volume, of water in the water cycle does not change much, if at all. While the amount of water in specific bodies of water may vary, the distribution of water between the reservoirs in the water cycle remains fairly constant.

The processes of the water cycle vary greatly across Kansas. The western sections of Greeley, Hamilton, Stanton, and Grant counties receive annual precipitation of less than 16 inches and have high rates of evaporation. On the other side of Kansas, the southeastern counties of Crawford, Labette, and Cherokee receive up to 44 inches of precipitation each year.

Earth's Water



Source: USGS

Water Resources

"Water is the most critical resource issue of our lifetime and our children's lifetime. The health of our waters is the principal measure of how we live on the land."

Luna Leopold, geomorphologist and hydrologist

Water is essential to all known forms of life. Humans require access to water that does not contain too many impurities, such as high amounts of salt minerals. Virtually all human uses require freshwater. Freshwater is water with less than 0.5 parts per thousand dissolved salts. [1] The Antarctic ice sheet, the largest single mass of ice on the planet, holds nearly 90 percent of the Earth's freshwater.

Water resources are sources of water that are useful or potentially useful to humans. Over 90 percent of the United States' freshwater is stored underground. In Kansas, freshwater is obtained from both groundwater and surface water resources.

Groundwater

Groundwater is water stored underground in a body of rock or other materials called an aquifer. The "water table" is the top elevation of water stored in the aquifer. The water table fluctuates as water enters or is withdrawn from the aquifer. Water that enters an aquifer is called "recharge," usually a natural process. Groundwater recharges occur naturally when surface water infiltrates the soil or other natural barriers to the aquifer. The outflow of water from an aquifer or other body of water is called "discharge." In Kansas, naturally occurring groundwater discharges are springs and seepage to rivers and streams.

Water Resource Definitions
Groundwater– water stored underground in an aquifer.
Surface water– water that flows across the surface of the land or is stored in a river, lake, or freshwater wetland.
Recharge– water that enters an aquifer or body of water.
Discharge– water that flows out of an aquifer or body of water.

The depth of the water table varies. The water table may be may be less than three feet below the surface of the land or more than 300 feet deep. It may even be at the land's surface. When this happens, the ground is often wet and marshy or the water creates a spring, pond, or river.

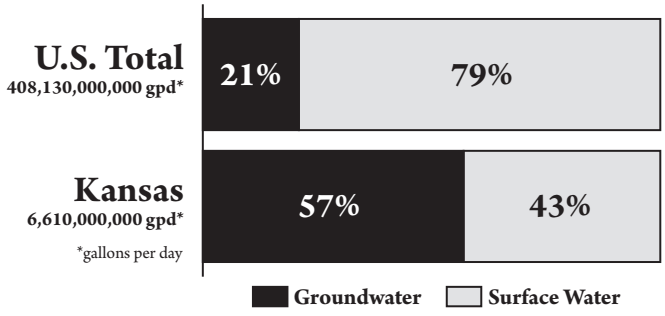
In some areas, including parts of Kansas, groundwater is the only reliable source of large volumes of water. Overall, Kansans rely on groundwater for 85 percent of their water needs. This is a higher percentage than almost any other state in the United States. However, eastern and western Kansas differ dramatically in the reliance on groundwater. In the western two-thirds of the state, where there is usually less precipitation, relatively abundant groundwater resources provide most of the water. Groundwater resources are more limited in the eastern third of the state; however, precipitation and surface water are more abundant there.

Surface Water

Surface water is water that flows across the surface of the land or is stored in a river, lake, or freshwater wetland. The only natural recharge for any surface water system is precipitation within its watershed, the land that drains to that surface water collection and storage area.

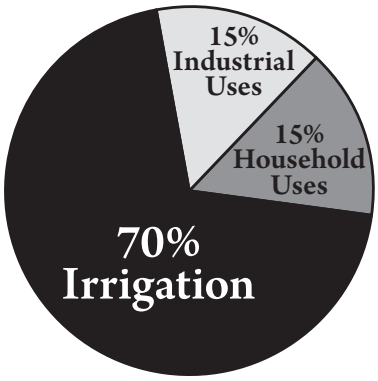
However, the total quantity of water in that system depends on many factors, including the storage capacity in lakes, wetlands, and constructed storage areas; the permeability of the soil beneath those storage areas; the physical characteristics of the land's surface in the watershed; the timing of precipitation; and the local climate, which affects the rate of evaporation. All of these factors also affect the amount of surface water lost through the natural processes of the hydrologic cycle, such as evaporation or discharge to the oceans. Through infiltration, surface water becomes groundwater.

