

# LESSON 3: Landfill in a Jug

## LESSON'S CONCEPTS

- Placing waste material in landfills is the most common method of disposing of solid waste in the United States today.
- Landfills take up space and are located in areas that are, or once were, habitats for people and wildlife.

## PURPOSE

Students will demonstrate that solid waste takes up space in a landfill and that many materials can be diverted from the landfill and reused or recycled.

## OVERVIEW

In this lesson students will:

- Listen to stories, such as *Farewell to Shady Glade* by Bill Peet and/or *Where Once There Was a Wood* by Denise Fleming, and discuss how a landfill can affect habitats of wildlife and people.
- Construct model landfills in a gallon jug, add garbage to these models on a daily basis, and record what has been added.
- Discuss what they can do with the new garbage when most of their model landfills are full.
- Identify the garbage they placed in the model landfill that could have been reused or recycled.

## CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS

- Students construct model landfills in a gallon jug, add garbage to these models on a daily basis, and record what they have added.
  - "Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept . . . students will: draw pictures that portray some features of the thing being described." (*Science Content Standards, Grades K-12; Grade 1; Investigation and Experimentation, Standard 4a*)

- "All matter has properties that can be observed, defined, and recorded. Matter occupies space, it has substance, and we can measure its weight." (*Science Framework, page 41*)
- Students develop a chart of items that often go into a garbage can, and they record each day the items which were placed in the model landfills. They categorize items in the model landfill as "reusable" or "recyclable."
  - Students "record observations and data with pictures, numbers, and/or written statements." (*Science Content Standards, Grades K-12; Grade 1; Investigation and Experimentation, Standard 4b*)
  - "Students sort and classify objects." (*Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve, page 2*)
- Students listen and interpret stories about wildlife and habitats.
  - "Students identify the basic facts and ideas in what they have read, heard, or viewed." (*English-Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve, page 2*)
  - "Different types of plants and animals inhabit the Earth. As a basis for understanding this concept, students know: stories sometimes give plants and animals attributes they do not really have." (*Science Content Standards, Grades K-12; Kindergarten; Life Sciences, Standard 2b*)
- Students generalize how a landfill can affect habitats of wildlife and people.

- "To develop geographic literacy, students must: Understand human and environmental interaction." (*History–Social Science Framework*, pages 15 and 16)
- Students show through drawings what happens to garbage after it is placed in a garbage can. They also draw and label items they placed in their model landfills on a daily basis.
  - "Students create original artworks based on personal experiences or responses." (*Visual and Performing Arts Framework*; Goal 4, page 101)
- Students sort objects in their landfills and develop a chart or bar graph, using pictures to show what materials should be reused, recycled, or placed in a landfill.
  - "Students organize, represent, and com-

pare data by category on simple graphs and charts." (*Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 6)

### SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, categorizing

### TIME

60 minutes to prepare for the lesson; 45–60 minutes per day for five days to implement the lesson

### VOCABULARY

garbage, landfill, recycle, reduce, reuse, solid waste, trash

## PREPARATION

- \_\_\_ 1. Read the "Background Information for the Teacher" at the end of this lesson.
- \_\_\_ 2. Obtain examples of pictures from magazines and old calendars that show pictures of natural areas, such as forests, deserts, and grasslands.
- \_\_\_ 3. Contact the local waste management coordinator and ask for information about the nearest landfill. (Check the telephone directory, or call California Integrated Waste Management Board's Office of Integrated Education at (916) 341-6769 to get the phone number for your city's or county's solid waste department, often part of the Department of Public Works.) If possible, have the coordinator send you photographs and other information on the landfill. Also, ask whether the coordinator is willing to come to speak about solid waste to the class or to set up a field trip. The coordinator will also have information about what could be recycled in your community.
- \_\_\_ 4. If possible, arrange to take students to see a local landfill or take slides or a video of the landfills to show the class. If that is not possible, show the video, *Kids Talking Trash* (available free of charge

- \_\_\_ 5. Ask students to bring plastic jugs from home. Cut the top off each jug. Pre-cut enough 1-gallon plastic water or milk jugs to provide one for each pair of students. (Clear, 1-gallon plastic juice containers would also work.) If any of the edges are jagged, trim them with scissors and tape with masking tape. Recycle the top portion of each jug. Cut blue construction paper to fit the bottom of each jug. See "Diagram of Landfill in a Jug" at the end of this lesson (page 34).

