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Water Problems of the Southwest

A Mediated Learning Package for use with Junior and Senior High School Students

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WATER PROBLEMS OF THE SOUTHWEST

This mediated learning package is designed for use with junior and senior high school students. The material was developed under a grant from the New Mexico Water Resources Research Institute, and the package was produced at New Mexico State University.

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Upon completion of the work with the learning package, please return it within one week in its original condition in order to enable others to use the materials as scheduled.

Chris Buethe
Project Director

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WATER PROBLEMS OF THE SOUTHWEST

OBJECTIVES

This package is designed to acquaint junior and senior high school students with some of the more serious water problems, particularly those of the Southwest.

CONTENTS OF THE PACKAGE

This package contains a set of 174 color slides to be shown in sequence, and a tape recording to accompany the slides. A copy of the tape script with designated slide changes indicated is included for use in previewing and in properly advancing the sequentially numbered slides. Printed supplementary materials* on water topics are also provided.

The total length of the program is approximately one hour and includes a 15-minute segment of taped student discussion. The material is divided into three subsets for instructional convenience. The teacher may wish to prepare written or oral quizzes, to follow the package with oral discussion, or to amplify the material in other creative ways.

*Teachers may wish to duplicate portions of the supplementary materials for classroom use in reinforcing learning. Also, local, familiar slide scenes may be substituted in order to enhance the meaning of the materials.

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WATER PROBLEMS

A: Water Quality

1. The three major sources of water pollution are:

    (1) domestic sewage;

    (2) industrial waste-water; and

    (3) sediment.

2. Man is the prime creator of water pollution.

3. Water can be polluted by human and animal wastes, vegetation contamination (excessive growth of algae), chemicals, oil wastes, heat, and silt.

4. In crowded residential areas that are not served by a sewer system, pollution from septic tanks can be recycled into local domestic wells.

5. Some water pollutants are concentrated in the food chain; these include certain pesticides, mercury, and some radioactive materials.

6. The natural self-purification system of some rivers and streams is being taxed far beyond its capacity; the results are depletion of oxygen in the stream, odors, discoloration, the excessive growth of slimes, and the manifestation of other forms of pollution.

7. Water that LOOKS clean and clear may not necessarily be free from contamination and may not be useable for a particular purpose. The physical appearance cannot be used as an absolute test of the purity of the water.

B: Water Quantity

1. In the Southwest the annual precipitation varies markedly from year to year, resulting in years of above average precipitation followed by more years of below average rainfall.

2. Because of the variable nature of precipitation supplied to states like New Mexico, surface water must often be stored in reservoirs for more than one year before use.

POSSIBLE SOLUTIONS TO WATER PROBLEMS

Technological research has helped resolve SOME water problems, but technology has not been able to solve ALL problems. Each individual must recognize that he shares the responsibility for protecting our water resources by helping to eliminate and reduce water pollution and waste.

A: Current Possible Solutions

1. Appropriate, enforced laws.

2. Close supervision of housing developments and trailer parks that use septic tanks can prevent ground water pollution.

3. Dams can be built to regulate the flow of rivers and streams. Water can be held in storage reservoirs for flood control purposes, irrigation, municipal and industrial water supply, hydro-electric power generation, recreational use, and navigational purposes.

4. Properly treated waste-waters can be used again for irrigation of golf courses, for some recreational purposes, and for domestic use if absolutely necessary. A few cities have recycled forty to fifty percent of their water supply during period of drought.

5. Better designed, lined, and maintained irrigation ditches can prevent excessive seepage losses.

6. Better irrigation methods, such as sprinkle and trickle irrigation, would conserve water.

7. Improvement of the lay-out of fields and the avoidance of over-irrigation would conserve water.

8. Water loss and erosion due to over-grazing of arid lands can be prevented by proper plant coverage.

B: Future Possible Solutions

1. Desalinization plants are a prospective means of using saline ground waters and sea water, but the processing is expensive. Additional research on improved technique will take time.

2. Cloud seeding has NOT proven to be sufficiently successful as a means of increasing the water supply of the Southwest because it is undependable and unpredictable.

- BE A PART OF THE SOLUTION -

WHAT THE INDIVIDUAL CAN DO TO PROTECT OUR WATER RESOURCES

A: To Avoid Waste

1. Run dishwashers only when full.
2. Wash only full loads of laundry.
3. Keep drinking water in the refrigerator instead of running the faucet until the water is cold.
4. Don't leave the water running when brushing your teeth, shaving, or when washing your face and hands.
5. Take quick showers instead of tub baths.
6. Fix leaky faucets: a dripping faucet can lose up to 15 gallons of water per day.
7. Keep all outside faucets completely closed when not in use.
8. Avoid unnecessary runoff of water when washing your car and watering your lawn.