U.S. and Kansas Water Withdrawals Ground vs. Surface – 2000



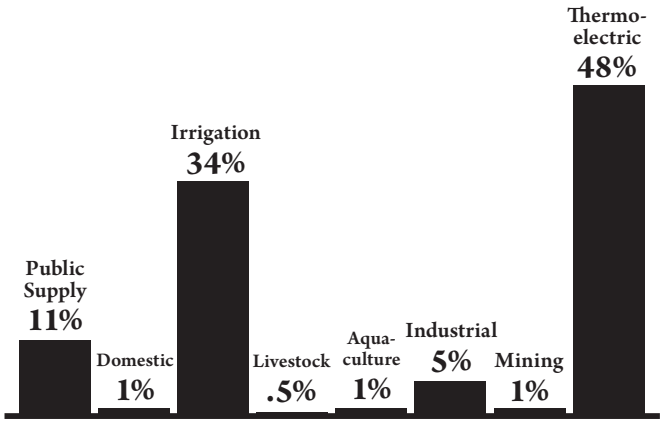
Source: USGS

Estimated Worldwide Water Uses



Source: Wikipedia

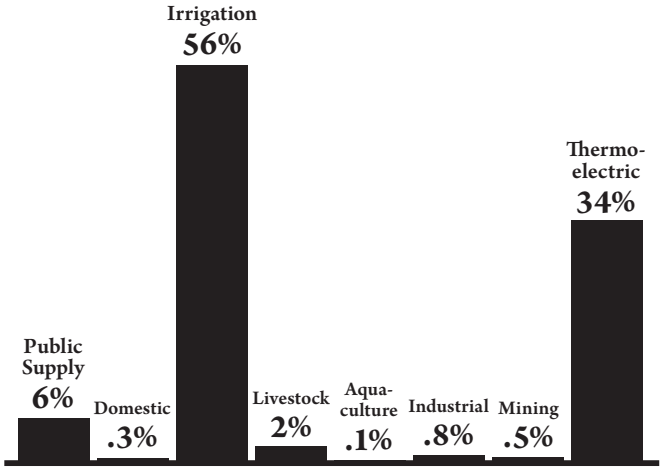
Estimated U.S. Water Uses – 2000*



*Includes the Virgin Islands and Puerto Rico

Source: USGS

Estimated Kansas Water Uses – 2000



Source: USGS

Water Uses

"Water is a common denominator of human activity."
C. E. Busby, geologist and conservationist

Uses of water can be categorized as consumptive or non-consumptive (sometimes called "renewable"). A use of water is consumptive if that water is not immediately available for another use. Water incorporated into a product, such as an agricultural crop, is considered a consumptive use. Evaporation or the infiltration of surface water (to become groundwater) would also be considered consumptive uses. A source of surface water that can be treated and used again as surface water, such as waste treated in a municipal wastewater treatment system, is generally considered a non-consumptive use of the water.

Agricultural Uses

It is estimated that 70 percent of water use worldwide is for irrigation. According to the U.S. Geological Survey, groundwater provides 37 percent of the water used for agricultural purposes in the United States, mostly for irrigation. In Kansas, irrigation makes it possible to produce the agricultural products that supply the world with food and fiber. As global populations grow and the demand for food increases, Kansas farmers are working to produce more food with less water.

Industrial Uses

An estimated 15 percent of water use worldwide is for industrial purposes. Major industrial users include power plants, which use water for cooling or as a power source; ore and oil refineries, which use water in chemical processes; and manufacturing plants, which use water as a solvent.

Today, according to the U.S. Geological Survey, hydroelectric plants produce around 10 percent of the energy produced in the United States. The only hydroelectric facility in Kansas is on the Kansas River in Lawrence. In Kansas, Coffey County Lake and La Cygne Reservoir are managed to support electrical generation plants. Both reservoirs also provide recreational opportunities.

Household Uses

Household purposes, including drinking water, bathing, cooking, sanitation, and gardening, use an estimated 15 percent of the water used worldwide. According to the U.S. Environmental Protection Agency, the average American uses 100 gallons of water each day but nearly 75 percent of the water that goes to homes in the United States goes down the drain.[2] Most of that water is treated and returned to surface water systems, except for water used in gardens and other landscaping activities.

