## Brief Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preface</td>
<td></td>
<td>ix</td>
</tr>
<tr>
<td>Chapter 1</td>
<td>The Need for Water in Ancient Societies</td>
<td>1</td>
</tr>
<tr>
<td>Chapter 2</td>
<td>The Ideal and the Reality of Classical Athens</td>
<td>19</td>
</tr>
<tr>
<td>Chapter 3</td>
<td>Health and Disease in the Greek World</td>
<td>41</td>
</tr>
<tr>
<td>Chapter 4</td>
<td>The Achievements of Augustus</td>
<td>65</td>
</tr>
<tr>
<td>Chapter 5</td>
<td>Invading Barbarians</td>
<td>87</td>
</tr>
<tr>
<td>Chapter 7</td>
<td>Life at a Medieval University</td>
<td>137</td>
</tr>
<tr>
<td>Chapter 8</td>
<td>Infidels and Heretics: Crusades of the High Middle Ages</td>
<td>162</td>
</tr>
<tr>
<td>Chapter 10</td>
<td>The Renaissance Man and Woman</td>
<td>210</td>
</tr>
<tr>
<td>Chapter 11</td>
<td>Pagans, Muslims, and Christians in the Mental World of Columbus</td>
<td>232</td>
</tr>
<tr>
<td>Chapter 12</td>
<td>The Spread of the Reformation</td>
<td>266</td>
</tr>
</tbody>
</table>
CHAPTER ONE

THE NEED FOR WATER

IN ANCIENT SOCIETIES

THE PROBLEM

The title of the course for which you are using this book is probably a variant of “Western Civilization.” Why do we use the term—“civilization”? What distinguishes human cultures that are labeled “civilizations” from those that are not? Though great differences separate them, all civilizations share some basic characteristics. The most important of these similarities is the presence of cities; indeed, the word “civilization” comes from the Latin word *civlis* (meaning “civic”), which is also the root of “citizen” and “civil.” Historians and archaeologists generally define a “city” as a place inhabited by more than 5,000 people, and they have discovered the remains of the earliest “communities” of this size in ancient Mesopotamia, which is present-day Iraq.

Why should the presence of cities be the distinguishing mark of cultural development? It is not the cities themselves but what they imply about a culture that makes them so important. Any society in which thousands of people live in close proximity to one another must have some sort of laws or rules governing human behavior. These may be either part of an oral tradition or, as in ancient Mesopotamia, written down. A city must provide its residents with a constant supply of food, which means developing ways to transport food into the city from the surrounding farmland, to store food throughout the year, and to save it for years marked by poor harvests. The presence of cities not only indicates that people could transport and store food effectively, but also reveals that they were producing enough surplus food to allow for specialization of labor. If all work time had been devoted to farming, it would not have been possible to build roads, produce storage bins, or enforce laws on which the city depended. This specialization of labor, then, gave some members of society the opportunity and time to create and produce goods and artifacts that
were not directly essential to daily survival. Urban residents in Mesopotamia began to construct large buildings and decorate them with sculptures, paintings, and mosaics; to write poetry and history; and to develop religious and philosophical ideas, all of which are pursuits we consider essential to a civilization. As the cities grew they required greater and greater amounts of food to feed their inhabitants, leading to further technological development.

Mesopotamia was in many ways an odd location for the beginning of a civilization. True, the soil is so rich that the region is called the Fertile Crescent, but it does not receive enough natural rainfall to grow crops steadily year after year. In fact, this region is not where agriculture began in the West; that happened closer to the Mediterranean, where the rainfall was more regular. Apparently, as techniques of planting and harvesting crops spread into Mesopotamia, the inhabitants realized that they would be able to use these techniques effectively only through irrigation. They needed to tap the waters flowing in the Tigris and Euphrates rivers, a project requiring the cooperation of a great many people. Thus, rather than proving a block to further development, the need for irrigation in ancient Mesopotamia may have been one of the reasons that cities first arose there. We may never know this with certainty, because irrigation systems were already in place when written records began and because cities and irrigation expanded at the same time. We do know, however, that in Mesopotamia, neither could have existed without the other; cities could survive only where irrigation had created a food surplus, and irrigation could survive only where enough people were available to create and maintain ditches and other parts of the system.

