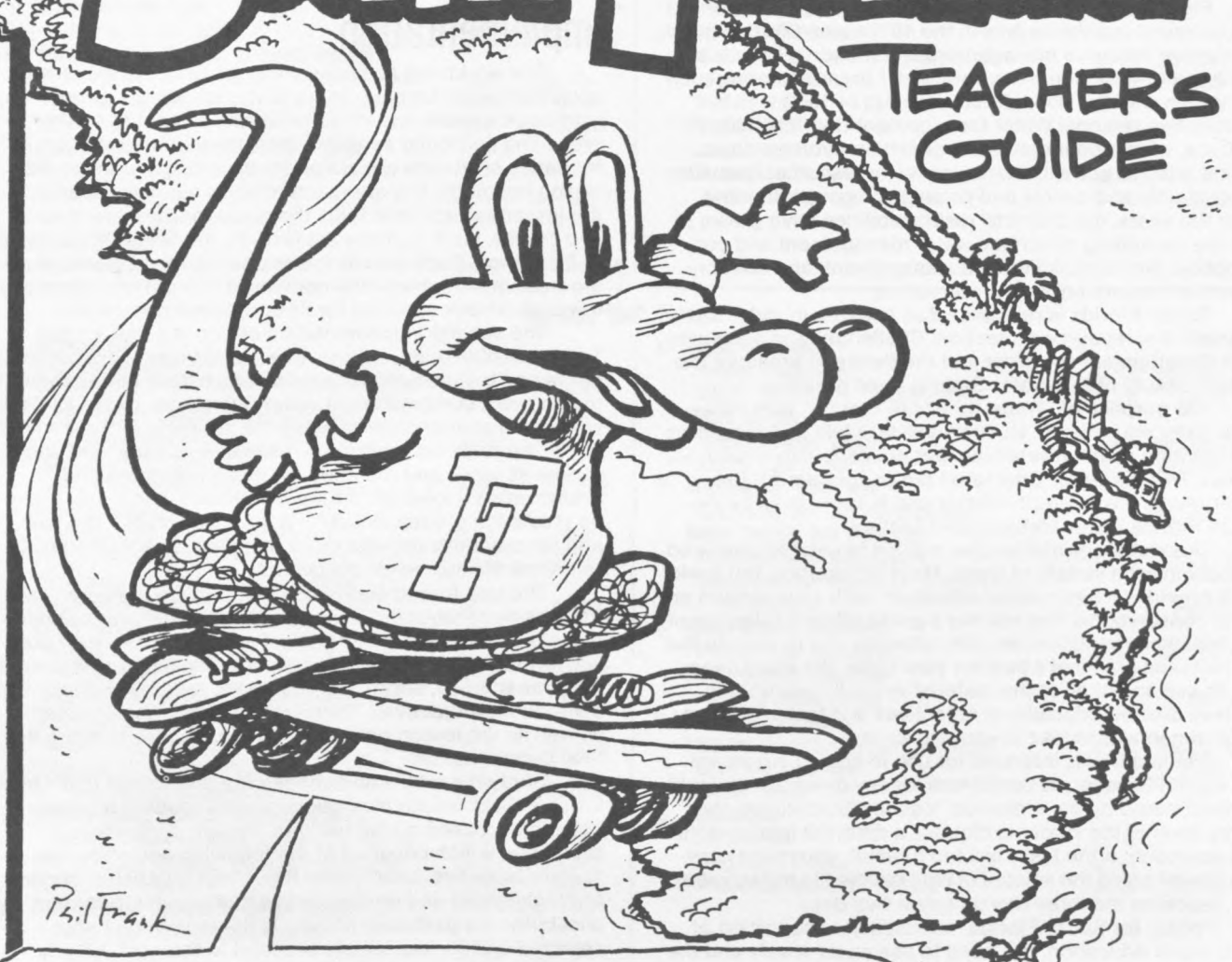
Middle School (6th)

Water for South Florida

TEACHER'S GUIDE



Freddy the Alligator, here... Protector of the Everglades and a very rad reptile. You know how sometimes we get wet weather to the max, and other times super dry spells? Well, that's why one of my main jobs is making sure we have enough water... and not just for the gang in the swamps, either. Homes, businesses and agriculture are all using more water than ever... Florida's growing for real.

So what? Let me show you. Grab a skateboard and let's jam.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Introduction

Florida is called the Sunshine State, but it could just as easily be nicknamed the Water State. Florida is blessed with a bountiful supply of freshwater: an average annual rainfall of 55 inches; countless rivers, lakes, wetlands and springs; and a vast underground system of aquifers.

But despite this seeming abundance, Florida's unpredictable climate results in an uneven distribution of its vital water resources. Seasonable weather patterns can bring periods of prolonged drought or torrential downpours. In addition, rapid population growth and economic expansion jeopardize the integrity and availability of freshwater. Increased consumption leads to saltwater intrusion and contamination of wellfields. Pollution from agricultural and urban runoff and toxic wastes severely threatens the quality of our water supply.

Florida's concern for protecting its water resources led to a series of legislative acts in the 1970s and '80s designed to improve resource management and preserve Florida's highly water-dependent environment. Foremost among such legislation was the Water Resources Act of 1972 which created five regional Water Management Districts. The Districts, whose boundaries are drawn on hydrogeologic basins, are charged with managing water resources to ensure water quality and supply and protection against flooding. Over the years, the Districts' responsibilities have grown to include permitting of surface water management and consumption, land acquisition and management, and environmental enhancement and preservation.

Today, Florida is recognized as a leader in water management and resource protection. Challenges and pressures from development are great, but the desire to preserve the natural beauty of this Water State is even greater.

The purpose of "Water for South Florida" is to introduce water education to students and facilitate understanding and learning in an entertaining, but educationally sound, format. This endeavor originated out of concern for the water resources of South Florida and is sponsored by the South Florida Water Management District.

This workbook and teacher's guide have been designed to accomplish a variety of goals. Most importantly, the workbook provides a basic water education, with an emphasis on water conservation. The teacher's guide offers a selection of flexible implementation formats, allowing you to choose the instructional plan that's best for your class. We encourage you to use any or all of the material in your classroom to achieve desired educational objectives and foster positive environmental attitudes in your students.

The material is intended for use in grades six, seven and eight. However, its usefulness for any given class should be determined by the individual teacher. Sometimes, the ability level of the students dictates a different implementation approach. If the tasks are too difficult, you might consider lengthening the amount of time devoted to the activities, e.g., teaching the three day unit over five days.

"Water for South Florida" stresses the acquisition of basic water education, the need to use water wisely and the importance of protecting our water resources. Beginning with the building of water awareness and appreciation, the material emphasizes cognitive objectives, showing the students **how** they can save and protect water. In addition, they learn **why** they should be concerned about water problems. Identifying, evaluating and selecting appropriate solutions for water problems all serve ultimately to validate the success of the program.

To help you use these materials most effectively, the Lesson Notes provide answers to workbook activities, coded curricular concepts based on the Department of Education's "Uniform Student Performance Standards," and step-by-step procedures for conducting the lessons. Often, additional suggestions are offered which add to the flexibility of the material and underscore the open-endedness of the program.

Finally, other more subtle concerns have been addressed throughout the material. The drawings and activities used in "Water for South Florida" seek to achieve specific goals in the areas of cross-cultural awareness, avoidance of role stereotypes, career orientation and a cognizance of the interrelated nature of all aspects of the environment.

Implementation

The workbook activities are to be used in one of two implementation formats. In the first, the teacher selects workbook lessons and/or activities which best fit his/her prevailing curricular setting. Since specific uniform performance standards are stated for each activity under the lesson headings, this approach enables teachers to select the lessons which help fulfill the goals for their grade level and course, such as those set forth by the State Department of Education. Each activity is designed to stand alone, allowing students to achieve the objectives without relying on any other workbook exercise for its successful completion.

The second implementation option is a unit format. Three possible units — three, five and ten day — are outlined below and feature specific lessons which have been selected to achieve a combination of water objectives. Generally, the suggested sequence introduces the students to the topic of water, explores its sources, investigates its uses, and underscores its value and the need for its conservation and preservation. However, if time is available, the subject can be studied in greater detail for a stronger impact; the five and ten day units provide more complementary lessons to reinforce the key water concepts.

The unit format matrix and the individual lesson plans have been constructed to assist you in identifying suitable activities to achieve many goals. Particularly, the workbook was written to provide a blend of interdisciplinary emphases (such as science, social science, math, reading, writing) and instructional objectives. Therefore, the activities themselves, as well as the lesson notes, permit the teacher to make the final determination.

Study the matrix and choose the unit format that's best for you. Each lesson plan offers several student learning objectives, based on the uniform student performance standards, which cover all of the following activities. The specific activities, cited under the "PROCEDURES" section, are highlighted and designated as to their unit format applicability. If a particular activity is not included in your selected unit format, simply proceed to the next activity.

"Water for South Florida" has been designed with a flexibility of choice, so that you, the teacher, can put it to your best use. It can serve in any situation, whether through the suggested units or by the selection of individual lessons which meet particular instructional needs. We hope that you and your students enjoy the materials.

Unit Formats

Five-Day Unit Format

Day	Lesson/ Activity(ies)	Lesson Notes	Student Book
1	**Introduction**		
	Classroom Poster		
	Introduction	p.5	p.1
	The Hydrologic Cycle		
	"Water and Weather"	p.6	pp.2–3
	Water Sources		
	"Where Does All That Rain Go?"	p.7	p.4
	"Down into the Ground"	p.7	pp.5–6
	"Porosity"	p.7	p.6
	"Permeability"	p.7	pp.6–7
	Water and the Land		
	"Water and the Land"	p.8	pp.8–9
2	**Natural Water System of South Florida**		
	"Natural Water System of South Florida"	p.9	pp.10–11
	"Who Lives Where" Activity — optional	p.9	repro
	"Water Glossary"	p.9	repro
	People-made System of South Florida		
	"South Florida's People-made Water System"	p.10	pp.12–13
	"Growing Water Needs"	p.10	p.13
	Water Treatment		
	"Water Treatment"	p.12	pp.14–15
3	**Water in Use**		
	"Water, Water, Water"	p.13	pp.16–17
	"Home Water Audit"	p.13	pp.18–19
	Wastewater Treatment		
	"Cleaning Up the Wastewater"	p.14	pp.20–21
4	**Water Quality and Pollution**		
	"Pollution and Solutions"	p.14	pp.22–23
	Water Supply Problems		
	"Floods and Droughts"	p.15	pp.24–25
	Water Supply Solutions		
	"Finding More Water"	p.15	pp.26–27
5	**Water Conservation**		
	"South Florida's Wacky Wildlife"	p.16	pp.28–29
	"Give Me a Break"	p.16	p.30
	"Water Trivia"	p.17	p.31
	Conclusion		
	Conclusion	p.18	
	Classroom Poster	p.18	
	"Water Crossword" Puzzle	p.18	p.32