Water fit for human consumption is called drinking water or "potable" water. In the United States, groundwater sources supply an estimated 51 percent of the drinking water for the U.S. population and account for an estimated 99 percent of the rural population's drinking water, according to the U.S. Geological Survey. [3]

Recreational Uses

Kansans value water for recreational purposes, including swimming, fishing, camping, bird watching, hunting, boating, sailing, and other water sports. Worldwide, recreational use is a small but growing percentage of total water use. Most of the lakes and reservoirs in Kansas provide water for recreational uses.

Credit: Bob Savannah, USFWS

Recreational usage is non-consumptive. However, sometimes it reduces the availability of water for other uses. For example, water retained in a reservoir to allow boating is not available for irrigating agricultural crops. When water is released to increase streamflow downstream to support river barge traffic, that may conflict with recreational water uses.

Water Rights

As a natural resource, water–and its availability–has always been a major social and economic concern. Historically, civilization flourished around rivers and major bodies of fresh water. Mesopotamia, often referred to as the "cradle of civilization," was situated between two major rivers, the Tigris River and the Euphrates River. In Kansas, many towns were located along major rivers or at the junction of two rivers, such as Junction City.

Water demand already exceeds supply in many parts of Kansas, with many more areas expected to experience this imbalance in the future. The framework for allocating water resources to water users is known as "water rights."

The right to use Kansas water is based on the principle of "first in time–first in right." In times of shortage, that means the earliest water rights or permit holders have first rights to use the water. The maintenance of water right and permit records allows Kansas water to be apportioned fairly. The Water Appropriation Act affects all Kansans. Farmers who use irrigation to grow crops are required to obtain a permit and make yearly reports of water use. City dwellers who drink, wash with, or play in city-provided water are able to do so because the city has one or more water rights.

It is illegal for individuals in Kansas to use water without holding a water right or a permit to appropriate (use) water from the Kansas Department of Agriculture's Division of Water Resources (DWR). The exception is water used solely for domestic purposes–water primarily used for the household, watering livestock on pasture, or watering up to two acres of lawn and gardens. No state permit is needed for that class of water usage. However, a county may require a permit to drill a water well for domestic purposes and a state permit is required to plug (fill in) a water well.

The Division of Water Resources provides management of the state's water resources by administering 28 state laws, including the Kansas Water Appropriation Act, and statutes concerning construction of dams, levees, and other changes to streams within Kansas. The Division of Water Resources also administers the state's four interstate river compacts and coordinates the national flood insurance program in Kansas.

Water Quality

"Human activity has profoundly affected rivers and streams in all parts of the world, to such an extent that it now extremely difficult to find any stream which has not been in some way altered, and probably quite impossible to find any such river."

H.B.N. Hynes, Canadian freshwater biologist

Water is the most common solvent found on Earth. In its liquid form, water dissolves many types of substances. The substances that will mix with and dissolve in water are known as hydrophilic (water-loving) substances. This means that water can absorb many substances, some of which can make the water unusable for specific purposes. Substances such as oil, that do not mix well with water, are known as hydrophobic (water-fearing). Such substances may be transported by water but are still chemically separated from the water molecules.

Water Words
Hydrophilic– water-loving; substances that will mix with and dissolve in water, such as salt.
Hydrophobic– water-fearing; substances that do not mix well with water, such as oil.

Water Pollution

There are two types of water pollution: point source pollution and nonpoint source pollution.

Point source pollution refers to pollution from a human activity that can be identified and controlled. Point source pollution is discharged into water through an identifiable point, such as a pipe, ditch, tunnel, or container. The primary types of point source pollution are sewage discharge and discharge of wastes from industrial or manufacturing operations.

Nonpoint source pollution comes from sources that cannot be easily identified or located. Examples of nonpoint sources would include sediment carried off a field or construction site by surface water runoff and residues, such as oil or antifreeze left by vehicles in a parking lot or on a highway. If those materials enter a river or stream after a rain, they can impact water quality and the lives of aquatic organisms, yet there may be multiple sources rather than one identifiable source of the pollutants.