Building irrigation systems presented both technical and organizational problems. The Tigris and Euphrates were fast-flowing rivers that carried soil as well as water down from the highlands. This rich soil created new farmland where the rivers emptied into the Persian Gulf. (The ancient Persian Gulf ended more than 100 miles north of its present boundary; all that land was created as the rivers filled in the delta.) The soil also rapidly clogged up the irrigation ditches, which consequently required constant cleaning. Every year these deposits were excavated and piled on the banks until the sides of the ditches grew so tall that cleaning could no longer be easily accomplished. At this point the old ditch was abandoned and a new ditch was cut, a task that required a great deal of work and the cooperation of everyone whose land was watered by that ditch.

Mesopotamian farmers used several types of irrigation. One technique, known as basin irrigation, was to level large plots of land fronting the rivers and main canals and build up dikes around them. In the spring and other times during the year when the water was high, farmers knocked holes in the dikes to admit water and fresh soil. Once the sediment had set, they let the water flow back into the channel. They also built small waterways between their fields to
provide water throughout the year, thereby developing a system of perennial irrigation. In the hillier country of northern Mesopotamia, farmers built terraces with water channels running alongside them. The hillside terraces provided narrow strips of flat land to farm, and the waterways were dug to connect with brooks and streams.

Farmers could depend on gravity to bring water to their fields during spring and flood seasons, but at other times they needed water-raising machines. They devised various machines, some of which are still in use today in many parts of the world. These solved some problems but created others, as farmers with machines could drain an irrigation ditch during times of low water, leaving their neighbors with no water. How were rights to water to be decided? Solving this problem was crucial to human social organization, and the first recorded laws regarding property rights, in fact, concern not rights to land but rights to water. In Mesopotamia, land was useless unless it was irrigated.

Many irrigation techniques developed in Mesopotamia either spread to Egypt or were developed independently there. Because it received even less rainfall than Mesopotamia, Egypt was totally dependent on the Nile for watering crops. Fortunately, the Nile was a much more reliable source of water than the Tigris and Euphrates because it flooded regularly, allowing easy basin irrigation. The rise and fall of the Nile was so regular, in fact, that the Egyptians based their 365-day calendar on its annual flooding. The Egyptians also constructed waterways and water-lifting machines to allow for perennial irrigation. As in Mesopotamia, irrigation in Egypt both caused and resulted from the growth of cities. It contributed as well to the power of the kings, whom the Egyptian people regarded as being responsible for the flood of the Nile.

Irrigation was more difficult in places that did not have flood-prone rivers, including many regions of North Africa and the Near East. Here people adopted techniques to conserve water from sporadic heavy rainfalls. They dammed the temporary lakes (termed, wadis) created by the rainfall and built ditches to convey the water to fields, rather than allowing it simply to flow off onto the desert. Sometimes this wadi irrigation involved a series of small dams down the course of rivers that ran only after storms. Besides providing water, wadi irrigation also built up terraces because the rivers carried soil with them.

The earliest water systems were for crop irrigation, but people also began to demand water fit to drink. In many parts of the ancient world, the demand for drinking water led to the establishment of a second system because river water that is suitable for irrigation may be brackish, unpleasant, or even unhealthful to drink. In southern Europe, where lakes were often near growing cities, people solved the problem by building channels made of timber, stone, or clay earthenware to carry water from the lakes to the cities. These channels might be open or closed, depending on the terrain and the level of technical development of the culture that built them. Generally they relied on gravity flow and fed
into underground tanks or reservoirs in the city; the oldest known water channels are in Jerusalem and date from about 1000 B.C. The construction of such systems, which demanded even more technical expertise than the building of irrigation ditches, provoked additional legal problems about ownership rights to this clean, cool water.