Ten-Day Unit Format

Day	Lesson/ Activity(ies)	Lesson Notes	Student Book
1	**Introduction**		
	Classroom Poster		
	Introduction	p.5	p.1
	"How Much Water Does It Have?" Experiment	p.5	repro
2	**The Hydrologic Cycle**		
	"Water and Weather"	p.6	pp.2–3
	Water Sources		
	"Where Does All That Rain Go?"	p.7	p.4
	"Down into the Ground"	p.7	pp.5–6
	"Building an Artesian Aquifer and Well" Activity — opt.	p.7	repro
3	**Water Sources**		
	"Porosity"	p.7	p.6
	"Permeability"	p.7	pp.6–7
	"Freddy's Fabulous Soils Experiment"	p.7	p.7
	Water and the Land		
	"Water and the Land"	p.8	pp.8–9
	"Natural Water Pollution" Experiment — optional	p.8	repro
4	**Natural Water System of South Florida**		
	"Natural Water System of South Florida"	p.9	pp.10–11
	"Who Lives Where" Activity — optional	p.9	repro
	"Water Glossary"	p.9	repro
5	**People-made System of South Florida**		
	"South Florida's People-made Water System"	p.10	pp.12–13
	"Growing Water Needs"	p.10	p.13
	"Hidden Water Names" Puzzle	pp.10–11	repro
6	**Water Treatment**		
	"Water Treatment"	p.12	pp.14–15
	"Water Treatment" Experiment	p.12	repro
	Water in Use		
	"Water, Water, Water"	p.13	pp.16–17
	"Home Water Audit"	p.13	pp.18–19
7	**Wastewater Treatment**		
	"Cleaning Up the Wastewater"	p.14	pp.20–21
	Water Quality and Pollution		
	"Pollution and Solutions"	p.14	pp.22–23
	"Groundwater Pollution" Experiment — optional	p.14	repro
8	**Water Supply Problems**		
	"Floods and Droughts"	p.15	pp.24–25
	Water Supply Solutions		
	"Finding More Water"	p.15	pp.26–27
9	**Water Conservation**		
	"South Florida's Wacky Wildlife"	p.16	pp.28–29
	"Give Me a Break"	p.16	p.30
	"Water Trivia"	p.17	p.31
10	**Conclusion**		
	Conclusion	p.18	
	Classroom Poster	p.18	
	"Water Crossword" Puzzle	p.18	p.32

Fifteen-Day Unit Format

1	**Introduction**		
	Classroom Poster		
	Introduction	p.5	p.1
	"How Much Water Does It Have?" Experiment	p.5	repro
2	**The Hydrologic Cycle**		
	"Water and Weather"	p.6	pp.2–3
	Water Sources		
	"Where Does All That Rain Go?"	p.7	p.4
	"Turbidity" Experiment	p.7	repro
3	**Water Sources**		
	"Down into the Ground"	p.7	pp.5–6
	"Building an Artesian Aquifer and Well" Activity — opt.	p.7	repro
4	**Water Sources**		
	"Porosity"	p.7	p.6
	"Permeability"	p.7	pp.6–7
	"Freddy's Fabulous Soils Experiment"	p.7	p.7
5	**Water and the Land**		
	"Water and the Land"	p.8	pp.8–9
	"Building a Terrarium" Activity — optional	p.8	repro
	"Natural Water Pollution" Experiment	p.8	repro
6	**Natural Water System of South Florida**		
	"Natural Water System of South Florida"	p.9	pp.10–11
	"Who Lives Where" Activity — optional	p.9	repro
	"Water Glossary"	p.9	repro
7	**People-made System of South Florida**		
	"South Florida's People-made Water System"	p.10	pp.12–13
	"Growing Water Needs"	p.10	p.13
	"Hidden Water Names" Puzzle	pp.10–11	repro
8	**Water Treatment**		
	"Water Treatment"	p.12	pp.14–15
	"Water Treatment" Experiment	p.12	repro
9	**Water in Use**		
	"Water, Water, Water"	p.13	pp.16–17
	"Home Water Audit"	p.13	pp.18–19
10	**Wastewater Treatment**		
	"Cleaning Up the Wastewater"	p.14	pp.20–21
11	**Water Quality and Pollution**		
	"Pollution and Solutions"	p.14	pp.22–23
	"Groundwater Pollution" Experiment	p.14	repro
12	**Water Supply Problems**		
	"Floods and Droughts"	p.15	pp.24–25
13	**Water Supply Solutions**		
	"Finding More Water"	p.15	pp.26–27
	Water Conservation		
	"South Florida's Wacky Wildlife"	p.16	pp.28–29
	"Give Me a Break"	p.16	p.30
14	**Water Conservation**		
	"To Water or Not to Water" Simulation Activity	p.17	repro
	"Water Trivia"	p.17	p.31
15	**Conclusion**		
	Conclusion	p.18	
	Classroom Poster	p.18	
	"Water Crossword" Puzzle	p.18	p.32

Fifteen-Day Unit Format

1	**Introduction**		
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15	**Conclusion**		
	Conclusion	p.18	
	Classroom Poster	p.18	
	"Water Crossword" Puzzle	p.18	p.32

Introduction

Student Book: Page 1

Minimum Student Performance Standards:

Reading

A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
C. The student will demonstrate literal comprehension skills. (12, 16)

Writing

J. The student will write legibly. (80)

Mathematics

G. The student will multiply whole numbers. (55)
H. The student will divide whole numbers. (61)
I. The student will add, subtract, and multiply fractions. (67)
M. The student will measure time, temperature, distance, capacity, and mass/weight. (90)
T. The student will solve measurement problems. (139)

Science

A. The student will apply basic process skills as tools for scientific investigation. (16, 22, 35)
C. The student will know basic life science concepts and facts. (53)
D. The student will apply basic life science concepts and facts. (120)
I. The student will appropriately employ scientific materials, equipment and techniques. (269, 271, 273)
K. The student will describe the interactions among science, technology and society. (282, 284)

Introduction: This activity serves to introduce the class to a water unit which should bring an understanding of the importance of this resource into their homes and onto their campus. By using a classroom poster, the initiating activity focuses attention on water, its potential as well as its problems. Thus prepared, the students are ready for an in-depth look at this vital resource.

Procedures:

1. Introduce the unit by bridging from the study of water in the regular curriculum to a focus on South Florida's water picture.
2. Begin the lesson by asking the class to suggest some important qualities of water as a resource, e.g.:
   a. Water is essential to life.
   b. Water is a finite, but renewable resource.
   c. Water can only meet our needs if it is in consistent and adequate supply.
   d. Water can only meet our needs if it is of acceptable quality.
   e. Water can only meet our needs if it is accessible when and where we need it.
   f. Polluted water negatively affects the natural environment, as well as our developed environment.
   g. Too much water can be a problem (floods).
   h. Too little water can be a problem (drought).

   If the students can identify a majority of these "water truths," you are well on your way to a successful unit.
3. **Classroom poster** (5,10,15)
   a. Without supplementing the students' list, proceed to put up the classroom poster and allow the students a few minutes to study it.
   b. Ask the students if the poster suggests any more water qualities to add to their list; if so, add them.
   c. If time permits, refer to the Poster-Fact Sheet and use the information provided to expand the discussion.
4. **Introduction** (5,10,15)
   a. Hand out the student books. Explain that this publication contains information about water, especially South Florida's water.
5. **How Much Water Does It Have?** (10,15)
   a. If time permits, have small groups of students conduct this experiment, which can be reproduced from page 19 in this guide.
   b. Once the students have completed this activity, have each group report its findings and discuss the results.
6. Conclude the lesson by having the students write a one-page summary on the value of water as a resource and the responsibilities of humans to protect it. You might also ask the students to start clipping articles about water in South Florida from newspapers, magazines and newsletters. These can be used to make a Water Scrapbook.

The Hydrologic Cycle

Student Book: Pages 2–3

Minimum Student Performance Standards:

Reading

A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
C. The student will demonstrate literal comprehension skills. (12, 16)
F. The student will demonstrate the appropriate skills for obtaining information. (25, 26)

Writing

A. The student will compose grammatically correct sentences. (3)
G. The student will spell correctly. (55)
H. The student will punctuate correctly. (62)
I. The student will capitalize correctly. (70, 71)
J. The student will write legibly. (80)

Science

A. The student will apply basic process skills as tools for scientific investigation. (5, 22, 33, 38)
B. The student will apply basic process skills to problem solving in science. (42, 46, 47)
G. The student will know basic earth/space science concepts and facts. (208, 221, 222, 229)
H. The student will apply basic earth/space science concepts and facts. (248, 249)

Introduction: This activity describes the hydrologic cycle, including evapotranspiration and percolation. It goes on to discuss rainfall patterns, hurricanes and drought-flood cycles, which occur on a regular basis in South Florida.

Procedures:

1. Begin the lesson by reading the following weather forecast:

   And now, here's the South Florida weather forecast for today, August 8. We have mostly sunny skies and warm temperatures this morning across the state. A few scattered showers are reported along the southeast coast, with radar detecting more rain out over the Atlantic. Temperatures are in the 80's; winds are light and variable. Water temperature is 84.

   The afternoon's forecast calls for highs in the upper 80's along both coasts, with low-to-mid 90's over the interior. There's a 40% chance of widely scattered thunderstorms late this afternoon over inland areas. On-shore 10–15 mph winds are expected this afternoon. More of the same weather is expected tomorrow.

2. Using either individual maps of the region or a large one, reread the forecast and ask the class to analyze the weather conditions in terms of the water cycle. Make sure that they explain why it will rain where forecast, what conditions might occur to change the predicted weather, and what will happen to the water that falls as precipitation. Key points should include:
   a. Florida's wet season is June–October and features a tropical climate. Storms, including hurricanes, bring heavy rains from westerly moving weather systems off the Atlantic Ocean.
   b. Florida's dry season is November–May and is marked by a mid-latitude climate — weather systems are brought by easterly moving winds off the Gulf of Mexico.
   c. Land warms and cools more rapidly than water. Hot land causes air to rise, thus pulling in more air from the ocean causing on-shore winds.
   d. Thunderstorms are produced as a result of rising air. Since maximum land surface heating occurs near 4:00 PM, this is the time of heaviest thunderstorm activity.
3. **Water and Weather** (5,10,15)
   a. Once the class has completed the discussion, have the students read "Water and Weather," pages 2–3 of the student book.
   b. When the students have finished the reading, relate the material to the earlier weather report discussion.
   c. Note why some areas of South Florida get more rain than others and how this varied rainfall affects water supply. (Ft. Myers — 52.2", Miami — 58.9", Moore Haven (Lake Okeechobee) — 49.5", Ft. Pierce — 53.2")
      (1) As ocean water warms, more storm activity is created through convective action.
      (2) The water is warmest in September; hence, it is the month of maximum storm and hurricane activity.
      (3) These storms drop the most water along the coasts as they come inland. Hence, coastal areas receive more rain than the interior.
      (4) The lowest annual average levels of rainfall generally occur in the Kissimmee River valley and in the Florida Keys.
   d. Have the students expand their earlier analyses to accommodate the additional information.
4. Have the students demonstrate their understanding of weather and its relationship to the water cycle by writing a one-paragraph South Florida weather report for a day in another season of the year. This should involve an entirely different set of conditions.
5. Conclude the lesson by having the students write a short fictional newspaper article on some event related to the weather they just predicted. Their articles might cover a boom in tourism based on fair weather, a hurricane watch, citrus crop damage due to a freeze or the need for water conservation due to drought conditions.

Water Sources

Student Book: Pages 4–7

Minimum Student Performance Standards:

Reading
- A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
- C. The student will demonstrate literal comprehension skills. (12, 16)
- D. The student will demonstrate inferential comprehension skills. (19, 20)

Writing
- J. The student will write legibly. (80)

Mathematics
- M. The student will measure time, temperature, distance, capacity, and mass/weight. (89, 90)
- T. The student will solve measurement problems. (138, 139)

Science
- A. The student will apply basic process skills as tools for scientific investigation. (16, 36)
- G. The student will know basic earth/space science concepts and facts. (206)
- I. The student will appropriately employ scientific materials, equipment and techniques. (269, 271, 273)
- K. The student will describe the interactions among science, technology and society. (284)

Introduction: This activity focuses student attention on where water goes after it falls to earth as precipitation — to surface bodies of water and into the ground. It covers how the water moves around on the surface of the land and how groundwater percolates through the earth to collect in aquifers, Florida's major source of water supply. The session concludes with an experiment, testing the porosity and permeability of various soils.