**Note:** Younger students may need a container larger than one gallon in which to work.

- \_\_\_ 6. If available, locate an area on or near the school grounds where students can collect grass, sticks, leaves, and small rocks to place in their model landfills. If such an area is not available, explain to students what they will be making and assign them to bring from home items to make the area inside their 1-gallon jugs more natural. (You might need to discuss with students what the term "more natural" means.)
- \_\_\_ 7. Make a transparency of "A Simple Diagram of a Landfill" (page 35).

## MATERIALS

### For “Part I, Designing a Natural Area in a Jug”

- \_\_\_ Enough 1-gallon milk or water jugs to provide one for each pair of students
- \_\_\_ A custom cut piece of blue construction paper for the bottom of each jug
- \_\_\_ Enough garden soil (not potting soil, because it is sterilized) to provide 6 cups for each student
- \_\_\_ Grass, sticks, leaves, rocks, plastic animals
- \_\_\_ Pictures (from outdated calendars) and books containing pictures of natural areas, such as forests, deserts, grasslands

### For “Part II, Reading Farewell to Shady Glade or Where Once There Was a Wood”

- \_\_\_ The following books:
  - *Farewell to Shady Glade* by Bill Peet
  - *Where Once There Was a Wood* by Denise Fleming

### For “Part III, Developing a Landfill”

- \_\_\_ The book, *Where Does the Garbage Go?* by Paul Showers
- \_\_\_ Transparency of “A Simple Diagram of a Landfill”
- \_\_\_ A small garbage can with nonhazardous solid waste, such as various types of paper, aluminum can, bottle, plastic cup, plastic bag, toys; at least one item for each student
- \_\_\_ One metal spoon for each pair of students
- \_\_\_ Scissors, tape, utility knife
- \_\_\_ Several plastic grocery bags, cut in fourths; or sandwich bags (to be used as landfill liners)
- \_\_\_ Clay or clay soil (enough for each pair of students to mold the clay or clay soil under their landfill; approximately 1 cup per jug)
- \_\_\_ Several cups of gravel
- \_\_\_ Plastic containers for soil dug up from the landfill in a jug

### Optional

- \_\_\_ The video, *Kids Talking Trash* (shows a landfill)
- \_\_\_ The book, *Trash!* by Charlotte Wilcox (contains photographs of a landfill)

### For “Part IV, Filling the Landfill with Garbage”

- \_\_\_ Assorted small pieces of garbage between  $\frac{1}{2}$  and 1 inch in size

(e.g., pieces of fruit, bread, leaves, cloth, newspaper, copy paper, aluminum foil; bottle caps; rubber bands; paper clips; pennies; plastic scraps; grass)

- \_\_\_ A pair of plastic or garden gloves for each pair of students

**Note:** If you would like to build a model of a sanitary landfill with your students, see the 4–6 Module, Unit 1, Lesson 2.

## PRE-ACTIVITY QUESTIONS

- A. Have students sit in a circle on the carpet, and place the garbage can containing non-hazardous solid waste in the middle of the circle. Ask the following questions.
- What is this? *A garbage can.*
  - What goes in it? *Trash; garbage; things we don’t want anymore.*
  - Why do we need to throw away garbage? *Gets smelly; takes up space.*
  - What are some garbage that we throw away? *Paper, cans, food scraps.*

Tell students that the difference between trash and garbage is that trash includes dry waste and does not include food waste; whereas, garbage is made up of dry waste and food waste. Solid waste includes garbage, yard waste, and other household waste (like appliances and furniture).