In Kansas, suspended solids, sometimes referred to as sediment, are the largest single category of nonpoint source pollution (as measured by volume or weight).[4] Suspended solids typically consist of solid organic or mineral particles that do not dissolve in the water. Instead, they are suspended in the water and move more slowly than the water itself, giving the water a cloudy or muddy appearance. Whenever the water slows enough to allow those particles to stop moving, they are deposited as sediment, either down lower on the slope of the land's surface or downstream in a body of water, such as a stream or lake. Sources of suspended solids include natural erosion and any activities that disturb natural vegetation, remove or disturb topsoil, or alter the terrain. The water can also carry nutrients and chemicals attached to soil particles, which may dissolve in the water and impact water quality. Before it is used for human consumption, surface water must be treated to remove sediment and other suspended solids, dissolved substances in the water, and harmful microorganisms.

Sediment– solid organic or mineral particles transported by water and deposited wherever the water slows enough to allow the particles to stop moving.

Types of Pollution
Point source pollution– water pollution from human activity originating from an identifiable source.
Nonpoint source pollution– pollution from source(s) not easily identified or located.

Federal Water Quality Legislation

In 1948, Congress passed the Water Pollution Control Act. It was the first attempt by the federal government to exert control over water quality issues, which continued to be managed by the states even after the legislation was enacted. In 1956, amendments to this legislation provided for federal financial support for the construction of wastewater treatment plants and direct federal regulation of waste discharges. Additional legislation passed in 1965, the Water Quality Act, established water quality standards for interstate waterways.

The objective of the 1972 Clean Water Act is to "restore and maintain the chemical, physical and biological integrity of the nation's waters." This legislation required that discharges of pollutants into the nation's waters be eliminated by 1985 and that all waters of the United States be "fishable and swimmable." The act was amended in 1977 to add programs dealing with nonpoint source pollution, which makes up as much as 60 percent of the pollution of the nation's surface water.

Federal Water Quality Laws
1948– Water Pollution Control Act; established federal-state cooperation over water quality issues but limited federal enforcement authority.
1956– amendments to 1948 law; provided federal financial support for wastewater treatment and federal regulation of waste discharges.
1965– Water Quality Act; directed states to develop water quality standards for interstate waterways.
1972– Clean Water Act (Federal Water Pollution Control Act Amendments); established basis for current water quality standards and extended protection to all surface waters of the United States; emphasized eliminating major visible sources of pollution and required states to establish water quality standards.
1974– Safe Drinking Water Act; established to protect quality of U.S. drinking water whether from above ground or underground sources and authorized EPA to establish safe standards of purity.
1977– amendments to Clean Water Act; established basic structure for regulating discharges of pollutants into the waters of the United States and gave EPA authority to implement pollution control standards.
1987– amendments to Clean Water Act; mandated states adopt numeric criteria for toxic pollutants in water and addressed nonpoint sources of pollution.

Meeting Water Quality Standards

Under the Clean Water Act, states are required to adopt water quality standards against which pollution levels within their water bodies are measured. If a water body fails to meet the applicable state water quality standards for its designated use, the state is required to list it as "impaired," specify what reductions are needed to achieve the standards, and implement a restoration plan.

The state of Kansas pioneered watershed based planning, which identifies the relationships that exist between surface water, groundwater, and land uses. Kansas uses the twelve major river basins and the smaller watershed units within each of the river basins to establish designated uses for each body of water in the state. Water quality is maintained to protect those uses.

It is not easy to compare water quality between states because there are inconsistencies among the ways that states assign designated uses and the criteria developed to protect those uses. For example, part of the Missouri River that forms a portion of the state boundary between Kansas and Missouri has a primary recreational use in Kansas and a secondary recreational use in Missouri. Because of this discrepancy between the states, Missouri can allow discharges at levels such that the identical stretch of water is not impaired in Missouri but is impaired in Kansas.

Designated Uses of Kansas Surface Water

Agricultural water supply– agricultural uses including irrigation and livestock watering.

Aquatic life support– maintenance of the ecological integrity of lakes, wetlands, and ponds, including the sustained growth and propagation of aquatic, semiaquatic, or terrestrial wildlife.

Domestic water supply– use, after appropriate treatment, for the production of potable water (water suitable for drinking).

Food procurement– obtaining edible forms of aquatic or semiaquatic life for human consumption.

Groundwater recharge– replenishing fresh or usable groundwater resources.

Industrial water supply– use for nonpotable purposes by industry, including withdrawals for cooling or processes.

Recreational use– divided into primary and secondary contact recreational uses.