Procedures:

1. Begin the lesson by taking the class outside and slowly pouring a gallon or two of water on a patch of uneven ground. Ask the students to observe where the water goes. Return to the classroom.
2. Once back in class, explain to the students that your demonstration reflects exactly what happens to precipitation when it falls to earth. Solicit explanations from the students, making sure that they point out that some of the water collects on the surface and some sinks into the ground.
3. **Where Does All That Rain Go?** (5,10,15)
   a. Have the students read "Where Does All That Rain Go?" page 4 in the student book.
   b. Once they have completed the reading, discuss the probable path of local precipitation, noting streams, ponds, rivers, lakes and other water bodies.
4. **Turbidity Experiment** (15)
   a. If possible, have the students conduct the "Turbidity" Experiment which may be duplicated from page 20 in this guide.
   b. At the conclusion of the experiment, ask the students to explain the sources of high turbidity in surface bodies of water. (Suspended solids come from decaying plant and animal matter and inorganic material which has been stirred up from the bottom.) Note that such substances must be filtered out before this water can be used for uses such as drinking.
5. **Down in the Ground** (5,10,15)
   a. Assign "Down in the Ground," pages 5–6 in the student book, for reading.
   b. Following the reading, ask for volunteers to come to the chalkboard and give a summary explanation of groundwater. Have them illustrate the structure of an aquifer, caverns and sinkholes.
6. **Building an Artesian Aquifer and Well Activity** (10,15)
   a. This activity provides an excellent opportunity for the students to understand how groundwater serves as a water source. If time permits, it can be conducted using the instructions on pages 21–22 in this guide.
   b. As an expedient alternative, the teacher can construct the model and demonstrate its use in class.
7. **Porosity** and **Permeability** (5,10,15)
   a. Have the students read the sections on "Porosity" and "Permeability," pages 6–7 in the student book.
   b. When they have concluded the reading, ask them to describe the soil where you poured the water at the beginning of the lesson. Was it porous? How permeable was it? Is it typical of the rest of the soil in the local area?
8. **Freddy's Fabulous Soils Experiment** (10,15)
   a. For a better understanding of porosity and permeability, have the students, individually or in small groups, conduct "Freddy's Fabulous Soils Experiment," page 7 in the student book.
9. Conclude the lesson on water sources by having the students write a summary paragraph on the subject. They should include the concepts of surface water, groundwater, aquifer, porosity and permeability.

Water and the Land

Student Book: Pages 8–9

Minimum Student Performance Standards:

Reading

A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
C. The student will demonstrate literal comprehension skills. (12, 16)

Writing

J. The student will write legibly. (80)

Science

A. The student will apply basic process skills as tools for scientific investigation. (5, 11, 22, 32, 36, 38)
B. The student will apply basic process skills to problem solving in science. (46)
C. The student will know basic life science concepts and facts. (69)
H. The student will apply basic earth/space science concepts and facts. (249)
I. The student will appropriately employ scientific materials, equipment and techniques. (269, 271)
K. The student will describe the interactions among science, technology and society. (282, 284)

Introduction: This activity explores the vital relationship between water and the natural environment. Following a class discussion on the importance of water to the vegetation and wildlife of South Florida, the students will read and investigate how water serves in its life-sustaining function. The lesson concludes with an examination of the differences between the natural environment of South Florida and other areas of the country.

Procedures:

1. Begin the lesson by asking the students to close their eyes and try to visualize a typical South Florida water scene. Have them note the type of water body, the animal life and the vegetation present.
2. After a few minutes, ask some volunteers to describe what they "saw." When a variey of settings have been covered, summarize their findings by noting that South Florida water scenes include rivers, lakes, canals, streams, ponds and wetlands — the subjects of the next reading.
3. **Water and the Land** (5,10,15)
   a. Have the students read "Water and the Land," pages 8–9 in the student book.
   b. When they have concluded the reading, discuss the material, relating it to the students' earlier descriptions.
4. **Building a Terrarium Activity** (15)
   a. If time permits, have the students construct a terrarium, as described on the reproducible sheet found on page 23 of this guide.
   b. This terrarium can serve for serveral months as an ongoing point of interest in the classroom. Have the students observe it each week and note any changes which occur. What do they think accounted for the changes?
5. **Natural Water Pollution Experiment** (10,15)
   a. This optional activity works especially well if related back to the "Turbidity" Experiment. Instructions for the "Natural Water Pollution" Experiment are found on page 24 in this guide.
   b. At the conclusion of the experiment, have the students report where they have observed natural water pollution occurring in the local area. What, if any, helpful or harmful effects do they think result from natual water pollution.
6. Conclude this section by having the students meet briefly in small groups and discuss how "Water and the Land" in South Florida compares with areas in other parts of the country which they have seen or read about. They should note which types of water bodies are more or less prevelant in other areas and to what degree precipitation affects the type and number of water bodies in a given area. Also, compare the different types of soils found in various areas around the state, such as the red clay of North Florida.

The Natural Water System

Student Book: Pages 10–11

Minimum Student Performance Standards:

Reading

A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
C. The student will demonstrate literal comprehension skills. (12, 16)
D. The student will demonstrate inferential comprehension skills. (17, 19, 20)
F. The student will demonstrate the appropriate skills for obtaining information. (25)

Writing

J. The student will write legibly. (80)

Science

A. The student will apply basic process skills as tools for scientific investigation. (36)
B. The student will apply basic process skills to problem solving in science. (46, 47)
D. The student will apply basic life science concepts and facts. (119)
K. The student will describe the interactions among science, technology and society. (282, 284)

Introduction: This activity introduces students to the natural water system of South Florida. Beginning with a recognition that the region's subtropical climate means periodic floods and droughts, the lesson examines the effects of this water, or lack of it, on the land. Particularly important in this regard are: the Everglades, the Upper Chain of Lakes, the Kissimmee River and Lake Okeechobee. The activity features an exercise in which the students analyze the relationships between several species of wildlife and the natural communities they inhabit. Key to these relationships is the role of water in the maintenance of the habitat. The students also receive the "Water Glossary" which contains all of the key water words of the unit. The session concludes with a discussion on the positive and negative effects of human intervention in the operation of natural systems.

Procedures:

1. Begin the lesson by having the students study the map of South Florida, page 10 of the student book.
2. Locate your home on the map and note other familiar landmarks.
3. Have the students describe various parts of the region (based on their travel and living experiences), noting similarities and differences, especially as they relate to water and weather.
4. **The Natural Water System** (5,10,15)
   a. Assign the reading, "The Natural Water System of South Florida," found on pages 10–11, to the students.
   b. Discuss the reading, emphasizing the water needs of the natural communities. Point out to the students how the landforms and topography, bodies of water and weather affect the native vegetation of an area. Note how these same factors, especially vegetation, determine the wildlife which populates a natural community. Stress the idea that natural resources, such as water, need to be shared by people and the wildlife.
   c. If time permits, a discussion of food webs, as they relate to the topic, would be in order.
5. **Who Lives Where?** (5,10,15)
   a. Hand out the "Who Lives Where?" Activity and have the students complete it. This worksheet may be reproduced from page 25 of this guide. If classtime is limited, the exercise may be done as homework. The answers to the worksheet are provided below.

ANSWER KEY

Cypress Swamp Forests — Florida Black Bear, Mangrove Fox Squirrel, Florida Panther
Everglades — Florida Panther, Wood Stork, Snail Kite
Prairie Grasslands — Gopher Tortoise, Burrowing Owl
Prairie Marshes — Snail Kite, Cape Sable Seaside Sparrow, Wood Stork

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   b. Once the students have finished their work, go over their answers in class and discuss their results.
6. **Water Glossary** (5,10,15)
   a. Hand out the "Water Glossary," duplicated from pages 26–27 of this guide. Suggest that the students refer to it frequently as they encounter new water vocabulary throughout the unit.
7. Conclude the lesson by having the students suggest how natural communities might be affected by people actions. (They may note that water diversions for domestic use could deprive habitats of needed water. On the positive side, they could observe that by controlling water releases from reservoirs like Lake Okeechobee, flood damage can be minimized or averted altogether.)

The People-Made Water System

Student Book: Pages 12–13

Minimum Student Performance Standards:

Reading
- A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
- C. The student will demonstrate literal comprehension skills. (12, 16)
- F. The student will demonstrate the appropriate skills for obtaining information. (25, 26)

Writing
- J. The student will write legibly. (80)

Mathematics
- U. The student will interpret graphs, tables, and maps. (146)

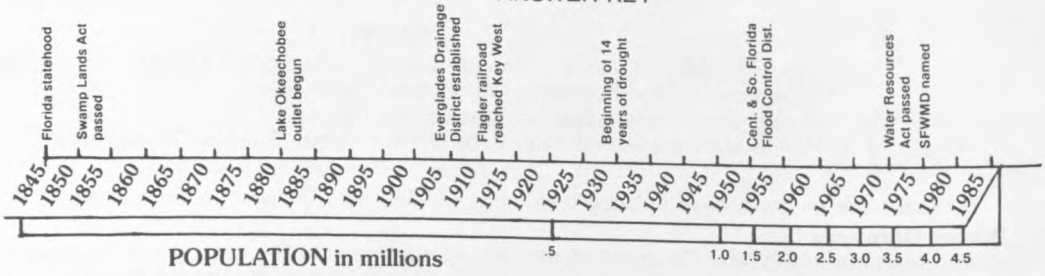
Science
- A. The student will apply basic process skills as tools for scientific investigaion. (11, 22, 32, 35, 36, 38)
- B. The student will apply basic process skills to problem solving in science. (44, 46, 47)
- G. The student will know basic earth/space science concepts and facts. (208)
- H. The student will apply basic earth/space science concepts and facts. (248)
- K. The student will describe the interactions among science, technology and society. (282, 284)

Introduction: This activity summarizes the development of water management in South Florida. Beginning with a historical perspective of the need for a physical network, the lesson explains the evolution of the area's water projects and the eventual creation of the South Florida Water Management District. The students engage in an activity in which they correlate the growth of South Florida's population with the effects of water management in the region. Finally, it discusses how the District operates its system to achieve the four elements of its mission statement: environmental protection and enhancement, flood control, water supply and water quality.

Procedures:

1. Begin the lesson by having the students study the map provided on page 12 of the student book. Ask them to note how the natural water system has been altered.
2. Have the students hypothesize as to why these changes have been made. Although the people-made water system made it possible for humans to make South Florida home, these changes have affected the natural environment.
   a. Stabilization of water levels versus natural flooding and drying out.
   b. Interruption of the historical north-south sheet flow of water through the marshes.
   c. Degradation of water quality due to discharge of agricultural and urban runoff.
3. **The People-made Water System** (5,10,15)
   a. Have the students read "The People-made Water System," found on pages 12–13 of the student book.
4. **Growing Water Needs** (5,10,15)
   a. Once they have finished the reading, have the class complete the "Growing Water Needs" activity, page 13.
   b. Break the class into small groups and have the students compare their answers and conclusions. Each group should consolidate their findings.