When lakes were not located close enough to make aboveground channels feasible, people had to rely on water from aquifers, underground water-bearing layers of 'gravel' or porous rock. The water could be obtained from wells drilled in the ground, but wells could supply only a small amount of water at a time. Once an aquifer had been discovered, however, a horizontal channel could be dug to lead the water to an aboveground channel or reservoir. A horizontal channel worked only in hilly areas where the aquifer stood higher than a nearby valley, but such channels, called qanats, more than 2,000 years old have been found in Iran, Syria, Egypt, and Turkey. If the amount of water it yielded was large enough, the qanat could be used for irrigation as well as drinking water.

When the Romans conquered the Middle East and North Africa in the second century B.C., they inherited irrigation systems that in some cases had already been in existence for more than 2,000 years. The Romans carried many ideas to other parts of their empire and made innovations as the terrain or distance required. Most of the European territory in the Roman Empire received adequate rainfall for farming without irrigation, but many Roman cities, especially Rome itself, experienced a chronic shortage of drinking water. The Romans solved this problem by building aqueducts, covered or uncovered channels that brought water into the cities from lakes and springs. The first of these in Rome was built in 312 B.C., and the system expanded continuously up to about A.D. 150. Over 300 miles of aqueducts served the city of Rome, with extensive systems in the outlying provinces as well. Although Roman engineers went to great lengths to avoid valleys, they were occasionally forced to construct enormous bridges to carry the aqueducts over valleys. Some of these bridges were over 150 feet high, and a few, such as the bridge-aqueduct in Segovia, Spain, still bring water to city residents. The Romans’ sophisticated architectural and construction techniques—the arch and water-resistant cement, for example—enabled them to build water systems undreamed of in Mesopotamia and Egypt. Legal problems were not as easily solved, however, and disputes about water rights recur frequently throughout the long history of Rome.

Supplying cities with water was not simply a technological problem; it had economic, legal, and political implications. Through their solutions to these complex problems, ancient societies created what we call civilization. Your task in this chapter is to use both visual and written evidence of ancient water systems to answer the question, How did the need for a steady supply of water shape civilization?
Sources and Method

Historians use a wide variety of sources when examining ancient irrigation and water supply systems. Because many of these systems were created before the development of writing, archaeological evidence is extremely important, especially in examining technological development. This evidence may be the actual remains of ancient ditches, machines, or aqueducts, but in many areas, these have completely disappeared. This does not mean that they have left no trace, however, for the ancient uses of modern landscapes are often revealed through patterns of depressions and discoloration.

The best way to detect these patterns is through aerial photography. Analyzing aerial photographs can be a difficult task, and learning how to read ancient land-use patterns through the overlay of modern development takes a great deal of training. Occasionally, the older patterns can be quite clear, however, and only a small amount of additional information is necessary for you to begin to decode them. The first piece of evidence, Source 1, is an aerial photograph of the site of a pre-Roman city in Italy. Examine the picture carefully. Can you see the old grid pattern of irrigation ditches, which shows up as light and dark marsh grass? The dark lines are the outlines of ancient irrigation ditches, the lighter squares are ancient fields, and the white parallel lines superimposed on the top are part of a modern drainage system. To examine the ancient system, you will need to strip away the modern system mentally. What do you think the broader black strip at the top left is? Does this system look like basin or perennial irrigation? Note the flatness of the landscape. Would silting be a problem?

