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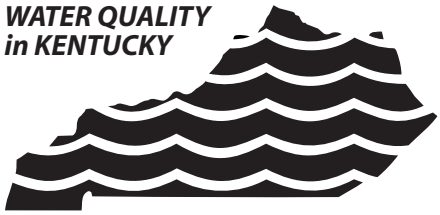

Summary Sheet

Understanding the Water System

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Water is essential for life. No other single substance is as important for our health, our economy, or our way of life. For example:

- People can live for weeks without food but only five to 10 days without water.
- A dairy cow requires 3 gallons of water to produce 1 gallon of milk.
- A fast food meal of a hamburger, french fries, and soft drink requires 1,400 gallons.
- Producing one car requires more than 30,000 gallons of water.

No matter where we turn, water is important to our lives. Agriculture requires water for animals and plants to grow. Industry uses water in cleaning and processing, for transportation, and in generating electricity. Consumers require water for health, hygiene, cooking, and recreation.

Kentucky has more than 89,000 miles of rivers and streams, and more than 5 percent of the land is in lakes and wetlands. Groundwater, while not seen, is also an important resource. Increasingly, however, Kentucky's water resources are threatened by runoff pollution from farms, construction sites, residential areas, illegal dumping, improper sewage disposal, oil and coal extraction, and poor management practices.

Shortages and incidents of contamination remind us that water must be conserved and protected. Clean and abundant water is a limited resource that can disappear if we do not manage it properly. Each of us has a responsibility to protect the water supply. Consumers, farmers, and industries would suffer if the water supply's quality and quantity deteriorate. This publication summarizes the basic issues in water quality so that individuals and groups can protect and conserve water sources for themselves, their community, and their country.

Water Is a Natural Resource

Our society generates a high demand for abundant, clean water. However, although water is found naturally in our environment, its supply is limited by its location and by the time and quality demanded.

Water is not available at every location. In the past, people settled where water was available, but in modern times we can bring water to most places through pipes or reservoirs. However, water's availability can change over time because precipitation fluctuates. Droughts, as in 1999 and 2000, can leave some areas vulnerable to changing water supplies.

Water is rarely found in a pure state. Because it is a universal solvent, it dissolves many minerals and chemicals. Thus, our water supply contains many components that affect its quality. Most minerals found naturally in water do not harm humans and can improve taste, but some microorganisms and chemicals can cause health problems and even death.

Over time, we have developed standards for drinking water. Industry also has standards for water, some more stringent than those for human consumption. Ultimately, the water supply at any time depends on the quality users demand. A large supply of water contaminated by pollutants is useless for many applications.

Cost

In the past, we viewed water as unlimited and cheap, and in many respects we were right. The United States has been blessed with an abundant supply at a relatively low cost: on average, water costs slightly more than $2 per 1,000 gallons—far less than in many other countries.

However, water costs are sensitive to the quality and quantity demanded. Most of the water we use must be treated to remove harmful microorganisms or chemicals. As water becomes more contaminated and standards of quality rise, treatment costs increase.

Likewise, water costs increase as demand rises faster than supply. From 1950 to 1980, our demand for water was increasing at a faster rate than our population (see Figure 1). Since 1980, however, we have begun to see a decline in our withdrawal of water. Regardless, we are demanding more water today for personal consumption and to produce goods than we did 50 years ago.

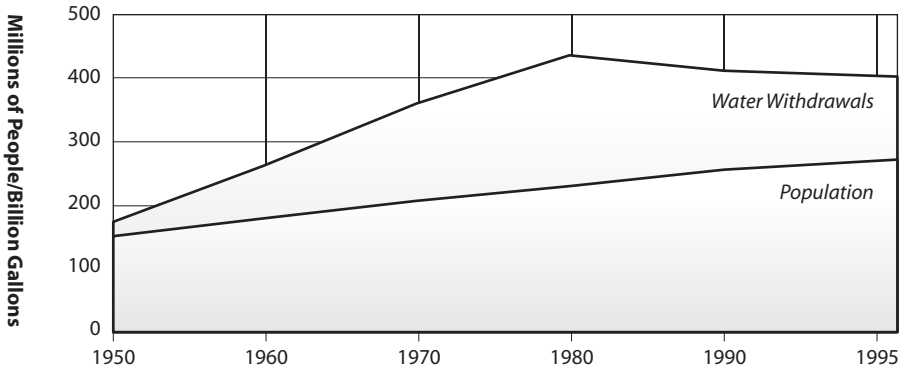
Contamination of the Water Supply

Because water is a natural resource, it must be managed properly to protect it for future generations. One of the greatest threats to the water supply is contamination from pollutants.