B: To Avoid Pollution

1. Measure accurately soaps, detergents, bleaches, and other laundry aids.
2. Avoid throwing cigarette filters into toilets: they cause problems at sewage plants.
3. Pull or hoe weeds by hand rather than use herbicides.
4. Use poisonous chemicals only as advised by qualified experts.

For more information on water laws and water quality protection, contact the New Mexico State Engineer Office and the Environmental Improvement Agency in Santa Fe. (Most states have comparable information agencies.)

- BE A PART OF THE SOLUTION -

SUMMARY OF WATER-RELATED INFORMATION TO AUGMENT TAPE AND SLIDES

I - Water's Role in the Human Body

1. The three most important requirements to keep man alive are water, air, and food.

2. Water composes over 2/3 of the body weight.

3. Adult muscle is from 80% to 90% water.

II - The Water Cycle

Water changes its form and its geographic location as it proceeds through the hydrologic cycle. The energy to move water through this cycle comes from the sun. The process involved includes:

1. Cloud formation.

2. Precipitation.

3. a) Seepage of precipitation into the ground and temporary storage prior to its natural or artificial (pumped) discharge.

   b) Runoff.

   c) Evaporation.

4. Uptake in plant life (transpiration) and animal life.

5. Return of water vapor to the atmosphere.

III - Water Purity and Supply

A: General

1. Almost three-fourths of the earth is covered with water.

2. Ninety percent of the earth's water is too salty or saline to be useable, and two percent is frozen in glaciers and ice caps at the poles.

3. Less than one percent of all the earth's water is fresh enough for use.

4. Fresh water is potable or drinking water that contains very little dissolved salt.

5. All water has some dissolved minerals in it.

6. Rainwater is not "pure" because raindrops build on particles of dust or salt in the air.

7. Fresh water is not to be found in sufficient useable amounts anywhere one may choose to drill a well.

B: In the Arid Southwest

1. Ground water is the main source for industrial and municipal water use in New Mexico.

2. Our ground water supplies are recharged from precipitation that seeps into soils and percolates into the ground.

3. Relatively little NEW water is added each year to the Southwestern ground water supplies.

4. The water table is lowering in many areas of the Southwest.

IV - Water Use

A: General

1. As the standard of living in an area goes up, the quantity of water required for municipal and industrial purposes increases.

2. As the population increases, the value of every gallon of water increases because of an increase in demand for a fixed quantity of water available.

3. North Americans are removing water from our ground water reservoirs at a rate that is approximately twice as fast as the hydrologic cycle can replace it.

B: In the Arid Southwest

1. Because there is not enough water to meet all demands in New Mexico, the right to use the available water is legally assigned to those who were using it first.

2. Of the 25 most popular recreational activities in New Mexico, eight require water.

3. The use of water to produce electricity is not generally a practical method because of the limited water supply available.

V - Agricultural Useage of Water

A: General

1. Most crops require AT LEAST 20 inches of water per year.

2. The type of crop determines the amount of water required for successful growth in a given location.

3. Almost one-half of the water in the United States is used for irrigation purposes: over one-fourth of this is lost in its transportation before it reaches its target crops.

4. Most irrigation in the United States takes place in desert and semi-desert areas.

B: In the Arid Southwest

1. About one half of the water for irrigation in New Mexico comes from surface water: the other half comes from ground water supplies.

2. The irrigation water is carried in ditches. Poorly designed irrigation ditches and lack of maintenance on properly designed ditches often result in excessive seepage losses.

GLOSSARY OF WATER TERMS

ACRE-FOOT: The volume of water required to cover one acre of land with one foot of water, or 43,560 cubic feet.

ADVANCED WASTE TREATMENT: See *TREATMENT*.

AQUIFER: A geologic formation which contains water and has the ability to transmit it from one point to another in quantity to permit economic development.

ARID: Dry from lack of precipitation.

BACTERIA: Primitive plants, generally free of pigment, which reproduce by dividing in one, two, or three planes. They occur as single cells, groups, chains, or filaments, and do not require light for their life processes. They may be grown by special culturing out of their native habitat.

BENEFICIAL USE OF WATER: The use of water for any purpose from which benefits are derived, such as domestic, irrigation, or industrial supply, power development, or recreation.

BIOCHEMICAL OXYGEN DEMAND (B.O.D.): The quantity of oxygen utilized primarily in the biochemical oxidation of organic matter in a specified time and at a specified temperature. The time is usually five days and the temperature is usually 20°C.