ANSWER KEY



In which year did the population reach 500,000? **1925**
What was the population in 1955? **1.5 million**

In which year did the population reach 3.5 million? **1975**
What was the population in 1985? **4.5 million**

   c. Have each group report its findings to the whole class. Make sure that they cite the appropriate data to support their contentions.
   d. Discuss some examples of how people-made projects have served as short-term solutions but ultimately created longer term problems.
5. Conclude the activity by noting how a broader environmental concern in recent years has resulted in a change in how we approach such problems. Pay particular attention to the role of the SFWMD in balancing the needs of the environment and its natural wildlife with those of the people who inhabit it.
6. **South Florida Hidden Water Names Puzzle** (10,15)
   a. If time permits, students will enjoy solving the "Hidden Water Names" Puzzle, which can be reproduced from page 28 in this guide. The answers to the puzzle appear below.

ANSWER KEY

To locate the first letter of the water names, use the coordinates provided:

ATLANTIC Ocean (H-10)
BISCAYNE Bay (I-5)
CALOOSAHATCHEE River (B-13)
CYPRESS Lake (M-1)
EVERGLADES (G-3)
FISHEATING Creek (L-1)
FLORIDA Bay (A-14)
Lake HATCHINEHA (P-14)

Lake HICPOCHEE (A-12)
HILLSBORO Canal (S-10)
HOMESTEAD Canal (L-12)
Lake ISTOKPOGA (K-4)
KISSIMMEE River and Lake (S-8)
LOXAHATCHEE River (B-8)
Gulf of MEXICO (Q-6)
MIAMI Canal (N-9)

N. NEW RIVER Canal (D-1)
NUBBIN Slough (N-5)
Lake OKEECHOBEE (E-4)
SHARK River Slough (S-9)
ST. LUCIE Canal (Q-8)
TAYLOR Slough and Creek (G-10)
Lake TOHOPEKALIGA (K-13)
WEST PALM BEACH Canal (F-2)

A	T	G	N	I	T	A	E	H	S	I	F	C	Y	P	R	E	S	S
H	S	O	B	N	W	E	S	T	P	A	L	M	B	E	A	C	H	C
D	B	U	W	L	E	E	V	E	R	G	L	A	D	E	S	E	D	J
E	I	J	F	O	O	W	W	C	G	I	S	T	O	K	P	O	G	A
E	W	P	E	H	K	V	R	B	E	L	V	I	N	U	B	B	I	N
H	V	K	T	R	X	E	E	I	C	A	O	C	I	X	E	M	F	L
C	M	Z	G	J	N	Q	E	S	V	K	H	Y	O	B	A	I	P	Z
O	L	O	X	A	H	A	T	C	H	E	E	M	M	I	S	S	I	K
P	Q	J	R	K	M	S	K	A	H	P	R	T	M	G	L	T	A	S
C	I	T	N	A	L	T	A	Y	L	O	R	O	B	S	L	L	I	H
I	L	M	R	U	X	N	U	N	Y	H	B	V	D	W	O	U	C	A
H	X	P	D	A	E	T	S	E	M	O	H	E	Q	Y	E	C	Z	R
S	C	A	L	O	O	S	A	H	A	T	C	H	E	E	N	I	R	K
F	L	O	R	I	D	A	H	E	N	I	H	C	T	A	H	E	A	F

Water Treatment

Student Book: Pages 14–15

Minimum Student Performance Standards:

Reading

A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
C. The student will demonstrate literal comprehension skills. (12, 16)
F. The student will demonstrate the appropriate skills for obtaining information. (25, 26)

Writing

A. The student will compose grammatically correct sentences. (3)
D. The student will write for the purpose of supplying necessary information. (30)
G. The student will spell correctly. (55)
H. The student will punctuate correctly. (62)
I. The student will capitalize correctly. (70)
J. The student will write legibly. (80)

Science

A. The student will apply basic process skills as tools for scientific investigation. (5, 11, 36)
B. The student will apply basic process skills to problem solving in science. (44, 46)
D. The student will apply basic life science concepts and facts. (120)
I. The student will appropriately employ scientific materials, equipment and techniques. (269, 271)
K. The student will describe the interactions among science, technology and society. (282, 283, 284)

Introduction: The topic of water treatment is an important one and a subject of vital concern, especially for communities which rely on surface water as their source of public supply. In addition to learning about the process of water treatment, the students will have an opportunity to conduct a water treatment experiment which simulates the actual process.

Procedures:

1. Begin the lesson by asking the students where the water they use in their homes comes from. (You should check with your local water agency ahead of time to find out if it uses groundwater or a surface water source as its supply.)
2. Continue the discussion by questioning the class as to what steps they think might be necessary to clean up water before it is delivered to homes for consumption.
3. **Water Treatment** (5,10,15)
   a. Introduce the "Water Treatment" reading, found on pages 14–15 of the student book, by telling the students that this reading will explain exactly how water agencies make sure that the water it delivers is clean and safe to drink.
   b. Once the students have finished the reading, ask for a few volunteers to diagram the treatment process on the chalkboard. Discuss their renderings.
4. **Water Treatment Experiment** (10,15)
   a. Conclude the lesson by having the students, working in small groups, conduct the "Water Treatment" Experiment, found on page 29 of this guide. This activity should help them appreciate the effects of the water treatment process.
   b. When they have finished with the experiment, have each group write a summary report, describing their results.

Water In Use

Student Book: Pages 16–19

Minimum Student Performance Standards:

Reading

A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
C. The student will demonstrate literal comprehension skills. (12, 16)
F. The student will demonstrate the appropriate skills for obtaining information. (25, 26)

Writing

J. The student will write legibly. (80)

Mathematics

E. The student will add whole numbers. (43)
G. The student will multiply whole numbers. (55)
H. The student will divide whole numbers. (61)
Q. The student will solve real-world problems involving whole numbers. 113, 114)

Science

A. The student will apply basic process skills as tools for scientific investigation. (5, 11, 32, 36)
B. The student will apply basic process skills to problem solving in science. (44, 46, 47)
J. The student will use science process skills and science information in daily activities. (276, 277)
K. The student will describe the interactions among science, technology and society. (281, 282, 283, 284)

Introduction: This activity explores how water is used in South Florida. The content includes wells removing underground water, treatment plants providing water for homes (cooking, washing, drinking, irrigation, swimming pools) and businesses (manufacturing, food processing, office buildings), and wastewater flowing to sewage treatment plants. The coverage also examines the use of individual wells for such needs as citrus groves and the reclamation of water from sewage treatment plants for golf course irrigation. Finally, the material discusses how surface water is used in canals for irrigation (sugarcane fields), for recreational purposes (boating, water skiing, fishing) and by animals in aquatic environments. The activity concludes with a method of measuring water use in the home, a water audit.

Procedures:

1. Begin the lesson by having the students make three lists: one of the ways in which their families use water in the home; one of ways in which water is used in their parents' jobs; one of the ways in which water is used around them in the community.
2. When the students have completed their lists, have them share the results with the class.
3. **Water, Water, Water** (5,10,15)
   a. Next, assign the reading of "Water, Water, Water," found on pages 16–17 of the student book.
   b. Have the students note any water uses which did not appear in the class compilation.
4. When the class has completed the reading, have the students draw a schematic of the people-made water cycle on a piece of paper. You might want to refer to the natural water cycle as a starting point and then suggest a couple of examples of how humans intervene into the natural cycle. The students should include many of the following elements in their drawings: surface water, groundwater, canals, residential water use, industrial use, commercial use, agricultural use (irrigation), recreational use, wastewater, sewage treatment and reclaimed water. If time permits, the students might write an accompanying description of their drawing.
5. After the students have completed their drawings, consolidate their concepts with one comprehensive schematic on the chalkboard.
6. **Home Water Audit** (5,10,15)
   a. Point out to the students that they have an important role to play in the use and conservation of this precious resource that we use in so many ways. Note that many homes have water meters which accurately record the amount of water supplied to the house. But simply knowing how much water is used is not enough. We must know where and how it is consumed before we can adopt water conservation behaviors to save it.
   b. Assign the "Home Water Audit" reading and activity, pages 18–19 in the student book.
   c. Once the material has been read and any questions answered, the students should be prepared to survey their family's water consumption. When completed, the students will get a very good idea on where and how their families can curtail their water use.
7. Conclude the lesson by identifying points in the board schematic where water problems develop. For example, locate where drought restricts the available water supply for various uses, or note points at which pollution degrades the water's quality and depreciates its value for other uses. (Refer to the Poster Fact Sheet.) Also indicate where and how some of these problems might be solved. For example, water conservation can extend the use of the resource, and treatment of wastewater can reclaim it for some other uses.

Wastewater Treatment

Student Book: Pages 20–21

Minimum Student Performance Standards:

Reading

A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
C. The student will demonstrate literal comprehension skills. (12, 16)
F. The student will demonstrate the appropriate skills for obtaining information. (25, 26)

Science

A. The student will apply basic process skills as tools for scientific investigation. (5, 11, 36)
B. The student will apply basic process skills to problem solving in science. (44, 46)
D. The student will apply basic life science concepts and facts. (120)
I. The student will appropriately employ scientific materials, equipment and techniques. (269, 271)
K. The student will describe the interactions among science, technology and society. (282, 283, 284)

Introduction: This section introduces the students to the processes involved in cleaning up wastewater. The material describes how septic systems and wastewater treatment plants serve to improve the quality of wastewater for safe disposal in the environment. The importance of this cleaning operation is stressed and the students are given an opportunity to simulate the process by conducting a wastewater treatment experiment.

Procedures:

1. Begin the lesson by reviewing with the students what they learned about wastewater treatment in the "Water, Water, Water" reading.
2. **Cleaning Up the Wastewater** (5,10,15)
   a. Explain to the students that wastewater treatment is very similar to water treatment, and almost as important. Have them read "Cleaning Up the Wastewater," pages 20–21 in the student book.
   b. Once they have completed the reading, discuss the similarities and differences between water treatment and wastewater treatment.
3. Conclude the lesson by having the students suggest all of the potential dangers, to humans and the environment in general, of not treating or inadequately treating wastewater.

Water Quality and Pollution

Student Book: Pages 22–23

Minimum Student Performance Standards:

Reading

A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
C. The student will demonstrate literal comprehension skills. (12, 16)
D. The student will demonstrate inferential comprehension skills. (19,20)
E. The student will demonstrate evaluative comprehension skills. (23)

Science

A. The student will apply basic process skills as tools for scientific investigation. (11, 22, 30, 36)
B. The student will apply basic process skills to problem solving in science. (42, 43, 46)
D. The student will apply basic life science concepts and facts. (120)
J. The student will use science process skills and science information in daily activities. (276, 277, 278)
K. The student will describe the interactions among science, technology and society. (282, 283, 284)

Introduction: This subject is a logical extension of the wastewater treatment discussion. The material introduces the students to a variety of water quality and pollution problems facing South Florida today. The copy covers everything from the pollution of Lake Okeechobee by agricultural sources to water quality problems associated with urban sources.

Procedures:

1. Start by having the students list as many sources of water pollution as they can. Write the list on the chalkboard.
2. Have the class categorize the pollution sources by type, i.e., agricultural, industrial, domestic, etc.
3. **Pollution and Solutions** (5,10,15)
   a. Have the students read the "Pollution and Solutions" reading, pages 22–23 in the student book.
   b. Once they have completed the reading, have the students add any additional water quality problems to the list on the chalkboard.
   c. Finally, see if the class can match the preventative and remedial measures presented as solutions in the reading with each of the problems cited on the board.
4. **Groundwater Pollution Experiment** (10,15)
   a. If time permits, have the students conduct the "Groundwater Pollution" Experiment, following the instructions found on page 30 of this guide.
5. Conclude the activity by assigning a newspaper research project to the class.
   a. Have them check out recent editions of local papers for any articles, columns or editorials on the subject of water quality or pollution. (This may either be done as homework or you might bring a stack of newspaper to class and have the students do the research there.)
   b. Once they have located their water quality materials, have the students discuss their findings. Do the articles address the same concerns covered in the class? Are opinions expressed supported by facts?