- B. Make a chart labeled “What Goes in a Garbage Can” and list students’ responses. Allow students to look inside the garbage can for additional ideas. If some students indicate that some of the items could be recycled, circle the names of those items, but at this time do not get into the topic of recycling. Keep the chart for reference, to add information to, and to use for assessment at the end of the unit.

### What Goes in a Garbage Can?

- |                 |                      |
|-----------------|----------------------|
| 1. Bottles      | 7. Plastic bags      |
| 2. Wrappers     | 8. Cardboard         |
| 3. Newspapers   | 9. Broken pencils    |
| 4. Chip bags    | 10. Plastic spoons   |
| 5. School paper | 11. Empty food boxes |
| 6. Paper plates | 12. Leftover food    |

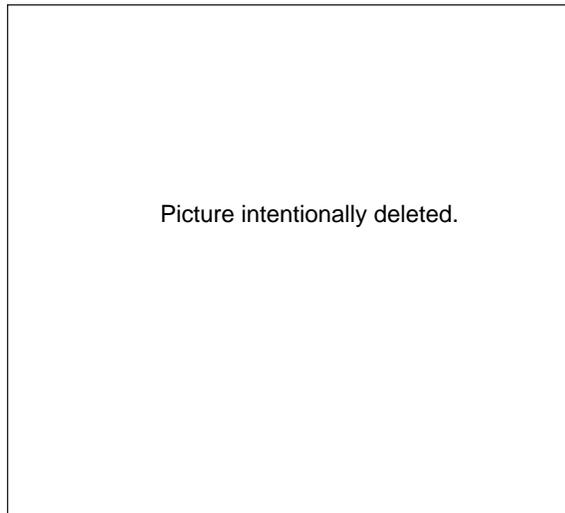
Submitted by Ted Schut’s first-grade class, Ripona Elementary School, Ripon Unified School District.

C. Ask students to use drawings or discuss and record responses to complete this sentence: "I put my garbage in a garbage can; then it goes . . ." Prompt students with the following questions:

- What happens to the garbage after it goes in the garbage can?
- Who moves the garbage can? *At school it is usually the janitor. At home it is a family member who places the garbage can by the curb.*
- How does the garbage get into the garbage truck? *Sometimes people lift the garbage can and throw the contents into the truck, and sometimes the truck has a special machine that lifts the can and places its contents into the truck.*
- Where does the garbage truck take it? (Some students will not know this or will say the landfill. Since this is the pre-activity section, allow students to answer in their own way.)
- If students completed drawings concerning where the garbage goes, then encourage several students to share and explain their drawings.

**Note:** To find out what happens to the garbage in your community after it leaves the curb, check with your local garbage company. In some communities the garbage truck takes the garbage directly to a landfill. In other communities, the garbage truck takes the garbage to a transfer station. From the transfer station, the garbage is placed on large transfer trailer trucks for hauling to the landfill. Some communities have a materials recovery facility (MRF) where the materials are first separated into recyclable materials and nonrecyclable materials. The nonrecyclables (solid waste) are then hauled to a transfer station or directly to a landfill. (See photograph on page 36.) (You may share this information with students in the next section of this lesson.)

D. If you were able to get the local waste management coordinator to speak to your class, have the class develop a list of questions for the speaker. Then send these questions to the speaker ahead of time so he or she can prepare the answers for the class.



Students in Carolyn Ann Weiss's fifth-grade class at Jefferson Elementary School begin designing a natural area in plastic jugs.