A more sophisticated type of aerial photography involves the use of satellites rather than airplanes. Satellites can take extremely detailed pictures of the earth’s surface that reveal natural and artificially constructed features, both ancient and contemporary. The sharpest images are produced by high-resolution military satellites, but those pictures are not available to the public. Lower-power images produced by Landsat (the satellite imagery system run by U.S. government agencies since 1972) or by other public or commercial satellite imagery systems are adequate for most archaeological and historical purposes, however. Source 2 is a map of the major ancient irrigation ditches between the Tigris and Euphrates rivers that were identifiable in a Landsat image. What does the size of the system reveal about Mesopotamian technology? What does it imply about the political systems in this area—would you expect, for example, the cities in Mesopotamia to be hostile to one another? Technologies such as satellite imagery not only provide answers to questions, but also guide future research. How could you use this map to plan further investigations of irrigation systems?

Aerial photography provides visual evidence of entire irrigation systems but not of the specific tools and machines used to lift water to the fields. For these we must look to the remains of the tools themselves or to
depictions of them in tomb paintings, mosaics, and pottery. Source 3 is the earliest depiction of irrigation ditches that has survived from ancient Egypt, carved on the head of a ceremonial mace dating from around 3100 B.C. The large figure in the middle is one of the early kings of Egypt, holding a hoe and flanked by two palm-fan bearers and a man holding a basket for the dirt dug up by the hoe. At the bottom are two other workmen, also with hoes, excavating or deepening the ditches. Based on what you already know about Egyptian society, would you expect the king himself to be digging ditches? Why might this mace, which signified royal authority, show the king involved in building irrigation ditches?

Some machines depicted in ancient paintings are still in use today, suggesting that many devices for lifting water have not changed at all for thousands of years. Sources 4 through 7 show four different machines for raising water that we know were in use in ancient times and are still in use in many parts of the world today: the shaduf, saqiya, Archimedes’ screw, and noria. To assess their role and importance, you must consider a number of different factors while carefully examining the four diagrams. Some of these factors are technical: How complicated is the machine to build? Does it have many moving parts that must all be in good repair? How much water can it lift? How high can it lift the water? Can it work with both flowing and stationary water? Some factors are economic: Does the machine require a person to operate it, thus taking that person away from other types of labor? Does it require a strong adult, or can it be operated by a child? Does it require an animal, which must be fed and cared for? Some factors are both economic and political: Does the machine require a variety of raw materials to build, more than one family might possess? Does it require any raw materials, like metal, that would have to be imported? (Such questions are political because someone has to decide which families get the raw materials necessary for their fields.) Some factors are legal: Does the machine raise so much water that laws about distribution would become necessary? At this point, you may want to make a chart summarizing your assessment of the advantages and disadvantages of each machine, which will help you in making your final conclusions.

We will now turn from visual to written sources. Because water is such a vital commodity, mention of water systems appears very early in recorded human history. The next five sources are written accounts of the construction or operation of water systems. Source 8 contains sections from the Code of Hammurabi, a Babylonian legal code dating from 1750 B.C., that refer to irrigation. Source 9 is a description of the Roman aqueduct system written by Vitruvius during the first century B.C., and Source 10 is a description of the water-system projects undertaken by Emperor Claudius during his reign (A.D. 41–54), written by the Roman

1. Archimedes (287–212 B.C.) was a Greek mathematician and inventor who is credited with inventing this machine.
historian Suetonius. The next selection is a discussion on some of the problems associated with Rome’s water system written about A.D. 100 by Fronto, who was commissioner of the water supply. The last is a proclamation issued by Emperor Theodosius in 438 as part of his code of laws, an edict that had probably been in effect for many earlier decades as well.

As you read these sources, notice first of all the technical issues that the authors are addressing. What problems in tapping, transportation, and storage of water do they discuss? What solutions do they suggest? Then look at legal problems, which you can find most clearly stated in the selection by Frontinus and the law codes of Hammurabi and Theodosius. Keep in mind when you are reading these codes that laws are generally written to address those problems that already exist, not those the lawmakers are simply anticipating. The presence of a law, especially one that is frequently repeated, is often a good indication that the prohibited activity was probably happening, and happening often. How did people misuse or harm the water systems? What penalties were mandated for those who did? Who controlled the legal use of water, and who decided how water was to be distributed?