Water Supply Problems

Student Book: Pages 24–25

Minimum Student Performance Standards:

Reading
- A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
- C. The student will demonstrate literal comprehension skills. (12, 16)

Science
- A. The student will apply basic process skills as tools for scientific investigation. (5, 11, 22)
- B. The student will apply basic process skills to problem solving in science. (44, 46)

Introduction: South Florida is faced with two significant water supply problems: floods and droughts. The material in this section focuses on these two extreme conditions and explains how one excess fails to adequately compensate for the other. It also covers the related problems of saltwater intrusion and the additional water demands of the tourist season and winter agricultural needs. This section serves to point the students directly at the need for serious water conservation.

Procedures:

1. Begin the lesson by asking the students to recall the most recent examples of local flooding and local drought. Have them describe the problems they experienced because of these conditions.
2. Explain to the class that, for a variety of reasons, South Florida suffers uniquely from these problems.
3. **Floods and Droughts** (5,10,15)
   a. Have the students read "Floods and Droughts," pages 24–25 in the student book.
   b. When they have finished the reading, have them meet in small groups to design strategies to cope with these conditions. They should consider ways to minimize the damage and any actions possible to counteract their negative effects.
4. Conclude the lesson by announcing that tomorrow's session will give them more solutions to the problems of floods and droughts.

Water Supply Solutions

Student Book: Pages 26–27

Minimum Student Performance Standards:

Reading
- A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
- C. The student will demonstrate literal comprehension skills. (12, 16)

Writing
- A. The student will compose grammatically correct sentences. (5, 9)
- C. The student will write a paragraph expressing ideas clearly. (24)
- E. The student will write letters and messages. (38, 39, 40)
- G. The student will spell correctly. (55)
- H. The student will punctuate correctly. (62)
- I. The student will capitalize correctly. (70, 71)
- J. The student will write legibly. (80)

Science
- A. The student will apply basic process skills as tools for scientific investigation. (36)
- B. The student will apply basic process skills to problem solving in science. (46, 47)
- J. The student will use science process skills and science information in daily activities. (276, 277)
- K. The student will describe the interactions among science, technology and society. (281, 282, 283, 284)

Introduction: Although much as been done in the field of flood control, we have little control over the weather. However, in dealing with the problem of drought, a variety of solutions offer possibilities. This section explores the subject of finding more water, through desalination, reclamation, surface water development and conservation.

Procedures:

1. Begin the lesson by reviewing the students' ideas for combatting drought.
2. **Finding More Water** (5,10,15)
   a. Introduce the reading, "Finding More Water," pages 26–27 in the student book by explaining that all of the solutions to be presented in the material offer real potential. However, ask the students to consider which solution(s) they find most promising in terms of cost, feasibility, public acceptance and ease of implementation. In other words, which strategy gives the greatest benefit for the least cost.
   b. When the students have completed the reading, solicit their responses to your cost/benefit question. (Conservation should be the consensus answer.)
3. Conclude the activity by having the students write a brief "Letter to the Editor" on the need for one of the water supply solutions. They should support their case by using the class material. If time permits, have the students share their letters with the rest of the class.

Water Conservation

Student Book: Pages 28–31

Minimum Student Performance Standards:

Reading
- A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
- C. The student will demonstrate literal comprehension skills. (12, 16)
- F. The student will demonstrate the appropriate skills for obtaining information. (25, 26)

Writing
- J. The student will write legibly. (80)

Science
- A. The student will apply basic process skills as tools for scientific investigation. (30, 36)
- B. The student will apply basic process skills to problem solving in science. (42, 43, 45, 46)
- J. The student will use science process skills and science information in daily activities. (276, 277)
- K. The student will describe the interactions among science, technology and society. (282, 283, 284)

Introduction: The coverage of water conservation is done in five sections. The first section begins by building an awareness of how much water various water-consuming appliances use. The activity goes on to unveil a light-hearted look at some imaginary Florida fauna which portray their human counterparts wasting water, unmindful of the consequences.

The second segment recaps the problems created by inadequate water supply and how wasteful practices contribute to the difficulties, giving examples such as over-irrigation, wasteful car washing, inefficient uses of water in cleaning and several other examples. The text goes on to tell the readers how they can help with wise water use in the home, giving examples of what the students and their families can do.

The third activity underscores the reality that even a concept such as water conservation is not an easy solution all of the time. A simulation activity is used to bring the point home to the students.

The fourth section is an almanac of some lesser known water facts and figures.

Finally, the lesson concludes with a suggestion that the place to begin practicing water conservation is on the school campus. Some strategies to achieve this goal are provided.

Procedures:

1. Begin the lesson by asking the class to write the following list on a sheet of paper. Announce that this water usage represents that of a family of four for a week.

Dishwasher	7 loads	_____ gallons
Washing machine	8 loads	_____ gallons
Shower	14 @ 5 minutes each	_____ gallons
Tub baths	11 baths	_____ gallons
Toilet	70 flushes	_____ gallons
Lawn sprinklers	3 hours of watering	_____ gallons
	TOTAL WATER USE	_____ gallons

2. Next, have the students estimate the total water consumption involved in these various activities and place their estimates beside each use as indicated.
3. Once the students have finished the exercise, compile and average the estimates on the chalkboard.
4. Discuss the results of the compilation and supply the following actual data.

Dishwasher	7 loads (15 gallons/load)	105 gallons
Washing machine	8 loads (60 gallons/load)	480 gallons
Shower	14 @ 5 minutes each (6 gallons/minute)	420 gallons
Tub baths	11 baths (35 gallons/bath)	385 gallons
Toilet	70 flushes (6 gallons/flush)	420 gallons
Lawn sprinklers	3 hours of watering (1800 gallons/hour)	5400 gallons
	TOTAL WATER USE	7210 gallons

5. **South Florida's Wacky Wildlife** (5,10,15)
   a. For a fun-filled review of some of the basics of water waste and water conservation, turn to "Wacky Wildlife," pages 28–29 in the student book.
   b. When the class has finished the reading, have the students suggest additional creatures and descriptions to add to the "Wacky Wildlife."
6. **Give Me a Break** (5,10,15)
   a. Discuss with the class the importance of everyone doing their part in saving resources. Particularly note that water conservation is something that everyone can do, even the small children in the family.
   b. Have the students read "Give Me a Break," page 30 of the student book.
   c. Once the class has finished the reading, discuss how each student can apply at least some of these water-saving tips at home.
   d. Have each student write a one-page water conservation program for his/her own home. You might have them report the results of their family's acceptance and participation after a week's implementation.

7. **To Water or Not to Water** (15)
   a. Introduce the "To Water or Not to Water" simulation activity, which can be duplicated from pages 31–32 in this guide. Explain to the students that even the best sounding ideas sometimes have their drawbacks and that this exercise should prove the point.
8. **Water Trivia** (5,10,15)
   a. On a lighter note, assign the reading of "Water Trivia," page 31 of the student book to the class.
   b. When the students have completed the reading, they may want to add to these funny and fascinating water facts by researching some of their own. They might even want to supply appropriate illustrations.
9. Conclude the lesson by discussing how the students' new-found knowledge on water conservation might be applied to the school campus. Perhaps the class can construct and conduct a school water audit (with the principal's cooperation, of course). Involve the school custodian. He or she will know where the school water meter is located. In fact, his assistance may be necessary in getting access to it. He might also be invited into the class for a demonstration on how to change a faucet washer. Finally, the class could design and implement a campus water conservation program. There's no better place to put lessons into practice than right at home...and the campus serves admirably in this regard.

Conclusion

Student Book: Page 32

Minimum Student Performance Standards:

Reading

A. The student will demonstrate knowledge of a basic vocabulary as determined by a specified word list. (1, 2)
C. The student will demonstrate literal comprehension skills. (12, 16)

Writing

G. The student will spell correctly. (55)

Science

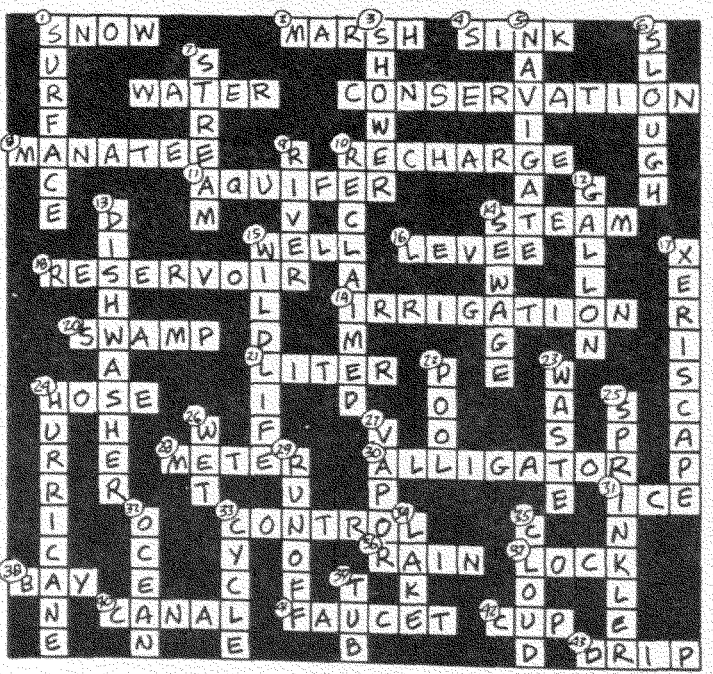
J. The student will use science process skills and science information in daily activities. (276, 277)
K. The student will describe the interactions among science, technology and society. (283, 284)

Introduction: This activity serves to culminate the preceding water unit. It is designed to instill in the students the relevancy of taking the theory of the classroom and making it the practice of life. Few lessons have as much significance for their future quality of life as does learning a respect for our water resources and how they can contribute to its enhancement.

Procedures:

1. Begin the lesson by having the students summarize what they found to be the most important new water information they learned from the unit. Ask them to cite any water-related newspaper articles or radio and television stories.
2. **Classroom poster** (5,10,15)
   a. Refer again to the classroom poster and have the students identify where people-actions come in conflict with the natural environment. Ask the students to describe how people are attempting to resolve these conflicts.
   b. Based on the poster discussion, have the class prioritize the three most pressing water problems in South Florida and then evaluate current and potential solutions to these problems.
3. **Water Crossword Puzzle** (5,10,15)
   a. Have the students turn to the "Water Crossword" Puzzle, page 32 of the student book.
   b. After reading the introduction, have the student solve the puzzle. The exercise serves as an excellent review of the unit vocabulary.
   c. Correct the puzzle, using the answer key below:

ANSWER KEY



4. Conclude the lesson and unit by noting that water is a resource which cannot be taken for granted. It is essential to all life, in both the natural and developed environments. The appreciation of water and its conservation must become part of their lives.

All materials required in the following experiments, e.g., alum, bromothymol-blue solution, can be purchased at a local pharmacy or science supply house.

"How Much Water Does It Have?" Experiment

OBJECTIVE: To develop an understanding of the abundance of water in foods.