## PROCEDURE

### Part I, Designing a Natural Area in a Jug

- A. Tell students that they will be designing a natural area in a jug. Do the following:
1. Provide one jug to each pair of students.
    - Have students place the custom cut (the size of the bottom of the jug) piece of blue paper in the bottom of their jugs.
    - Tell students that the construction paper represents water found underground. This is called groundwater.
    - Place (or have students place) four cups of soil on top of the blue paper. Ask what this could represent. *Soil on Earth.*
  2. Tell students to design a natural area inside the gallon jug, such as a grassland, oak woodland, or desert. They can do this by adding items, such as grass, sticks, leaves, and rocks. You can ask students to bring materials from home or organize a collecting expedition on or near the school grounds. Provide pictures and books containing pictures of natural areas.
  3. Encourage students to draw or list some plants and animals that might live in the natural areas they have created. They can make cardboard cutouts of some living things.

## Part II, Reading *Farewell to Shady Glade* or *Where Once There Was a Wood*

- A. Introduce students to the word *landfill*. Show photographs, read sections of a book (pages 4–16 in *Where Does the Garbage Go?* by Paul Showers) and/or show a video about landfills. (At the beginning of the video, *Kids Talking Trash*, a landfill is shown; show only that section at this time.)

**Note:** Other books, such as *Trash!* by Charlotte Wilcox, contain photographs of a landfill.

- B. Do one or both of the following:
- Read to students the book, *Farewell to Shady Glade*. Have students suppose that a landfill was planned in Shady Glade. Discuss:
    - How will Shady Glade be affected? *Shady Glade would be filled with garbage.*
    - How might the animals that live in Shady Glade be affected? *They wouldn't have a place to live. The animals' homes might be destroyed. Do animals always have another place to move to? No.*
    - Could real animals jump on a train to go to another area to live? *No.*
    - How could animals get to another area to live? *They can walk or run, slither, or fly there.*
    - If the animals move to another place, what happens to the animals that already live in that other place? *The animals might be crowded and fight for territory; there might not be enough food and shelter for all of the animals.*
    - Can animals really talk as people do? *No.*
    - Do animals, like people, need a place to live? *Yes.*
  - Read to students or have students read the book, *Where Once There Was a Wood*. Have students imagine that instead of a housing development, a landfill was placed in the area of the forest. Discuss:
    - How would the landfill affect the forest? *The trees would be cut down.*
    - What could the people who are developing a landfill do to help

the animals? *They could make sure the animals have another place to live. They can leave trees around the landfill for the animals.*

**Note:** It is important for students to realize that many landfills are also in cities and not just located far away in nature. Any time a landfill is built, the area will change because of the construction of the landfill.

## Part III, Developing a Landfill

- A. Tell students that they will be developing a landfill in their plastic gallon jugs.
- Provide metal spoons.
  - Have students use metal spoons to dig a hole for a landfill in the soil in their gallon jugs. They can make the hole as small or as large as they want, but they should not touch the blue paper, which represents groundwater.
  - Have them note that the soil area was disturbed as a result of digging the hole.
  - Ask what could be done with the soil that was dug up. *The soil could be placed in a garden, in a pot with a plant, or in a container.* Tell students that because they will need this soil at a later time, they should place it in other containers.
- B. Ask students what the blue paper on the bottom part of the gallon jug represents. *Water under the ground.* Tell students that people pump this water through wells and use it to drink and to water their crops. Garbage should not touch or leak on the blue paper.
- C. Challenge students to make sure that their landfills won't leak on the blue paper, even if it rains on the landfill. Allow students to design their landfills and provide the materials they ask for. Some students might think to place a plastic liner, gravel, and/or clay (or clay soil) under the garbage; other students might not. Allow students to make their own decisions.
- D. Provide about six or seven pieces (about 1/2 to 1 inch in size) of garbage and/or allow students to find something in the classroom that they could put in their landfills. They can refer to the chart, "What Goes in a Garbage Can?" that they created.