BRACKISH WATER: Water containing dissolved minerals in excess of acceptable normal municipal, domestic, and irrigation standards, but less than the levels of sea water.

CESSPOOL: An underground pit into which raw household sewage or other untreated liquid waste is discharged and from which the liquid seeps into the surrounding soil or is otherwise removed. Also called Leaching Cesspool.

CHLORINATION: The application of chlorine to water, sewage, or industrial wastes, generally for the purpose of disinfection, but frequently for accomplishing other biological or chemical results.

CLOSED BASIN: A basin closed with respect to surface flow when its topography prevents the occurrence of visible outflow. It is closed hydrologically if neither surface nor underground outflow can occur.

CLOUD SEEDING: The process of attempting to induce rain by injecting clouds with silver iodide or dry ice.

CONCENTRATION: The quantity of dissolved materials in a unit volume or weight of water. Concentration is expressed in milligrams per liter, parts per million, equivalents per million, specific electrical conductance in micromohs per cm, and tons per acre-foot.

CONFINED AQUIFER: An aquifer which is bounded above and below by formations of impermeable or relatively impermeable material.

CONSUMPTIVE USE OF WATER: The sum of the quantity of water used by vegetative growth in transpiration or building of plant tissue and the quantity evaporated from adjacent soil or plant surfaces in a given specified time. Also referred to as Evapotranspiration.

DEEP PERCOLATION: In geology, the percolation downward of water by leakage through the geologic formation.

In hydrology, the percolation downward of water past the lower limits of the root zone.

DEGRADABLE: Capable of being decomposed, deteriorated, or decayed into simpler forms with characteristics different from the original. Also referred to as Biodegradable.

DEPLETION (GROUND-WATER): The withdrawal of water from a ground-water source at a rate greater than its rate of replenishment, usually over a period of several years.

DESALINIZATION: The process of removing salt from saline waters to make them more useable.

DISINFECTION: The killing of most (but not necessarily all) of the harmful and infectious microorganisms in or on a medium by means of chemicals, heat, ultraviolet light, etc.

DISSOLVED OXYGEN: The amount of free (not chemically combined) oxygen in water. Usually expressed in milligrams per liter.

DISTILLATION: The process of evaporating water and condensing it for the purpose of removing undesirable salts.

EFFLUENT:
(1) A liquid which flows out of a containing space.
(2) Sewage, water, or other liquid, partially or completely treated or in its natural state, flowing from any part of a reservoir, basin, or treatment plant.

EUTROPHICATION: The process of overfertilization of a body of water by nutrients which produces more organic matter than the self-purification process can overcome.

EVAPORATION: The natural process by which water is changed from a liquid to a gas or vapor state.

FILTRATION: The process of passing a liquid through a filtering medium (which may consist of granular material such as sand, magnetite, or diatomaceous earth, finely woven cloth, unglazed porcelain, or specially prepared paper) for the removal of suspended or colloidal matter, usually of a type that cannot be removed by sedimentation.

FLOOD: An unusually large flow of water covering land not normally covered by water.

FLOOD PLAIN: Land bordering a stream and which receives overbank flow.

GROUND WATER: Water beneath the earth's surface accumulating as a result of infiltration and deep percolation.

GROUND WATER BASIN: A ground water reservoir together with all the overlying land surface and the underlying aquifers that contribute water to the reservoir. (In some cases, the boundaries of successively deeper aquifers may differ in a way that creates difficulty in defining the limits of the basin.)

GROUND WATER RESERVOIR: An aquifer or aquifer system in which ground water is stored. The water may be placed in the aquifer by natural or artificial means.

HYDRO-ELECTRIC POWER: The electricity generated by the energy of falling water.

HYDROLOGIC CYCLE: See *WATER CYCLE*.

HYDROLOGY: The study of water in the air, on the surface of the earth, and underground.

INFILTRATION: The process whereby water passes through an interface, such as from air to soil or between two soil horizons.

IRRIGATION: Supplying land with water by ditches or artificial channels. Four types of irrigation are

TRICKLE: slow movement of water by pipes or hoses to specific locations or plants in a field.

SUBSURFACE: gravity flow through top soil layers in the down-slope direction.

SPRINKLE: use of sprinklers to disperse water in a field.

FLOOD: complete covering of a field with water; submersion.

NAVIGATION: Directing water along a course to a desired location.

PERCHED GROUND WATER: Ground water supported by a zone of material of low permeability and located above an underlying main body of ground water with which it is not hydrostatically connected.

PERCOLATION: The movement of water within a porous medium such as soil.