The written sources also include information about political and economic factors in ancient water supply systems that is nearly impossible to gain from archaeological evidence. Careful reading can reveal who paid for the construction of such systems and who stood to gain financially from them once they were built. What reasons, other than the simple need for water, might rulers have had for building water systems? What political and economic factors entered into decisions about the ways in which water was to be distributed?
THE EVIDENCE


1. Aerial Photograph of Pre-Roman City in Italy

2. Major Ancient Levees Identifiable in LANDSAT Imagery

3. Egyptian King Cutting an Irrigation Ditch, Drawn from Mace-head Carving, 3100 B.C.

Sources 4 through 7 adapted from sketches by Merry E. Wiesner.

4. Shaduf

5. Saqiya
8. Sections from the Code of Hammurabi Referring to Irrigation, 1750 B.C.

53. If a man neglects to maintain his 'dike' and does not strengthen it, and a break is made in his dike and the water carries away the farmland, the man in whose dike the break has been made shall replace the grain which has been damaged.

54. If he is not able to replace the grain, they shall sell him and his goods and the farmers whose grain the water has carried away shall divide [the results of the sale].

55. If a man opens his canal for irrigation and neglects it and the water carries away an adjacent field, he shall pay out grain on the basis of the adjacent field.

56. If a man opens up the water and the water carries away the improvements of an adjacent field, he shall pay out ten gur of grain per bur[ of damaged land]...

66. If a man has stolen a watering-machine from the meadow, he shall pay five shekels of silver to the owner of the watering-machine.
9. Vitruvius's Description of the
Roman Aqueduct System, first
century B.C.

The supply of water is made by three methods: by channels through walled conduits, or by lead pipes, or by earthenware pipes. And they are arranged as follows. In the case of conduits, the structure must be very solid; the bed of the channel must be leveled with a fall of not less than half a foot in 100 feet. The walled conduits are to be arched over so that the minimum amount of sun may strike the water. When it comes to the city walls, a reservoir is to be made. To this reservoir a triple distribution tank is to be joined to receive the water; and three pipes of equal size are to be placed in the reservoir, leading to the adjoining tanks, so that when there is an overflow from the two outer tanks, it may deliver into the middle tank. From the middle tank pipes will be laid to all basins and fountains; from the second tank to the baths, in order to furnish an annual revenue to the treasury; to avoid a deficiency in the public supply, private houses are to be supplied from the third, for private persons will not be able to divert the water, since they have their own limited supply from the distribution sources. Another reason why I have made these divisions is that those who take private supplies into their houses may by their taxes paid through tax farmers contribute to the maintenance of the water supply.

If, however, there are hills between the city and the source, we must proceed as follows: underground channels are to be dug and leveled to the falls mentioned above. If the bed is of tufa or stone, the channel may be cut in it; but if it is of soil or sand, the bed of the channel and the walls with the vaulting must be constructed, and the water should be thus conducted. Arrows are to be so constructed that they are 120 feet apart....

Water supply by earthenware pipes has these advantages. First, in the construction: if a break occurs, anybody can repair it. Again, water is much more wholesome from earthenware pipes than from lead pipes. For it seems to be made injurious by lead because white lead is produced by it; and this is said to be harmful to the human body. So if what is produced by anything is injurious, there is no doubt that the thing itself is not wholesome. We can take an example from the workers in lead who have complexion affected by palor: For when lead is smelted in casting, the fumes from it settle on the members of the body and, burning them, rob the limbs of the virtues of the blood. Therefore it seems that water should by no means be brought in lead pipes if we desire to have it wholesome. Everyday life can be used to show that the flavor from earthenware pipes is better because everybody (even those who load their table with silver vessels) uses
earthenware to preserve the purity of water. But if we are to create springs from which the water supplies come, we must dig wells.