- ***Primary contact***—recreational uses from April 1 through October 31 of each year, during which some inadvertent ingestion of water is probable; includes boating, mussel harvesting, swimming, skin diving, waterskiing, and windsurfing.
- ***Secondary contact***—recreational uses during which the ingestion of surface waters is not probable; includes wading, fishing, trapping, and hunting.

Source: KDHE

Kansas Water Quality Programs

In response to the federal legislation, states instituted programs to monitor water quality and address any problems. In Kansas, the Kansas Department of Health and Environment is responsible for designating stream uses, establishing water quality standards that support those uses, and ensuring compliance with the standards. Every two years, federal law requires the Kansas Department of Health and Environment to report the status of water quality in the state through the Kansas Water Quality Assessment Report.

The Kansas Surface Water Quality Standards, established by the Kansas Department of Health and Environment, provide specific water quality goals for surface waters in the state. Designated use categories are: agricultural water supply, aquatic life support, domestic water supply, food procurement, groundwater recharge, industrial water supply, and recreation. The surface water quality standards that apply to a specific body of water vary according to the water's designated use(s), with the most protective standards applying if there is more than one designated use.

Monitoring is conducted on each body of water. If monitoring indicates that a river segment or other body of water is consistently violating the standards, the body of water is designated as "impaired," which requires the establishment of a maximum amount of pollution that a water body can receive without violating the standards–known as the "total maximum daily load" or TMDL. The quality of surface water in Kansas is being improved by using tools such as TMDLs to target and reduce water pollution.

Water Conservation

"We think of our land and water and human resources not as static and sterile possessions but as life-giving assets to be directed by wise provision for future days."

Franklin D. Roosevelt, 32nd President of the United States

Water conservation is essential to assure that a sufficient, long-term supply of water is available for Kansans for many years in the future. Current state policy regarding water conservation is guided by the principle that the privilege to use water carries with it the responsibility to use the water wisely. A philosophy of sharing a limited supply among those using a water source in drought or other emergency conditions before imposing regulations also shapes current policies.

Water Conservation Plans

The Chief Engineer, Division of Water Resources, may require a water right owner to adopt and implement a water conservation plan. In addition, the Chief Engineer may require and enforce conservation measures for domestic users and may delegate this authority to municipalities that have approved conservation plans. The Chief Engineer currently requires plans from water users who have had difficulty staying within their authorized quantity and those who appear to have problems with the feasibility of their intended use of the water.

The Kansas Department of Agriculture, the Division of Water Resources, and the Kansas Water Office cooperatively review water conservation plans for municipal, irrigation, and

industrial users. The Kansas Water Office provides, or arranges to provide, technical assistance to water users who are required to adopt and implement water conservation plans. Assistance in developing water conservation plans is also provided by Kansas State University, local groundwater management districts, and by the Kansas Rural Water Association (KRWA).

As of 2004, assistance provided to irrigation and municipal users who were required to adopt and implement conservation plans had resulted in the development and implementation of water conservation plans for over 500 public water suppliers in the state. In addition, over 800 irrigators in Kansas have approved water conservation plans in place. Previous evaluations have shown that conservation plans can be effective if properly implemented. Recent droughts have raised questions regarding enforcement authority from additional public water suppliers that want to address domestic use during times of drought. However, there is no comprehensive state monitoring or enforcement of the goals and initiatives outlined in conservation plans.

Personal Water Conservation

The earth is covered with water yet only 1 percent is available for drinking water. Unfortunately, that water is often taken for granted. In the United States, over 40 percent more water is used than needed to carry out cooking, washing, flushing, watering, and other tasks. The largest use of household water is to flush the toilet, followed by water for bathing.

Source: USDA NRCS

Water for Future Uses

"All things, including weather and rainfall, change fast, and our memories are short. When it rains, we forget about the dust bowl; when it is dry, we forget about floods."

Alfred Stefferud, editor, 1955 Yearbook of Agriculture

Water is essential for all known forms of life. Understanding the water cycle is critical to understanding issues related to both water quality and water quantity. With only 1 percent of the earth's water available for drinking water, maintaining the quality of that water is crucial. It is also important to take steps to ensure that future generations will have adequate water supplies.

Kansas would be a much different place without the existing water resources. The people of Kansas have a responsibility to work together to ensure that water resources are protected and used wisely. The future of the state depends on it!