PESTICIDES: Chemical compounds used for the control of undesirable plants, animals, or insects. The term includes insecticides, weed killers, rodent poisons, nematode poisons, fungicides, and growth regulators.

POLLUTANTS: Substances that may become dissolved, suspended, absorbed, or otherwise contained in water and that impair its usefulness.

POLLUTION: The presence of any substance (organic, inorganic, biological, thermal, or radiological) in water at intensity levels which tend to impair, degrade, or adversely affect its quality or usefulness for a specific purpose.

POTABLE: Suitable for drinking.

PRECIPITATION: Moisture from the atmosphere in the form of rain, sleet, snow, hail, or dew.

RECYCLE: The process of making water reuseable.

RESERVOIR: A basin for collecting a supply of water.

RETURN FLOW: That part of a diverted stream flow which is not consumptively used and which returns to a source of supply (surface or underground).

SALINE WATER: Water containing dissolved salts. See also *BRACKISH WATER.*

SEDIMENT: Mineral material deposited or transported by water.

SEDIMENTATION: The process of subsidence and deposition by gravity of suspended matter carried by water, sewage, or other liquids. It is usually accomplished by reducing the velocity of the liquid below the point where it can transport the suspended material. Also called Settling.

SEWAGE: Largely the water supply of an Installation after it has been fouled by various uses. (From the standpoint of source it may be a combination of the liquid or water-carried wastes from residences, buildings, and industrial establishments, together with such ground water, surface water, and storm water as may be present.)

SEWER: A pipe or conduit, generally closed, but normally not flowing full, for carrying sewage and other waste liquids.

SOLVENT: Having the capability to dissolve other substances.

SURFACE WATER: Water above ground which can be seen.

TREATMENT: *BIOLOGICAL:* Forms of sewage treatment in which bacterial or biochemical action is intensified to stabilize, oxidize, and nitrify the unstable organic matter present. Examples are: intermittent sand filters, contact beds, trickling filters, and activated sludge process.

SECONDARY: The treatment of sewage by biological methods after primary treatment by sedimentation.

ADVANCED WASTE TREATMENT: The additional treatment of sewage beyond that of secondary treatment in order to obtain a very high quality of effluent. Usually includes nutrient removal.

WATER CYCLE: The movement of water from the atmosphere to the earth and back to the atmosphere through various stages or processes including cloud formation, precipitation, interception, runoff, infiltration, percolation, storage, evaporation, and transpiration.

WATER TABLE: The top level of saturation where water is found in the ground.

WATER

Lazy, rushing

flowing, glistening, sparkling

clear, cold----black, a mess

destroying, hurting, killing

polluted, destroyed

POLLUTION

Sandie Ochoa
Zia JHS
Grade 8

POLLUTION

Where has all the water gone
Long time passing
Where has all the water gone
Long time ago
Where has all the water gone
Gone to the industries everywhere
When will they ever learn
When will they ever learn

Where have all the industries gone
Long time passing
Where have all the industries gone
Long time ago
Where have all the industries gone
Gone to people everywhere
When will they ever learn
When will they ever learn

Where have all the people gone
Long time passing
Where have all the people gone
Long time ago
Where have all the people gone
Gone to pollution everywhere
When will they ever learn
When will they ever learn

Where has all the pollution gone
Long time passing
Where has all the pollution gone
Long time ago
Where has all the pollution gone
Gone to the water everywhere
When will they ever learn
When will they ever learn

Diana Rogers
Zia JHS
Grade 9

WATER

(1)* This learning package was produced for secondary school use through the New Mexico Water Resources Research Institute. (2) Funds were supplied in part by a grant from the U. S. Department of the Interior, under P.L. 88-379. The project director was Dr. Chris Buethe, Associate Professor of Education at New Mexico State University.

(3) Do You know what a closed system is? It is really very much like a spaceship. If you were going (4) to the moon, like our Apollo astronauts, you would soon realize that <u>anything</u> you might need in order to live would have to be <u>on</u> (5) the spaceship. You wouldn't be able to stop along the way to pick up the things you forgot. (6) Well, the Earth is a lot like a spaceship. It is a closed system, too. (7) Whatever we need in order to live is here--and now. And if we run out of <u>anything</u>, there is nowhere we can go to pick it up--at least not yet! (8)

For example, nothing can live without water. We know that. (9) So if we should run out of water, what on Earth (10) would we do? We would <u>die</u>, that's what; and so would (11) other living things.

We are all very much (12) aware that water is being polluted and, furthermore, it is being (13) extravagantly wasted by almost all of us. Unfortunately, too many people are not fully aware of the seriousness of (14) this problem, or they don't really care; or if they are aware and do care, they don't know what to do about it.