But if the soil is hard, or if the veins of water lie too deep, then supplies of water are to be collected from the roofs or higher ground in concrete cisterns,... If the cisterns are made double or triple, so that they can be changed by percolation, they will make the supply of water much more wholesome. For when the sediment has a place to settle in, the water will be more limp and will keep its taste without any smell. If not, salt must be added to purify it.

10. Suetonius's Description of the Water Projects Undertaken by Emperor Claudius (r. A.D. 41–54)

The public works which Claudius completed were great and essential rather than numerous; they were in particular the following: an aqueduct begun by Caligula; also the drainage channel of Lake Fucine and the harbor at Ostia, although in the case of the last two he knew that Augustus had refused the former, to the Marsians in spite of their frequent requests, and that the latter had often been considered by the deified Julius but given up because of its difficulty. He brought to the city on stone arches the cool and abundant springs of the Claudian aqueduct... and at the same time the channel of the New Anio, distributing them into many beautifully ornamented fountains. He made the attempt on the Fucine Lake as much in the hope of gain as of glory, inasmuch as there were some who offered to drain it at their own cost provided the land that was drained be given them. He finished the drainage canal, which was three miles in length, partly by leveling and partly by tunnelling a mountain, a work of great difficulty requiring eleven years, although he had 30,000 men at work all the time without interruption.


11. Frontinus's Discussion of Rome's Water System, ca A.D. 100

The New Anio² is drawn from the river in the district of Sinbrinum, at about the forty-second milestone along the Via Sublacensis. On either side of the

2. An aqueduct completed under the emperor Claudius in A.D. 52.
river at this point are fields of rich soil which make the banks less firm, so that the water in the aqueduct is discolored and muddy even without the damage done by storms. So a little way along from the inlet a cleansing basin was built where the water could settle and be purified between the river and the conduit. Even so, in the event of rain, the water reaches the city in a muddy state. The length of the New Anio is about 47 miles, of which over 39 are underground and more than 7 carried on structures above the ground. In the upper reaches a distance of about two miles in various sections is carried on low structures or arches. Nearer the city, from the seventh Roman milestone, is half a mile on substructures and 5 miles on arches. These arches are very high, rising in certain places to a height of 109 feet.

... All the aqueducts reach the city at different levels. So some serve the higher districts and some cannot reach loftier ground. For the hills of Rome have gradually increased in height because of the rubble from frequent fires. There are five aqueducts high enough at entrance to reach all the city, but they supply water at different pressures....

Anyone who wants to tap water for private consumption must send in an application and take it, duly signed by the Emperor, to the Commissioner. The latter must take immediate action on Caesar's grant, and enroll one of the Imperial freedmen to help him in the business.... The right to water once granted cannot be inherited or bought, and does not go with the property, though long ago a privilege was extended to the public baths that their right should last in perpetuity....

Now that I have explained the situation with regard to private supply, it will be pertinent to give some examples of the ways in which men have broken these very sound arrangements and have been caught red-handed. In some reservoirs I have found larger valves in position than had been granted, and some have not even had the official stamp on them....

Another of the watermen's intolerable practices is to make a new outlet from the cistern when a water-grant is transferred to a new owner, leaving the old one for themselves. I would say that it was one of the Commissioner's chief duties to put a stop to this. For it affects not only the proper protection of the supply, but also the upkeep of the reservoir which would be ruined if needlessly filled with outlets.

Another financial scheme of the watermen, which they call "puncturing," must also be abolished. There are long separate stretches all over the city through which the pipes pass hidden under the pavement. I found out that these pipes were being tapped everywhere by the "puncturers," from which water was supplied by private pipe to all the business premises in the area, with the result that only a meagre amount reached the public utilities. I can estimate the volume of water stolen in this way from the amount of lead piping which was removed when these branch pipes were dug up.
12. **Proclamation of Emperor Theodosius, A.D. 438**