MATERIALS:

a potato	a cucumber
celery	a scale
a sharp knife	2 jars
dried peas	dried prunes
dried raisins	other dried fruits
water	

PROCEDURE: PART A

1. Cut thin slices of potato, cucumber, or other fresh vegetable or fruit.
2. Weigh the slices on a scale. Record weight.
3. Put the slices on a sunny windowsill to dry. (To speed drying, use an oven.)
4. When slices are dry, weigh them again. Record weight.
5. Subtract the weight of the slices after dried from the weight when fresh. The difference between the weights is the amount of water lost.
6. QUESTION: What percent of the weight of the fresh vegetables or fruits was water?

FOOD	ORIGINAL WEIGHT	DRIED WEIGHT	DIFF.	% LOST

EXAMPLE: $\frac{4 \text{ oz.}}{16 \text{ oz.}} \times 100 = 25\%$ $\frac{\text{change in weight}}{\text{original weight}} \times 100 =$ % of object that was water

The object was 25% water.

PART B

7. Weigh dried fruits or vegetables, then place in a container and cover with tap water.
8. To allow total absorption, weigh them again in two days.
9. Compare the difference. Compute the percentage gained. Graph results.
10. Which changed more, dried fruits gaining or fresh fruits losing? What percentage change occurred for each?
11. Discuss the results of your experiment.

FOOD	DRIED WEIGHT	AFTER 2 DAYS	DIFF.	% GAINED

"Turbidity" Experiment

OBJECTIVE: To observe the effect solids suspended in water (turbidity) have on penetration of light.

BACKGROUND:

The term used for suspended solids within the water is "turbidity." These are the soil particles and other matter that are "suspended" (floating around) in the water. This is important because the amount of turbidity can affect the amount of light penetration and the color of the water.

MATERIALS:

balance scale
funnel
beaker or jar
graduated cylinder or 1 liter container
water samples from various creeks, rivers etc.
ring stand
ring
filter paper

PROCEDURE:

1. Weigh the filter paper and place inside the funnel.
2. Take a water sample. Using the graduated cylinder, measure 1 liter (just more than a quart) of sample to filter.
3. Slowly empty 1 liter of sample through the filter paper into beaker or jar.
4. Remove the filter paper and allow it to dry completely.
5. Reweigh the filter paper to the nearest milligram.
6. Take the difference between the new weight and old weight of the filter paper.
7. The difference in milligrams would be the amount of suspended solids per liter. Express your answer in parts per million (ppm). This is equal to milligrams per liter.

Weight of filter paper after filtration	mg
Weight of filter paper before filtration	mg
Difference	mg/liter = ppm

QUESTIONS:

1. What effect do you think water clarity might have on plant life?

2. What are some things that might cause turbidity?

3. How might the different types of wetlands help in improving water clarity?

"Building an Artesian Aquifer and Well" Activity

OBJECTIVE: To construct an artesian aquifer and observe what causes water levels in wells tapping it to rise above the top of the aquifer.

MATERIALS: WELL #1

standard aquarium
construction sand (dry)
gauze or cheesecloth
waterproof tape
water
watering can with spout
waterproof modeling clay
clear plastic (or glass) tubing (½" or slightly larger diameter)
2 bottles food coloring (contrasting colors)

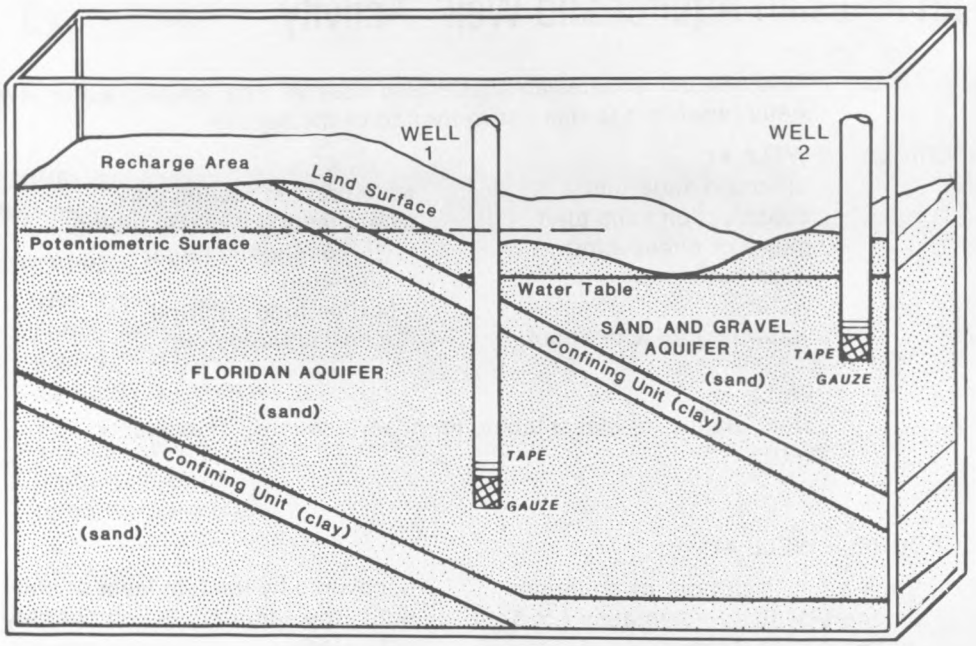
WELL #2

clear plastic (or glass) tubing (or hose)—square, if available
water

PROCEDURE: WELL #1

1. Bank sand in bottom of aquarium on one side to approximately 4 to 5 inches at the highest point. (see illustration)
2. Cover sand with a thin layer of modeling clay. (at least ½ inch thick)
3. Bank another layer of sand, 5 to 7 inches deep, keeping to the original slope.
4. Cover end of plastic hose/tubing with gauze or cheese cloth and secure with waterproof tape.
5. Gently insert hose/tubing into sand along the side of the aquarium (see illustration.)
6. Cover sand with another layer of modeling clay, ½ inch or less, leaving several square inches of sand uncovered at the highest point. (This is the recharge area.)
7. Fill in remainder of space with sand to a level slightly less than the layer of modeling clay.
8. Fill watering can with water and add a few drops of blue food coloring.
9. Gently pour colored water into the recharge area (the area left uncovered by the last layer of clay) until the aquifer is completely saturated.
10. Watch the water as it moves through the confined layer of sand.
11. Water should begin to rise through the plastic tube (well #1) and should reach a level even with the top of the recharge area.

This level to which water rises is called the ***potentiometric surface***. This is the level to which water in a confined/artesian aquifer will rise in a well. The reason the water rises is because it is under a lot of pressure. If this level is above the top of the well, then the water will flow out of the well without pumping. This is called a *free-flowing artesian well*. However, if the top of the well is above the potentiometric surface, the water will still rise above the top of the aquifer, but will not flow out unless it is pumped. Although this well is an artesian well, it is not free-flowing.



WELL #2
A second well showing water table conditions.

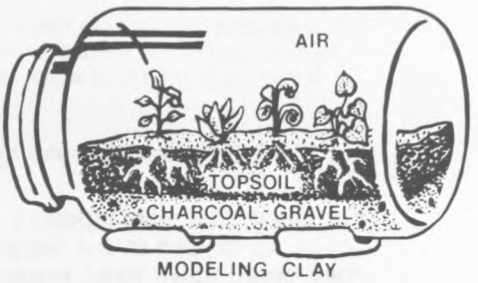
PROCEDURE:

1. Cover end of clear hose/tubing with cheesecloth or gauze and secure with water-proof tape.
2. Gently insert hose/tubing into sand, along the side of the aquarium (see illustration) so that one side of the tube allows an unobstructed view of the inside of the well.
3. Fill watering can with water and add a few drops of yellow food-coloring to differentiate between aquifers.
4. Gently pour or sprinkle water on the surface of the sand to simulate rainfall.
5. Observe the water as it moves through the aquifer and seeps into the well.
6. Water should seep into the well and rise until it reaches a level even with the water table.

"Building a Terrarium" Activity

OBJECTIVE:

To observe the way the water cycle works and how plants interact to maintain a balanced environment.



MATERIALS:

large, wide-mouth, clear jar with lid
charcoal or gravel
topsoil
several small plants
modeling clay
spray bottle
water

PROCEDURE:

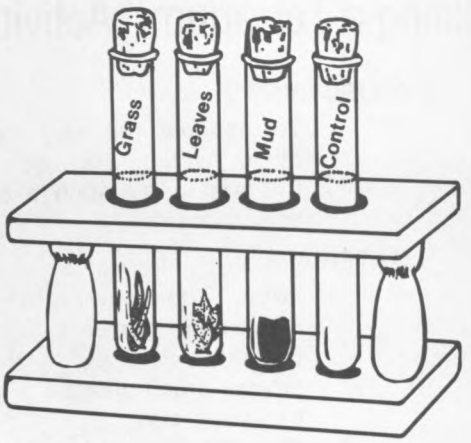
1. Obtain a large wide-mouth jar used to hold salad dressing or pickles. (Check with your cafeteria manager.)
2. Place clay "feet" under jar to prevent rolling.
3. In "bottom" spread 1/2" of charcoal and/or gravel.
4. Layer 2" of topsoil above charcoal.
5. Plant small plants in soil.
6. Using a spray bottle, water plants until soil is completely moistened. Do not water too much.
7. Close lid tightly.
8. Place jar in indirect sunlight. The water cycle soon becomes apparent. The condensation of water appears on jar. Plants begin to grow and transpiration occurs. Transpiration is the release of water into the air from the leaves of plants.
   In this terrarium, all needs for growing the plants are provided by the interaction of light, water, oxygen, and carbon dioxide. This balanced terrarium is an ECOSYSTEM. An ecosystem is a community of animals, plants and their environment. (In this case, there are no animals.) All parts are dependent on each other.
9. Draw a poster of the terrarium and explain what is occuring in the water cycle of your ecosystem.

QUESTIONS:

1. Why don't you need to water the plants like you would plants outside the jar?

2. What would happen to a terrarium without plants, without water, or without a lid?

"Natural Water Pollution" Experiment



OBJECTIVE:

To show that decomposers are using up oxygen in the water as they break down dead materials and wastes.

BACKGROUND:

Wastes such as fertilizers and detergents that are carried into the water of a stream, river or lake cause the rapid growth of algae. The algae flourish for a short time and then die. But then decomposers cause the dead algae to decay. The decay process uses up oxygen in the water. After a while, fish living in the water die due to a lack of oxygen. The change in the water as the oxygen is used up may be detected by using a chemical called "bromothymol blue". Bromothymol blue that is added to the water will become yellow as oxygen is used up.

MATERIALS:

4 corks
water
dead grass
dead leaves
4 test tubes
test tube rack
medicine dropper
mud from a puddle
glass-marking pencil
bromothymol-blue solution

EXPECTED OUTCOME:

I think that dead grass, dead leaves and mud in streams, rivers and lakes can cause water pollution in the following way...

PROCEDURE:

You may work with other students in doing this activity. However, each of you should record your own results.

1. Fill four test tubes about half full of water. Add four drops of bromothymol-blue solution to the water in each test tube. Place the four test tubes in the test tube rack.
2. To the first test tube, add a small amount of dead grass that has been broken up into small pieces. Add a small amount of broken-up dead leaves to the second test tube, and then add a small amount of mud from a puddle (or a small amount of dirt from a pond) to the third test tube. Other than water, no materials should be added to the fourth test tube because it will serve as your control.
3. Use the glass-marking pencil to label each test tube, telling what substance was placed inside. The fourth test tube should be labeled Control. Add more water to each test tube so there is just enough room for a cork. Put a cork into each test tube.
4. Observe the test tubes each day for five days. Record any color changes that take place in the test tubes.