(15) Now, let's talk about some ways of <u>wasting</u> water. Do <u>you</u> (16) ever waste water? Of course you do. (17) Everyone does. Now you may be thinking: "Well I'm only one person, how much difference can (18) I make?" But just think about it. If every person in the United States wastes water--and we (19) all do--it adds up to quite a bit of total wasted water.

(20) How much water do you think each person in the United States uses each day? Not just by himself at home but (21) including <u>all</u> the water used by (22) industries, farms and ranches, recreation, (23) and everything. How much water per person per day do you think it might add up to? Go ahead and make a guess, I'll wait; and write it down s mewhere where you can see it, and see how close you came.

Got it? Well the actual (24) figure is about 1,500 to 2,000 gallons per person per day. If you even came <u>close</u>, you're remarkable. Most people have no idea how much water it takes just to keep (25) things going. Even if you think about the amount of water you <u>alone</u> use around your home--forgetting about industry, agriculture, and (26) recreational uses--you use about 150 gallons per day! Can you believe that? Just think of the size of a quart of milk. Well, 150 gallons would be 600 times that much! And that's how much water we use per person each day on (27) the

* *The numbers throughout the text indicate the point in the script at which the appropriate slide should be advanced into viewing position.*

average. Summer demands for lawns and cooling can increase home water-use to 300 gallons per day.

(28)

Have you ever lain awake at night, wishing you could fall asleep, and listened to the maddening sound of water dripping from a leaky faucet? Well if you have, then you know why this person screamed. But a dripping faucet causes more problems than loss of sleep. (29) Just one drop per second from that one leaky faucet, constantly dripping for one year, would add up to around 400 gallons. Now, when you go home, count up all your leaky faucets. You can see that one of the best ways to save water in your home would be to fix the leaky faucets.

Right now, see if you can jot down some other ways to save water at home. I'll wait and give you some time. Are you ready? Now listen to some other ways suggested, and see if yours are among them. (30) Don't bathe every day; try it every other day (31) When you do bathe, don't fill up the tub; five to six inches of water is plenty. (32) Showers can use a lot of water. If you must shower, at least turn off the faucet while you're soaping yourself. (33) When you wash your clothes, make sure that you have a full load for your washer. (34) Consider using the wash water for two loads before you start the rinse cycle. (35) Don't run the water for a drink until its cold: keep a bottle of water in the refrigerator. (36) Don't let the water run out of the faucet (37) while you brush your teeth; (38) remember to turn it off. Don't (39) rinse your dishes one at a time under a stream of running water; (40) fill a container with hot water and dip the dishes into it. (41) Don't wash you car for hours with a running hose. (42) When you water your lawn or garden, remind yourself to do it after the sun goes down in order to cut down on the amount of evaporation.

(43) "What are we talking about all these picky little things for? PICKY, PICKY, PICKY! As far as I'm concerned, I think that pollution is a lot worse than the things you guys have been talking about, and every-body (44) knows that industry's doing that. Let them worry about it. It's not me that's doing it. I'm not involved!"

But she is involved. These suggestions may not save a lot of water all at once, but if each of us follows good habits, we will save a lot of water over a lifetime. Besides, in the future it may even be more impor-tant to save water than it (45) is today.

It is true that industry is sometimes a polluter and a waster of water. Sometimes it's easier and cheaper to pollute than to stop. But there are some industries in New Mexico that recycle their water as many as 20 times! (46)

Now, if we were a less developed country than we are, a country with-out industry, it would be a much simpler problem to solve. A less developed country would not have as many pollution-causing industries to put up with, nor would its people (47) know the luxuries that we grown used to.

Imagine yourself (48) having to live without electricity! What does electricity have to do with water or water pollution? (49) Well, to begin with, electrical plants use lots of water. In some parts of the United States, water is temporarily used along rivers to run the generators that produce (50) electricity. These are called hydro-electric plants. (51) But here in the dry Southwest, we don't have enough water to do much of that. (52) Instead, we burn fuels such as oil and coal and natural gas to run our (53) generators. Even so, large amounts of water are still necessary to produce electricity because these fuels are burned to heat water to produce steam, which in turn is used to turn generators to produce electricity. Water is used to cool the steam (54) for reuse. Not only is water used up, but some of it is polluted as well.