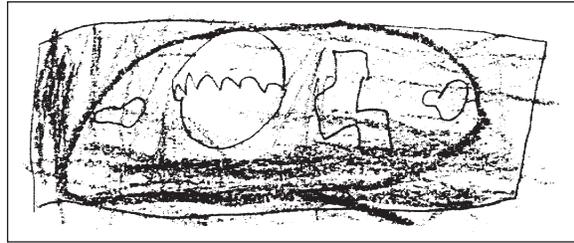
Offer some additional examples, such as a piece of crayon, part of snack/lunch, a leaf, a piece of paper, or a tissue.

- Ask students to record in their journals today's date and to describe what they plan to place in their landfills.
  - Have students pretend that they are unloading a garbage truck, and have them place pieces of garbage in their landfill. Ask the students what they might do before the garbage trucks arrive the next day to keep the garbage from smelling, blowing away and becoming litter, or attracting rats? *Cover the existing garbage with soil.* Explain to students that in real landfills, covering the garbage on a daily basis is required by law.
- E. Show students the transparency, "A Simple Diagram of a Landfill." Ask students to compare the drawings in the transparency to the landfills they completed.
- F. Allow students to redesign their landfills. They can remove the garbage and add clay, a liner, and gravel, and then they can place the garbage on top of the gravel.
- G. Ask students to draw pictures of their model landfills in their journals. They can also write how they developed their landfills and what they added to their landfills. They should describe their journal entries to a group of students.

**Homework Assignment:** Have each student name his or her landfill and to share the name with the class the following day.

#### Part IV, Filling the Landfill with Garbage

- A. Students will be adding garbage to their landfills every day for about five days or when at least half of all the landfills in jugs are full. Ask students to draw and label in their journals the items they "dumped" into their landfills every day. Each day, students should pack down the garbage, as the compactors do at a real landfill. (They should determine a way to do this without touching the garbage.) Then they should cover the new garbage layer with soil. This simulates how the garbage at a landfill is covered daily with soil to eliminate odor and to keep animals, such as rats, out of the landfill.



Submitted by Beverly Hayes, kindergarten and first-grade teacher, John A. Otis Elementary School, National School District.

First we dug the hole. Then we put clay to cover the soil. Then we put the banana peel and other garbage.

Before that there was a beautiful area for animals and plants but you see now it's filled up with garbage and stuff like that.

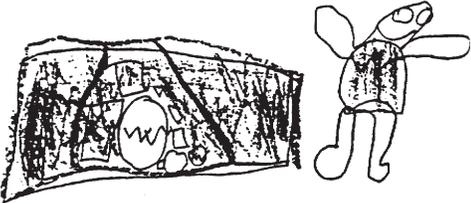
Submitted by Anne Harris, second-grade teacher, Jefferson Elementary School, Cloverdale Unified School District.

1. Note that some landfills in a jug will become full before others. The students with full landfills can work on a plan on what to do with their future garbage. Maybe some can negotiate using someone else's landfill on a temporary basis.
  2. When most students' model landfills are full, ask what students can do with the new garbage. Ask students to describe the results of their negotiations concerning the use of someone else's landfill. If some students recommend digging new landfills, discuss the impact the new landfill will have. Lead students to a discussion on recycling and reusing. Discuss how not to make garbage in the first place by not buying as much stuff that will become garbage when you are done with it. (This concept will be covered in Unit 2, Lesson 1.)
- B. If available, show the entire video *Kids Talking Trash*. Discuss those parts applicable to this lesson.

NAME Jonas  
DATE 4-9-97

**LANDFILLS**

**WE MADE A MODEL OF A LANDFILL TODAY. HERE IS A PICTURE OF OUR LANDFILL.**



**THIS IS WHAT WE PUT IN OUR LANDFILL:**

Jelly beans, egg shells,  
Paper towel, Chalk, Paper  
Scraps

Submitted by Beverly Hayes, kindergarten and first-grade teacher, John A. Otis Elementary School, National School District.

- C. Have students create a master list of all the items that they placed in their landfills. Label the list, "What Went into Our Landfill Each Day." With two different colored markers, have students help you circle those items on the chart which could be reused or recycled. This can be referred to throughout the unit as students add to the list and circle new items that can be reused or recycled (or both).