It is our will that the landholders over whose lands the courses of aqueducts pass shall be exempt from extraordinary burdens, so that by their work the aqueducts may be cleansed when they are choked with dirt. The said landholders shall not be subject to any other burden of a superindiction, lest they be occupied in other matters and not be present to clean the aqueducts. If they neglect this duty, they shall be punished by the forfeiture of their landholdings; for the fisc will take possession of the landed estate of any man whose negligence contributes to the damage of the aqueducts. Furthermore, persons through whose landed estates the aqueducts pass should know that they may have trees to the right and left at a distance of fifteen feet from the aqueducts, and your office shall see to it that these trees are cut out if they grow too luxuriantly at any time, so that their roots may not injure the structure of the aqueduct.

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**QUESTIONS TO CONSIDER**

Now that you have looked at both visual and written evidence, you will need to put together the information you have gathered from each type of source to achieve a more complete picture. Because sources for the earliest period of human development are so scanty, we need to use every shred of information available and use it somewhat creatively, making speculations where no specific evidence exists.

Take all the evidence about technical problems first. Keeping in mind that the ancient world had no power equipment, and no tools more elaborate than axes, hammers, saws, and drills (the Romans also had planes and chisels), what would you judge to be the most difficult purely technical problem involved in constructing water systems? In keeping them operating? The four diagrams of the water-raising machines are arranged in chronological order of their development: The shaduf may be as old as 2500 B.C., and the other three did not

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3. That is, any special taxes.
4. fisc: the imperial treasury.
5. This proclamation was addressed to the administrator of the water supply, the office which Frontinus held earlier.
appear until 1,000 years later. Looking at your chart on the advantages and disadvantages of each machine, in what ways did the later machines improve on the shaduf? What additional problems might these improvements have produced? What types of technological experimentation did the need for water-encourage?

Technological advance is not always an unmitigated blessing. For example, water standing in irrigation ditches can become brackish, providing a good breeding ground for mosquitoes and other carriers of disease. Cities that depend on irrigation suffer food shortages and famine when ditches cannot be kept clear or when river levels are low. The diversion of large quantities of water for irrigation makes rivers much smaller when they finally reach their deltas, which means that the deltas become increasingly salty from seawater and unable to support the types of plant and animal life they originally fostered. Judging by the aerial photograph and the LANDSAT map, would you expect any of these problems in ancient Italy or Mesopotamia? Do you find evidence in the written sources for problems in the later Roman water systems that were caused by technical advances? Do the written sources offer suggestions for solving these problems?

Now consider what you have learned about the economic issues associated with water systems. You have undoubtedly noticed that tremendous numbers of people were needed to construct irrigation ditches and aqueducts. Some of the written sources, such as the extract from Suetonius, provide exact figures. The size and complexity of the systems in the other sources also imply a substantial work force, given the lack of elaborate equipment. The rulers of Egypt, Mesopotamia, and Rome saw the need for a large labor force as no problem; it was, rather, a solution to the greater problem of unemployment. According to a story told about the Roman emperor Vespasian, when he was offered a labor-saving machine, he refused to allow its use because that would put people out of work and lead to social problems in Rome. We might regard this concern for full employment as a positive social attitude, but it should also tell you something about the value of labor in ancient societies. What would you expect wages to be for construction workers? What class of people would you expect to find working on these water systems?

Large numbers of workers were needed not only to build but also to maintain irrigation systems and to operate water-lifting machines. What does this fact tell you about the value of labor? What would happen with a sudden drop in the population, such as that caused by a famine or an epidemic? How would a loss of workers affect the available food supply?

The sources also reveal information about political factors associated with water systems. What does the construction of these systems indicate about the power of rulers to coerce or hire labor? How do rulers control the building and maintenance of machines and ditches? How might their control affect the power and independence of local communities or of individual families? What does this
tell you about the role of water in expanding centralized political power?

Finally, the sources provide evidence of alterations in the law made necessary by the search for water. Previously unrestricted and unregulated actions, now came, under the control of public authorities, which meant that the number of enforcement agents and courts had to increase. What would this do to taxation levels? In what ways would political concerns shape the regulations?