"Who Lives Where?" Activity

Here are some special animals that live in South Florida. Some of these are listed as endangered or threatened species. Read their descriptions and then see if you can place them in their natural habitat. When you have found the correct setting described below, write the names of the animals in the space provided. Keep in mind that animals may use more than one type of habitat and may be listed more than once.

The **BURROWING OWL** is an unusual bird. Unlike most owls, it is active during the daytime and lives underground, sharing its home with other animals.

The **CAPE SABLE SEASIDE SPARROW** is a small bird which is rarely seen except during breeding season. Then the male sings from prominent perches in its marshy home.

The **FLORIDA BLACK BEAR** is a large mammal that feeds on nuts, berries, roots and leaves. It prefers areas of dense cover and can be found in palmetto thickets.

The **FLORIDA PANTHER** is a large, long-tailed, tawny cat which travels long distances throughout southern Florida searching for its favorite prey, the white-tailed deer.

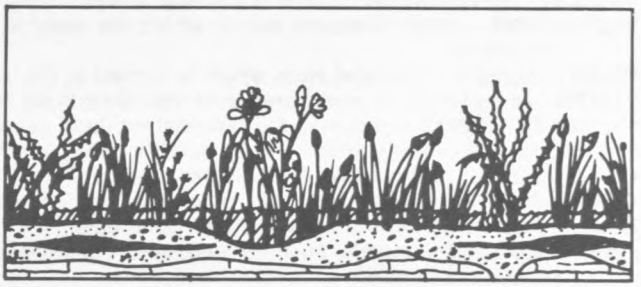
The **GOPHER TORTOISE** is a slow-moving reptile that grazes for many hours each day on grasses, fallen leaves and berries. It digs burrows in the sand to escape the heat. These tunnels provide homes for many other animals.

The **MANGROVE FOX SQUIRREL** is a bushy-tailed rodent, found in South Florida woodlands. It builds leaf nests, high in trees, to provide shelter and nesting areas.

The **SNAIL KITE** is a rare bird of prey. Its sharp, hooked beak helps to extract its favorite food, the Apple Snail, from its shell. Snail kites nest on small tree islands within marshes.

The **WOOD STORK** is a long-legged, white bird with black wings. It nests in cypress or mangrove trees and feeds on small fish, using its stout bill to probe through the muddy waters.

CYPRESS SWAMP FORESTS — This low-lying area is subject to seasonal flooding. Large cypress trees tower over smaller shrubs such as the coco plum, palmetto and wax myrtle. Other vegetation includes saw grass and air plants. Aquatic and water-tolerant insects, fish, reptiles, birds, and large and small mammals populate the area.



PRAIRIE MARSHES — This area of rich, loamy soil is usually saturated or covered with surface water for two or more months of the year. Many "tree islands" are found throughout these marshes which provide excellent nesting habitat for many kinds of birds. Rushes and grasses dominate the natural vegetation.

EVERGLADES — The Everglades historically extended for more than 100 miles from Lake Okeechobee to the southern end of the state. A vast expanse of saw grass, tree islands, sloughs and marshes, it is the largest fresh-water wetland on the Florida peninsula. Water plants, grasses and trees provide food and shelter for a variety of fish, deer, wading birds and aquatic mammals.

PRAIRIE GRASSLANDS — This area was formed by the exposure of ancient beach, dunes and sea bottom to the air and fresh water. The resulting soil is sandy with scattered pockets of organic peat. The area is subject to flooding during the rainy season. Grasses and rushes make up most of the vegetation. Ground-loving animals that like to burrow are often found here.

Water Glossary

ALGAE — aquatic plant which can cause a problem if it grows very rapidly and uses up the oxygen supply in a body of water; such rapid growth occurs in the presence of nitrogen and phosphorus.
ALLIGATOR — large amphibious reptile: Freddy.
AERATION — water treatment step in which the water is sprayed into the air to release unwanted gasses and add oxygen.
AQUIFER — large underground bed of sand and gravel which holds water.
BACTERIA — microscopic organisms which often cause disease.
BAY — body of water partly enclosed by land but having a wide outlet to the sea.
CANAL — constructed channel filled with water.
CAVERN — large, tunnel-like opening in underground limestone, caused by acidic groundwater dissolving the rock.
CHLORINATION — water treatment step in which small amounts of chlorine are added to kill bacteria in the water.
CHLORINE — chemical used to kill bacteria in the water treatment process.
CLOUD — visible mass of tiny droplets, mixed with vapor, suspended in air.
COAGULATION — water treatment step in which alum is added to the water to create floc which attracts particles of dirt.
CONDENSATION — process in which water vapor cools into tiny droplets, which collect and form clouds.
CONFINING UNIT — layer of impermeable rock or sediments which does not allow water to flow easily through it.
CONSERVATION — using water wisely instead of wasting it.
CUP — small bowl used to hold liquids; 8 ounces.
DECOMPOSE — to break down a substance, such as dead plant and animal matter, usually by bacteria or fungi, and oxygen.
DESALINATION — process by which the salt is removed from seawater.
DIGESTION — process in wastewater treatment in which bacteria decompose small impurities suspended in the wastewater.
DISHWASHER — appliance used to clean dishes.
DISINFECTANT — substance used to kill germs.
DRAINAGE BASIN — area from which water flows into a body of water.
DRIP — slow discharge of water.
DROUGHT — period of time in which little or no rain falls.
EFFLUENT — treated wastewater.
ESTUARY — coastal area where freshwater from rivers, streams and canals mixes with ocean saltwater.
EVAPORATION — process in which water is warmed by the sun, turns into a vapor and rises into the air.
EVAPOTRANSPIRATION — combination of the process of plants giving off water vapor from their leaves and evaporation.
FAUCET — device which delivers water from a pipe.
FILTRATION — water treatment step in which the water is piped through layers of sand, gravel and rock to remove solid impurities.
FLOC — clusters of dirt and alum which is formed in the coagulation step of water treatment.
FLOOD — overflowing of water onto land that is normally dry.
FLOOD CONTROL — reducing the potential for flood damage by channelizing streams and building water control structures.
FLOOD PLAIN — areas which can be flooded during storms without causing damage.
GALLON — four quarts; a liquid measure.
GROUNDWATER — water from rain which has seeped down through the soil to aquifers.
HAIL — precipitation in the form of small, solid balls of ice and hard snow.
HEAVY METALS — metals, such as lead, zinc, copper and chromium, which can harm fish life when they become suspended in water.
HOSE — flexible tube used to deliver water.
HURRICANE — severe tropical storm with high winds and heavy rains.
ICE — solid form of water.
IRRIGATION — process of supplying water to dry land by artificial means.
LAKE — natural, non-flowing body of water.
LEVEE — embankment raised to prevent flooding.
LIMESTONE — brittle rock that has many cracks which can fill up with water.
LITER — metric liquid measure; approximately 1.056 quarts.
LOCK — section of a waterway closed off with gates, used to raise or lower the water level to allow boat passage.
MANATEE — large aquatic mammal of warm Atlantic coastal waters; an endangered species.
MARSH — non-forested wetland dominated by aquatic plants.
MICROORGANISMS — tiny animals, such as bacteria.
NAVIGATE — to travel by water.
NUTRIENT — dead plant and animal matter or chemical which serve as food for living plants and animals.
OCEAN — huge body of saltwater which covers ¾ of the earth.
PERCOLATION — process in which water seeps down into the earth.
PERMEABLE — allowing easy passage of a substance, such as water, through soil.
PESTICIDE — chemicals used to kill unwanted insects and small animals which harm crops.
POLLUTION — process by which the environment, such as the air or water, is dirtied.
POROUS — able to hold water, such as soils and rocks which have cracks and spaces.
PRECIPITATION — rain, snow, or hail which falls from clouds.
PRIMARY TREATMENT — first step of wastewater treatment in which the solid materials are removed.

RAIN — liquid precipitation.
RECHARGE — process of replacing groundwater.
RECHARGE AREA — area in which water can seep into an aquifer to refill it.
RECLAIMED WATER — water purified to a level acceptable for some non-potable uses.
RECLAMATION — process by which previously used water is cleaned and treated for another use.
RESERVOIR — artificial lake used for water storage and recreation.
REUSE — using treated wastewater over again.
REVERSE OSMOSIS — desalination process in which water is forced through a membrane, leaving the salt behind.
RIVER — flowing body of water of considerable volume.
RUNOFF — rain in excess of the amount absorbed by the ground.
SALTWATER INTRUSION — act of saltwater moving into an aquifer and mixing with the freshwater, making it unfit for many uses.
SEASONAL VARIABILITY — the change in the amount of rainfall from one season of the year to another.
SECONDARY TREATMENT — the second stage of wastewater treatment in which bacteria "digest" remaining impurities.
SEDIMENTATION — water treatment step in which the water is allowed to stand while the floc settles to the bottom of a tank.
SEPTIC SYSTEM — wastewater treatment system used in rural areas in which the wastewater flows into a large tank where the solids decompose and the effluent is released into the ground.
SEPTIC TANK — the holding tank used in a septic system.
SEWAGE — human wastes carried off by sewers.
SHOWER — device used for bathing which delivers water in a spray, fine stream or drops.
SINK — shallow container, equipped with faucet and drain, used for washing.
SINKHOLE — low spot in the ground, created when the ceiling of an underground cavern collapses.
SLOUGH — swamp, especially one that is an inlet or backwater.
SNOW — precipitation in the form of crystals of frozen water.
SPRINKLER — device used to water a lawn.
STEAM — state of water after boiling.
STREAM — small flowing body of water.
SURFACE WATER — water stored on top of the land; lakes and rivers.
SURFICIAL AQUIFER — aquifer found near the surface of the earth.
SWAMP — land saturated with water dominated by trees.
SWIMMING POOL — water container used for swimming.
TOPSOIL — dirt on the earth's surface, made up of sand, clay, rocks and decayed plant material.
TOXIC CHEMICALS — chemicals which can harm and even kill plants and animals.
TUB — container in which one bathes.
VAPOR — water in the form of a gas.
WASTEWATER — water which has been used.
WATER CYCLE — route water takes as it changes forms between earth and sky.
WATER METER — device used to measure water consumption.
WATER TABLE — shallowest point at which groundwater is found in a given area.
WATER TREATMENT PLANT — facility where water is filtered and treated with chemicals to make it safe to drink.
WELL — hole drilled in the ground to reach a water supply.
WET — condition of not being dry.
WETLAND — area covered or soaked by water at least one month out of the year.
WILDLIFE — animals living in a natural setting.
XERISCAPE — style of landscaping used to reduce water use; it features good design, careful plant selection, improvement of the soil, wise grass use, careful watering and use of mulches.

"Hidden Water Names" Puzzle

Hidden in the puzzle below are 24 water names of South Florida. They include lakes and reservoirs, as well as rivers, creeks, canals, bays and sloughs, which make up South Florida's waters. Many of them can be found on the maps on pages four and six. NOTE: Only the proper part of the name has been used. For example, only KISSIMMEE has been used, not River or Lake. The names may be spelled out forwards, backwards or on the diagonal. When you have found a name, circle it.