In the past, the biggest threat to water supplies was microorganisms, which caused diseases like dysentery, typhoid, and giardiasis. Today a bigger threat comes from contamination by chemicals. Inorganic chemicals include metals and nutrients, while organics include pesticides and industrial solvents. Many of these chemicals have been linked to cancer, liver and kidney disease, and nervous system damage.

A major difficulty in identifying contaminants is knowing their source. Point

Figure 1. Trends in Water Withdrawals and Population, 1950 to 1995.



Source: "Estimated Use of Water in the United States in 1995", U.S. Geological Survey Circular 1200, (1998), U.S. Department of the Interior, Denver, CO.

sources can be readily identified, such as waste water from sewage treatment or manufacturing plants. Although point sources have decreased in recent years because of federal and state laws, they still threaten our water supply.

When pollutants come from a variety of places, their sources are called nonpoint sources. These include sediments, animal wastes, pesticides and other material from agriculture, municipal dumps, and runoff. Because individual nonpoint polluters are hard to identify, regulation is less effective and must rely more on voluntary compliance.

Major Sources of Contamination

Where do the chemical contaminants come from? Actually, a variety of sources exist: manufacturing industries, agriculture, municipalities, and individuals.

Manufacturing industries often use toxic chemicals. Proper disposal of these chemicals can be very costly, and the temptation is great to dump them illegally. Even legal disposal of industrial by-products in landfills and dumps can cause problems.

Another source of water pollution is **agriculture.** A farm may use many pesticides and fertilizers that can percolate through to the groundwater. Animal wastes can also contaminate the water supply, and soil erosion can clog rivers and streams.

Cities and towns also contribute to water quality problems. Contaminants can enter ground and surface waters from municipal landfills, sewage treatment plants, and water runoff from roads and storm sewers.

Commercial activities can also contribute to water quality problems when chemicals used as sales products (gasoline stations), in processing (drycleaners), and as cleaning agents (restaurants) are disposed of improperly. Storage tanks can also leak chemicals into the groundwater.

Individuals are a final source of water pollution.

- Within the home a number of toxic chemicals are used for cleaning, painting, and car care. These chemicals are often disposed of in the sink, toilet, or trash.
- About 25 percent of all households use septic systems for sewage disposal. These systems can leach harmful chemicals into the groundwater.
- Homeowners also use lawn and garden products that can get into ground or surface waters.

Impacts of Pollution

The primary concern about contaminated drinking water is ill health. Bacteria, viruses, heavy metals, and chemicals have been related to gastroenteric diseases, cancer, and nervous system disorders, some of which are fatal. At present, the risks are relatively small, and by and large the drinking water supply is safe. However, many questions remain unanswered concerning water quality's long-term effect on health. One thing is certain: the situation will not improve unless positive and proactive steps are taken to maintain the quality of the water supply.

Contaminants also pose other problems such as bad odors and taste, increased hardness and acidity, and cloudiness. While these effects are not harmful *per se,* they reduce water's quality and limit some of its uses.

Contaminants in water also increase its cost. Great concern over quality leads to more frequent and more extensive testing and treatment. Treatment is becoming more complex as new chemical compounds are detected each year.

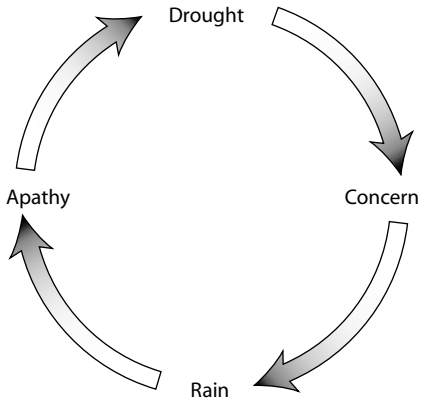
What Can Be Done?

Most of these problems can be managed if industries, farmers, and consumers are committed to do so. The question is, are we willing to make the changes and sacrifices needed to protect the water supply?

The most important thing is to foster a climate of understanding. Too many people are part of the hydro-*ill*-logical cycle (see Figure 2). When problems arise over quality or quantity, great concern exists, but once problems diminish, apathy returns. Our present reactive approach to water quality needs to shift toward a proactive stance. Until people are aware of water's continued importance, present conditions will get worse. Kentucky cannot afford to squander this precious resource.

For more information, see Cooperative Extension publication IP-1 *Understanding the Water System.*

Figure 2. Hydro-*ill*-Logical Cycle.



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