(55) All of these things add up to a sticky problem to which there is no easy answer. We could just say: "Get rid of the factories!" But you probably agree that we (56) need them. And besides, most factories are not "bad guys." Many factories, at their own expense, are right this minute working at solutions to solve their (57) own pollution problems. But this is expensive, and not all companies are financially able to solve all their problems right (58) now. It will take lots of time and money to solve the problems--money to pay for the research to find the answers; money to pay the men who do the research and run the systems to purify the air and water. MONEY! MONEY! MONEY! (59)

We could insist that the factories clean up their own pollution themselves. This, of course, would be terribly, terribly expensive. It could result in their shutting down. To help share the expense, some people have suggested lower taxes for companies that try to correct their own pollution mistakes. We could tax products a lot that wear out quickly (60) and have no tax on things that last a long time. Other possible solutions have been suggested.

We could close down all the factories completely. Some people think that we should. However, if we do this, we would all have to be prepared (61) to change our styles of living completely. You wouldn't be able to have electric light, of (62) course. And that car you're dreaming of having one day--it would have to go, too. And not only would we have to give up many things we have become used to, but we would have the added problem of finding jobs for all the people who had worked in the factories. (63) Well, maybe some of them could become camel herders! Can't you just picture yourself eating a great big juicy camelburger? Ha Ha! Well, if you're wondering where camels (64) come in, it's that camels are among the ideal animals to raise here in our Southwest because they don't require (65) much water. Beef cattle, which we raise because we like to eat beef, indirectly require great amounts of water. Farm and ranch production use most of the water in states like New (66) Mexico. The problem really looks bad, doesn't it? But don't give up!

Part II

(67) Let's look at the brighter side of water problems because there is a brighter side. But first, it is important to know and understand some of the water-related terms that we have used and will use again. The water cycle is the movement of water from the earth to the atmosphere and

back again. It includes cloud formation, precipitation, run-off, and evaporation. (68).

Do you know what is meant by ground water? Can we make ground water by mixing ground and some water? Well actually, ground water is water that moves beneath the surface of the ground in rock or sand and gravel, or it is water that is trapped between soil and rock particles. When we drill a well, we hope to find ground water (69) that may be pumped to the surface for use (70)

What is a water table? Is it like a water bed? Can we see a water table? How do we know where a water table is and how high it is? (71) A water table is the top level at which ground water is found. If the water table is (72) high, water may come to the surface as a spring or lake. (73) Once water is above the ground it is called surface water. A lake, spring, or river is called surface water. (74) Reverse

Did you know that the water level in wells of the Southwest is falling? This is called a declining water table. Do you think that this is important? Think of three wells, all drilled to different depths. When the water table drops, what will happen to the well that is shallowest? The deepest well may not be affected, but the other wells may become dry as the water table drops. (75) Even if none of the wells go dry, water must be pumped from a greater depth, and that takes more money and more energy. An example of a dropping water table may be found in the Pecos River Basin near Roswell, New Mexico, where the use of water exceeded the recharge of water by over 40 percent in 1967. The situation may be a little better today, but the use of ground water in the basin still exceeds the annual inflow of water back into the ground, so the net result is a dropping water table. What can be done about the declining water table? (76) Perhaps less land could be farmed and less water used as a result. (77) Since it often costs less in dollars and in water to farm (78) where rainfall exceeds 20 inches per year, perhaps the irrigation of the drier lands should be reduced in order to support farming (79) that already has almost--but not quite--enough (80) water.

(Change carousel)

(81) Another example of a declining water table is found in the Carlsbad Caverns. The caves are drying up because of man's interference. The elevators that take people to and from the caverns take with them not only people, but also moist cave (82) air. The air in a cave is very moist compared with the very dry air outside the cave. As the cave air becomes drier, parts of the cave structure become weaker and may break or fall some day. (83) Is anything being done about that problem? Well, you bet! Water is carried or pumped down into the caverns and the surface water within the cave is partially restored. (84) Also, air-tight doors are being put on the elevators. This is a very small problem area, but the interest to solve the problem is great--great enough to do something about it. (85) The bright side of the story is that young people care and are involved in the solution to the problem. (86) When people care, they will learn what needs to be done, and they will do it. (87)

Is water in a ditch drinking water? Could it be used for that purpose? Why would you not want to drink the water that is used to irrigate fields? Too salty? Too many chemicals? Too muddy? Why? (88) Water that can be used by crops may not be used by man in the same way. The food that plants need is not the same as food that people need. (89) But man can again use water after plants have used it. Water can have many lives and may be used by crops, man, and (90) industry. Water is recycled by nature, and man should help to recycle the water he uses if he is to get maximum use out of it. (91) Consider the good practices of an electrical plant that has its own lake. The lake is man-made just for the plant. Instead of using new or fresh water, the power company keeps using the water over and over. The company pumps water into the lake to replace the water that evaporates, and when the company is ready to use it, it is there for use. The water is used industrially many (92) times, and people can also use the lake for recreation.