Political issues affect not only the types of laws to be passed, but also the stringency or selectivity with which those laws are enforced. We have very little information about how rigidly law codes were implemented in ancient societies, for few legal documents have survived; law codes were frequently copied and reissued, but the outcome of individual cases was not. It is therefore dangerous to assume that the prescribed penalties were actually levied or that the law was regularly obeyed. (Think for a minute the mistake a person 2,000 years from now would make in describing traffic patterns in twentieth-century America if he or she assumed that the posted speed limit described the actual speed at which traffic moved!). Looking again at the law codes of Hammurabi and Theodosius, would you expect the penalties to be carried out, or do they appear to serve more as a strong warning? How would the penalties differ in their effects on poor and rich people?

You are now ready to answer the question posed at the beginning of the chapter. How did the need for a steady supply of water affect the development of civilization in the West?

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**EPILOGUE**

The irrigation and water supply systems of the ancient world not only required huge amounts of labor, but also made necessary a strong central authority to coerce or hire that labor and to enforce laws to keep the channels flowing. At first, each Mesopotamian city managed its own irrigation system, but the wealthy and advanced cities were attractive targets for foreign conquerors. The political history of ancient Mesopotamia was one of wave after wave of conquerors coming down from the north—the Akkadians, Babylonians, Assyrians, Persians, Greeks, and finally, the Romans. Most of these conquerors realized the importance of irrigation and ordered the conquered residents to maintain or expand their systems. When the Muslims invaded the region in the seventh century, they also learned Mesopotamian techniques and spread these westward into North Africa and Spain, where Roman irrigation systems had in many places fallen apart.

Irrigation could also be overdone, however, and during periods of political centralization many areas were overirrigated, which led to salinization, making the land useless for farming. This, combined with the
rivers of Mesopotamia changing their courses, meant that many cities could not survive. Centuries of irrigation combined with too little fertilization made even land that was not salinized less and less productive.

The benefits and problems produced by irrigation are not limited to the ancient world, however; they can be seen in many modern societies. One of the best modern examples comes from the same part of the world we have been studying in this chapter. Throughout the twentieth century, Egypt expanded its irrigation system watered by the Nile with a series of dams, culminating in the Aswan High Dam; this dam, begun in 1960, was designed to provide hydro-electric power and limit the free flow of water at the height of the flood season. The enormous reservoir formed by the dam can also be tapped at low-water periods to allow for perennial irrigation. The Aswan Dam serves all its intended purposes very well, but it has also created some unexpected problems. The river’s regular flooding had brought new fertile soil to the Nile Valley and carried away the salts that resulted from evaporation. Once the dam stopped the flooding, Egyptian fields needed artificial fertilizers to remain productive, a commodity many farmers could not afford. The soil of the Nile Valley has a high clay content, rendering drainage difficult, and a steady supply of water makes many fields waterlogged and unusable. The large reservoir created by the dam sits in the middle of the Sahara, allowing a tremendous amount of evaporation and significantly decreasing the total flow of water in the Nile; it has also put many acres of farmland under water and forced the relocation of tens of thousands of people. Ending the flooding allowed snails carrying bilharzia or schistosomiasis—an intestinal parasite that makes people very weak—to proliferate in the fields and irrigation ditches. The high water table resulting from the dam is destroying many ancient monuments, such as the temples of Luxor and Karnak, that have survived for millennia. Thus, like the lead pipes that brought water to the Romans, the Aswan High Dam has proved a mixed blessing in modern Egypt.

As you reflect on what you have discovered in this chapter, think about problems associated with the distribution of water in your own region. How does the need for water affect the political and economic structures of your city or state? What technological solutions has your region devised, and how have these worked? Thinking more globally, why might analysts be predicting that by the end of the twenty-first century the distribution of water will be a far greater political and economic issue than the distribution of oil?