Water Conservation Tips
Repair leaky faucets, indoors and out. One leaky faucet can use up to 4,000 gallons of water per month.
When washing dishes by hand, save up to 15 gallons of water by soaking dirty dishes in the sink or dishpan before rinsing them off.
Only run dishwashers with a full load
Take short showers instead of baths. Showers use an average of 5 to 7 gallons per minute, three times less than the water needed for a bath. To cut water use even more, install a low-flow showerhead that uses just 3 gallons per minute.
Turn off the water to brush teeth. This can save up to 4 gallons of water each brushing.
Repair leaky toilets to save more than 50 gallons of water per day. To check for leaks, add 12 drops of food coloring to the toilet tank. If color appears in the toilet bowl one hour later, the tank is leaking.
Water the lawn and garden in the morning when evaporation is lowest.
Using a barrel covered with a screen, collect rainwater for watering plants.
Sweep down decks and driveways instead of hosing them down.

Endnotes

1. "Groundwater Glossary", The Groundwater Foundation, <http://www.groundwater.org/gi/gwglossary.html>.

2. The Groundwater Foundation, <http://www.groundwater.org/gi/depend.html>.

3. "Groundwater Facts", The Groundwater Foundation, <http://www.groundwater.org/gi/GWBASICS2.pdf>.

4. Daniel L. Devlin and Kent A. McVay, *Suspended Solids: A Water Quality Concern for Kansas*, Kansas State University, February 2001, MF-2501, <http://www.oznet.ksu.edu/library/h20ql2/mf2501.pdf>

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Smith, Deborah Takiff, ed. *Agriculture and the Environment: The 1991 Yearbook of Agriculture*. Washington, D.C.: U.S. Government Printing Office.

Stefferud, Alfred, ed. *Water: The Yearbook of Agriculture 1955*. Washington, D.C.: U.S. Government Printing Office, 91st Congress, 2nd Session, House Document No. 91-254.

U.S. Geological Survey. 2007. <http://www.usgs.gov>.

Teacher Resources

Books:

** Teachers & Advanced Readers;* AR - *Accelerated Reading Level*

A Cool Drink of Water
Kerley, Barbara. 2006

Did a Dinosaur Drink This Water?
Wells, Robert E. 2006

Down the Drain: Conserving Water
Oxlade, Chris. 2005 (AR - 5.2)

A Drop Around the World
McKinney, Barbara Shaw. 2004 (AR - 5.1)

A Drop around the World: Teacher's Guide *
Malnor, Carol. 2004

A Drop of Water
Wick, Walter. 1997 (AR - 5.8)

Earth
Van Rose, Susanna. 2005

Field Manual for Water Quality Monitoring: An Environmental Education Program for Schools *
Mitchell, Mark K. 2000

The Incredible Water Show
Frasier, Debra. 2004 (AR - 3.7)

The Life and Times of a Drop of Water
Royston, Angela. 2005 (AR - 3.7)

The Magic School Bus Wet All Over: A Book About the Water Cycle
Relf, Pat. 1996 (AR - 3.1)

Watching Water Birds
Arnosky, Jim. 2002 (AR - 5.3)

Water and the Weather
Olien, Rebecca. 2005 (AR - 2.9)

Water Bugs
Taylor, Barbara. 2003 (AR - 4.7)

The Water Cycle
Harman, Rebecca. 2005 (AR - 5.5)

The Water Cycle
Kalman, Bobbie. 2006 (AR - 4.2)

Water on the Move
Slade, Suzanne. 2007 (AR - 5.2)

Water Music
Yolen, Jane. 2004 (AR - 4.2)

Weather
Cosgrove, Brian. 2004 (AR - 7.6)

Weather
Wyatt, Valerie. 2000 (AR - 5.7)

Weather and Climate
Silverstein, Alvin. 2007 (AR - 7.6)

The Wonder in Water
Swanson, Diane. 2005 (AR - 6.0)

Websites:

Drinking Water for Kids (and Teachers)
U.S. Environmental Protection Agency
www.epa.gov/safewater/kids/index.html

H_2OUSE Water Saver Home
California Urban Water Conservation Council
www.h2ouse.org

Kansas Water Office
www.kwo.org

Water Science for Schools
U.S. Geological Survey
http://ga.water.usgs.gov/edu/index.html

WaterWise Resource Action Program
www.getwise.org
(Materials also available in Spanish)

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