Multiple uses of recycled water. That's a big idea; that's what we're talking about. And that means we have to establish priorities for our water uses. Of course, the most important need for water is in the small amount we have for our bodies each day. We can use water for non-polluting industries and recreation after we have provided enough for (93) our homes. Recreational water is less important than water for our bodies and homes, but we do like to swim or ski or boat or fish, don't we? Can you think of a plan that makes a given supply of water useable in at least four different ways? *(seven second pause)* (94) Did you include irrigation, the main use of water in the Southwest?

All this irrigation water--well, where does it come from? Remember that there are two main sources of water (95) in the State: ground water, from the (96) wells, and surface water, from lakes and rivers (97) like the Rio Grande. Would you say that the Rio Grande is an important water (98) source in the Southwest? In New Mexico about half the water used comes from ground water and the other half from surface water. (99)

How does the water get from surfaces (like Caballo Lake) to the field, or from the ground (for example, from wells) to the crops? Is there a best way to get irrigation water from place to place? (100) Pipes? (101) Open cement ditches? (102) Open dirt ditches? Which one of these is best? What would be the reason (103) to use something other than the best? That's (104) right...Money! Money is an important reason that we see so many dirt ditches; it costs (105) a lot to line a ditch or to have pipes put in to move water. Are leaks in ditches or pipes the only way that water is lost? No. (106) Evaporation from reservoir surfaces and from rivers is another way that water in the Southwest is lost. When it's very hot and the air (107) is very dry, it is very easy for water to evaporate. (108)

Sometimes too much water is used when watering a field. When this happens, (109) the flooded field should be drained. Do you think this is wasting water? Do you think that the water that is drained from a field is as clean as it was when it went onto the field? Do you think that some chemical fertilizers (110) might have gotten into the water that was intended for the crops? Where does the water (111) that fills lakes and rivers come from? (112) The areas in which rivers and water sources start are called the headwaters of drainage basins or (113) watersheds. Usually, rain falls or snow melts, forming little streams (114) that come together along a watershed to form rivers, and rivers (115) come together to form larger rivers. When a river is damned up, a man-made lake is (116) formed. Springs may be seen along a watershed. They are evidence of ground water seeking its own level as the Earth's gravity pulls it.

Are there other sources from which you might get water? One important idea (117) might be desalting saline water. Saline water is salty water. Near Roswell, New Mexico, there (118) is a desalting plant that has the capacity to make a million gallons of fresh water each day. This process, so far, is very costly, and is only in the experimental stages. If you could economically desalt saline water, think of the vast amounts of water you could have from the seas.

What are some of the most important water problems of the (119) Southwest? Listen to some students talk about the problems as soon as you have taken time to write a list of New Mexico's water problems as you see them. Turn off the tape recorder until you have your list ready. *(Stop. Pause a few minutes, then restart the tape.)*

(120)

(121)

(Slides 120 through 123 to be shown during this seven minute student discussion portion of the tape.)

(122)

(123)

Remember, there are many important terms to know when you are dealing with water problems. Do you know them? Did you agree with the students and their discussion?

Your teacher may now wish to give you a short test over some of the materials you have covered. Try to do your best.

Part III

(124) We have been talking a lot about how industry causes pollution. Perhaps we'd better admit to ourselves that a great deal of pollution (125) is caused by ordinary people like you and me. (126) Every time you add soap--not detergent, mind you, but soap--to hard water, you change the chemicals in that water into particles that will not dissolve. Using detergent is really no better because detergent itself is a pollutant. Water softeners, we have learned, may be equally as bad. (127)

Have you ever turned on the faucet to get a glassful of drinking water and come away with foam on the top? If you have, that may be evidence that there's some detergent in your water! Some U.S. cities have experienced this for short periods of time. (128) You know that scum--no, not your kid brother, now--that gray, mucky stuff that makes a ring in the bathtub? That's pollution...thanks to soap and chemicals mating. And what are you doing about it?

Nothing! And it's no joke. There we go again, (129) misusing water in every step of our daily lives, and we can't afford to say: "So what?"

Another disgusting way that we, the people, are polluting our precious water is by poor planning in the placement of our water supplies too close to septic tanks. You see, if you dig a well too close to a septic tank or its drainfield, you may be getting your drinking water out of the same soil that the dirty sewage has seeped into. And just to make sure that you're clear on this, septic tanks hold human wastes! Now, if you don't happen to have your own septic tank, then (130) you're probably part of the public sewage system. Some sewage treatment plants (131) are pouring wastes into streams and rivers--our Rio Grande for one--(132) and people swim there! And they wash their knives and forks in that water after a picnic. Doesn't that make you sick? Doesn't it make you want to do something?