ATLANTIC Ocean
BISCAYNE Bay
CALOOSAHATCHEE River
CYPRESS Lake
EVERGLADES
FISHEATING Creek
FLORIDA Bay
Lake HATCHINEHA
Lake HICPOCHEE
HILLSBORO Canal
HOMESTEAD Canal
Lake ISTOKPOGA
KISSIMMEE River and Lake
LOXAHATCHEE River
Gulf of MEXICO
MIAMI Canal
N. NEW RIVER Canal
NUBBIN Slough
Lake OKEECHOBEE
SHARK River Slough
ST. LUCIE Canal
TAYLOR Slough and Creek
Lake TOHOPEKALIGA
WEST PALM BEACH Canal

A	T	G	N	I	T	A	E	H	S	I	F	C	Y	P	R	E	S	S
H	S	O	B	N	W	E	S	T	P	A	L	M	B	E	A	C	H	C
D	B	U	W	L	E	E	V	E	R	G	L	A	D	E	S	E	D	J
E	I	J	F	O	O	W	W	C	G	I	S	T	O	K	P	O	G	A
E	W	P	E	H	K	V	R	B	E	L	V	I	N	U	B	B	I	N
H	V	K	T	R	X	E	E	I	C	A	O	C	I	X	E	M	F	L
C	M	Z	G	J	N	Q	E	S	V	K	H	Y	O	B	A	I	P	Z
O	L	O	X	A	H	A	T	C	H	E	E	M	M	I	S	S	I	K
P	Q	J	R	K	M	S	K	A	H	P	R	T	M	G	L	T	A	S
C	I	T	N	A	L	T	A	Y	L	O	R	O	B	S	L	L	I	H
I	L	M	R	U	X	N	U	N	Y	H	B	V	D	W	O	U	C	A
H	X	P	D	A	E	T	S	E	M	O	H	E	Q	Y	E	C	Z	R
S	C	A	L	O	O	S	A	H	A	T	C	H	E	E	N	I	R	K
F	L	O	R	I	D	A	H	E	N	I	H	C	T	A	H	E	A	F

"Water Treatment" Experiment

AERATION

OBJECTIVE: To demonstrate the steps required in treating the water we drink.

MATERIALS:

- mud or dirt
- wire screen
- water source
- fine sand
- half-gallon container
- pebbles
- 2 one-quart jars with lids
- coarse sand
- glass-marking pencil
- cup
- mixing container
- 10 alum crystals
- clock with second hand
- one-liter plastic bottle
- scissors or knife
- tablespoon

COAGULATION

SEDIMENTATION

FILTRATION

PROCEDURE:

1. Mix ½ cup of mud or dirt with 2 quarts of water in a half-gallon container until the water appears dirty.
2. Evenly distribute the dirty water into the 2 one-quart jars, leaving about 3 inches of space at the top of each jar. Label jars "A" and "B".
3. AERATION: Place a lid on top of jar "A" and shake it for 10 seconds. Next pour the water back and forth into the mixing container.
   How does this action allow the trapped gases to escape and new oxygen to be added to the water?
4. COAGULATION: Dissolve 10 alum crystals in 1 tablespoon of warm water in a cup. Grind the crystals while mixing them into the solution. Pour the contents of the cup into the jar of aerated water, rinse the cup and add this water to the jar. Slowly stir for five minutes and observe the formation of "floc".
   How rapidly did the floc begin to form?
5. SEDIMENTATION: Allow the floc to settle and observe every five minutes.
   How long did it take before the floc had settled to the bottom?
6. FILTRATION: Make a filter using the one-liter plastic bottle. Cut the bottle in half and turn the top up-side down. Place a wire screen in the bottom to hold further particles inside your "funnel". Layer the pebbles on top of the screen, then the coarse sand and the fine sand.
7. Run some tap water through the filter to make sure that it is clean. Slowly pour off half of the water from the sedimentation jar into the filter bottle, being careful not to shake it. Compare jar "A"'s filtered water with jar "B"'s muddy water, and with the remaining "floc" water. Describe the differences in appearance of the water in each container.

"Groundwater Pollution" Experiment

NOTE: Use experiment, "BUILDING AN ARTESIAN AQUIFER AND WELL," on pages 16 and 17 of Lesson One to perform this experiment.

OBJECTIVE:

To show how the Sand and Gravel Aquifer can become polluted by contaminants on the land surface.

MATERIALS:

Refer to experiment, "BUILDING AN ARTESIAN AQUIFER AND WELL."
red food coloring
syringe
water

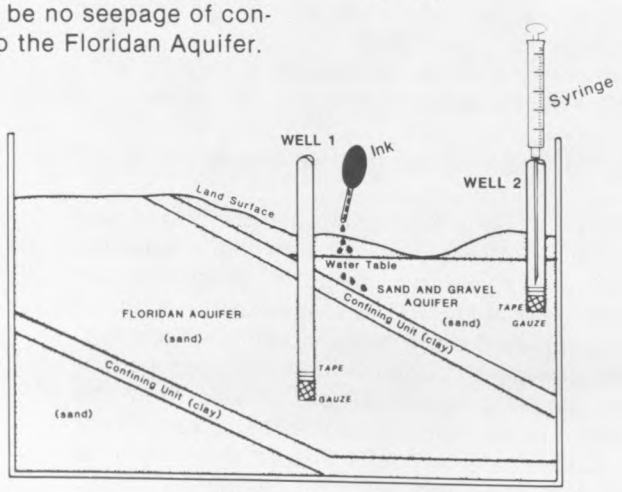
PROCEDURE:

1. Introduce drops of red food coloring (representing a contaminate-source of pollution) to the surface area away from Well #2. You may want to dilute it slightly with water.
2. Observe as the red coloring begins to mix with the water in the Sand and Gravel Aquifer.
3. To speed up the movement of the contaminant, insert the end of the syringe (simulated pump) into the well and remove water.
4. Repeat pumping action to speed movement of contaminant through the water and into the well.
5. Note that if the layer of clay (confining unit) has been properly installed, there should be no seepage of contaminant into the Floridan Aquifer.
6. Review all procedures and discuss:
   ***The Floridan Aquifer is less likely to become contaminated from pollutants placed on the land surface because...

   ***Potential for ground water pollution in your area...(use newspaper articles, television reports and personal observations)

   ***Sources of water supplies in your area...(Does your water supply come from the Sand and Gravel or Floridan Aquifer, or from a surface water source?)

   ***Agencies responsible for testing water...



"To Water or Not to Water" Simulation Activity

This activity requires you to weigh the pros and cons of water usage under certain circumstances. Read the values and the story and then discuss what you think you would or could do in such a situation.

Value 1.

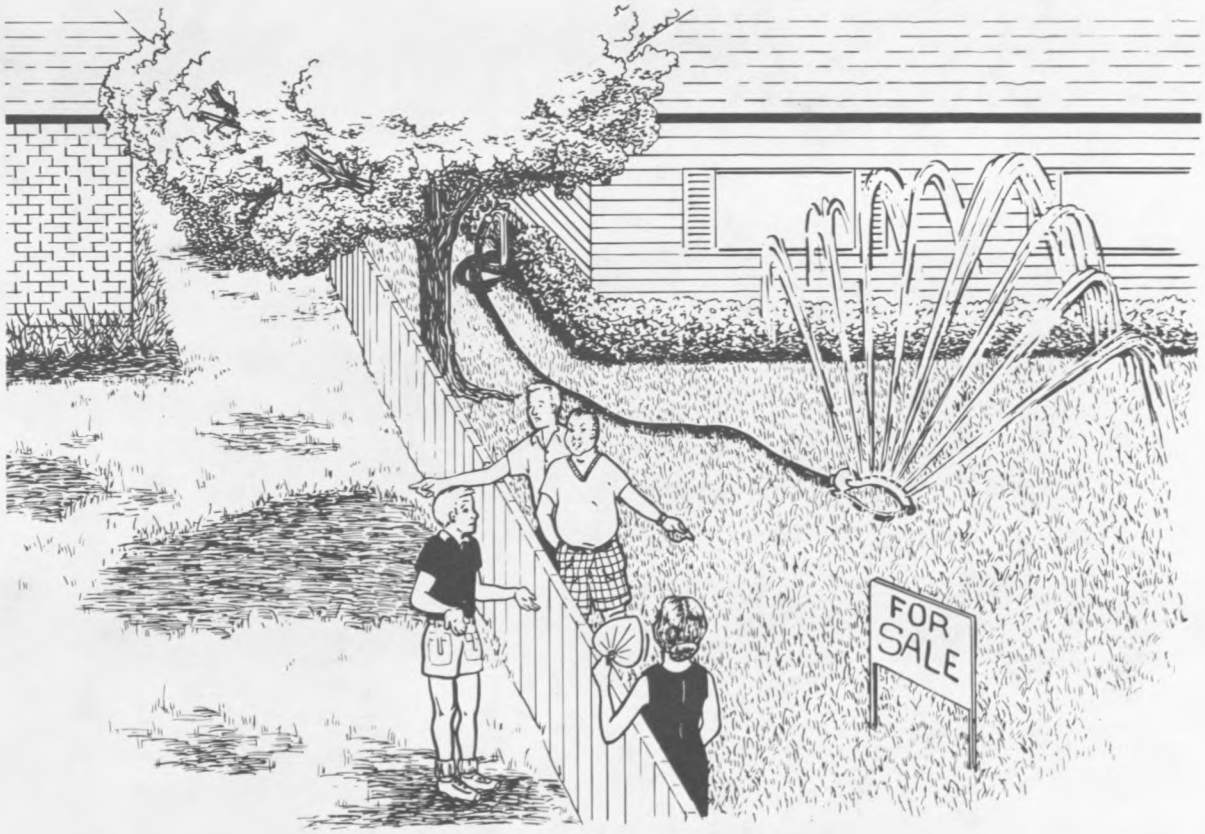
GREEN, HEALTHY GRASS ADDS TO NEIGHBORHOOD PROPERTY VALUES. Green, healthy grass increases property value. Brown, sparse grass lowers property value. An ugly lawn reflects poorly upon the entire neighborhood.

Value 2:

CONSERVATION OF WATER IS A COMMUNITY PROJECT. Conservation of water usage during hot, dry summer days helps to maintain an adequate supply for all. Unlimited use of water by a single community dweller limits the supply of water available to other residents.

STORY

Frank Robinson, a long-term resident of your community, lived in a home in the heart of a nice neighborhood. He had noticed that this particular July the weather had been unusually dry. Therefore, he felt it was his obligation as a member of the community to severely cut back on the watering of his lawn in order to save water.



Other residents did not follow his example. They did not think the problem was that bad. They continued to water their lawns on a regular basis. By mid-August, rain had not fallen. It was reported that the water table had dropped considerably.

Most of the people who live in the neighborhood stay about two years at the most. Within a year most of the residents are transferred to other areas in the state. These residents are interested in maintaining high property values. After all, they bought the property in order to make a profit upon resale.

Late August arrived; still no rain. Mr. Robinson's grass noticeably turned brown and some bare spots appeared.

Some of the residents complained of the loss of water pressure but continued to use water unwisely. John Dixon, next door neighbor to Frank, placed his house on the market. John had been transferred to a new location; he was anxious to sell his property.

Prospective buyers of John's property looked elsewhere in town. The property next door was in bad shape. There was no excuse for such lack of care given to that lawn.

John Dixon and some other residents met with Frank Robinson to discuss the problem. Frank refused to listen and tried to explain that his conservation of water would, in the long run, benefit his community.

DISCUSS BOTH SIDES
Do values 1 and 2 conflict?

Was Frank unreasonable?

How would you react if you were Frank? Explain.

How would you react if you were John? Explain.

What are some alternatives that might please both sides?