(133) We must do something because water is scarce here in the Southwest. Oh, I know (134) we've all seen the Rio Grande and the other rivers swollen with water in the Spring, but we have also (135) seen them in the Fall--dry as a bone. Well, on a less dramatic basis--at least to the sight--the same thing is happening to all the water here in the Southwest. This may surprise you, but we just don't have as much useable water here as we had 10 (136) years ago. One reason is that many people, city dwellers and farmers for example, have taken out much more water from the ground water system than nature has been able to put back. (137) We are literally mining water from some of our ground water systems in New Mexico, often taking out more water than is returned. You may want (138) to check to see if New Mexico's water laws are appropriate or if they are being enforced. If you want answers (139) to questions about water laws, contact the office of your State Engineer at the State Capitol. You can see that the overuse of water in the past by thoughtless people may cause a real water shortage for us in the future.

(140) *(Thunderclap)* Do you hear that? Not very often, I'm afraid. And the lack of rain here in the Southwest magnifies the water shortage problem that we've been talking about. (141) You see, rain and other forms of precipitation are our only sources of new water. (142) Since we have very little rain or snow here, much of our ground water is old: some has been stored in the ground thousands of years.

(143) To improve this water shortage situation, some people have suggested seeding clouds with dry ice or other chemicals to make the clouds rain. (144) Experts, however, tell us that this isn't a very practical idea, at least not here. And you don't have to be much of an expert yourself to see why. (145) How often do you see rain clouds around here? (146) Why not pipe in water from those areas that have too much water? Well, for one thing it's a very expensive method, (147) especially if you realize that arid--extra dry--soil, such as we have around here, is very thirsty soil and (148) it would swallow up much of this borrowed water before it could even be put to use. Also, think of the great amount of energy it would take just to lift water from, say, the wet Mississippi Delta to Albuquerque, a mile higher. (149) So it would probably be more sensible to pipe the water to areas with less thirsty soil and less thirsty air, where better use might be made of it.

So what's the answer? Well, let's face it. We know that we have only a limited amount of water, and we are not likely to get any more. (150) So it's obvious isn't it? We have to figure out a way to make the most efficient use of the water that we (151) have. Think back to the discussion that you heard earlier with the young people offering solutions to our water problems. (152) They mentioned recycling water. Recycled water, properly treated, can be used for recreation and industry and farming, and with further treatment can even be put back into our homes. In fact, some cities in our nation use as much as 40 to 50 percent of their recycled water. Perhaps you're aware of the fact (153) that the Apollo astronauts use their own recycled liquid wastes for drinking (154) water. Don't be horrified. Of course, it is perfectly good because it has been meticulously cleaned and purified: Recycled! In fact, it's probably cleaner than the water you drink! So, by recycling water, the total amount of water needed can be greatly reduced. And this is what we're trying to get at--making better use (155) of the short supply of water we have. And remember, only one percent of the Earth's water is useable.

(Change carousel)

(156) Do you want to know about another villain who robs us of our precious water? It is sediment. Do you know what that is? (157) Well, this is what it looks like. (158) The stuff causes a lot of trouble. Sediment is a solid (159) made up mostly of silt and sand; it especially builds up in places where water (160) is caught and trapped with no easy outlet. A reservoir (161) like Elephant Butte, New Mexico, for example, would soon fill up with sediment if something were not done to prevent it. The same sort of thing can happen anywhere water (162) is trapped: hot water tanks, for example.

How do we work ourselves out of this (163) problem? Ground cover, or plants, helps. Plants and their roots hold the (164) soil, helping to keep it from washing away into water sources such as rivers. But do you see a vicious circle in this? Plants help prevent sediment from forming, (165) reduce flash-flooding, and help with other water systems. (166) But we don't have many plants here in the Southwest. And why don't we? Because plants need water, and we don't have enough water. And why don't we have enough water? Well, by now you should know the answer to that. (167)

Isn't there any way out of the sediment predicament, (168) then? Flood control dams, spaced closely enough together, might be an answer. As the water flows down the stream or river, it is caught at each consecutive dam, and there the sediment is trapped, where it remains. This allows the water to continue flowing, (169) each time cleaner than at the previous dam. Without such controls the water in a river (170) gets increasingly dirtier as it travels.

Boy! Aren't water problems complicated? They sure are. (171) Water problems are economic, (172) technological, (173) and social. But they must be solved. (174) Will you do your part?