**Part V, Digging in the Landfill**

- A. After five days or when the landfills are full, provide plastic or garden gloves to each pair of students and have them sort through their landfills. They should do this, if possible, without disturbing the non-landfill areas in their jugs.
- B. Discuss what in their landfills could have been reused or recycled. Could some of the items not have been used or bought in the first place?

**DISCUSSION/QUESTIONS**

Ask students:

- How long did it take for the landfill to fill up?

- Why did some landfills fill up faster than others? *Smaller hole; more garbage was placed in the hole.* Although the students' landfills are much smaller than real landfills, the concepts still apply. Some communities have to expand their landfills, as they are too small. Most communities in California have reduce, reuse, and recycle programs in place, so the garbage doesn't fill up landfills too quickly.
- What could students have done to keep the landfill from filling up too quickly? Explain that cities and counties throughout California are trying to keep a lot of the solid waste from going to landfills. This solid waste can be reused or recycled. (Note that since some "solid waste" can be reused or recycled, it is not really waste, but is actually materials which can be reused or recycled.) Some cities and counties are also expanding their landfills. All of these expansions require a layer of clay soil under a plastic liner and a layer of crushed rock followed by a layer of soil to be placed on the ground before any garbage is added. The clay soil, liner, and layers of other materials (e.g., gravel) are used to protect the groundwater from becoming contaminated by rainwater that can pick up hazardous substances from the garbage.
- Was it easy to take the garbage out of the students' landfills and to separate it?
- Would it be easy or difficult to try to separate the garbage from a real landfill? *Difficult.* What would some of the problems be? Explain to students that some communities have a "recovery" facility that takes all types of solid waste and materials and separates it. However, in a landfill, once the solid waste has been covered with soil, it is very difficult and would be very expensive to try to remove all the items that could be reused and recycled. Therefore, it is more efficient to separate the recyclable and usable materials before the solid waste is buried in the landfill.
- What was the condition of the items placed in the model landfills when they were removed? Was anything rotting? Explain to students that solid waste placed in landfills usually does not rot or decompose rapidly, because there is not enough air for many living things (e.g., certain bacteria and fungi) that make things decompose. However, there are bacteria that do not need oxygen to live, and they

can decompose materials. Therefore, some decomposition does occur in landfills. (This topic will be addressed further in the K–3 Module, Unit 3.)

### FIELD TRIP OR SPEAKER

- A. Take students on a field trip to see their local landfill (or transfer station). Students should note that it would be quite difficult to separate garbage once it is placed in the landfill. Many urban areas also have transfer stations, where the garbage is taken and loaded on larger trailer trucks for transporting to the landfill. These might be closer to the school and easier to visit.
- B. If a field trip is not possible, ask the waste hauler or local solid waste coordinator to visit your class and explain where the garbage goes. Ask whether the speaker can bring a video, slides, or pictures of the local landfill.

### APPLICATION

- A. Discuss, as a class, the pros and cons of placing garbage in a landfill. For example, some pros include: that garbage needs to go somewhere, and a landfill keeps garbage away from where people live; placing garbage in a landfill is easy; the garbage is better contained. Some cons to placing garbage in a landfill are: landfills take up space which can be used by people and wildlife; a landfill is unsightly; a landfill might pollute groundwater. Also, landfills themselves have limited space. When a community’s landfill closes, where will its garbage go?
- B. Ask students to review the chart, “What Goes in a Garbage Can,” and decide whether the items for recycling are accurate. Ask what other items should be recycled, and add these to the chart.
- C. Have students determine what items in their model landfills (including the containers themselves) should be reused, recycled (or composted), or placed in a landfill after the activity. For example, many communities recycle rinsed gallon HDPE bottles (high-density polyethylene); organic wastes, such as banana peels and leaves, can be composted or mulched; pennies can be reused; newspapers can be recycled, mulched, or composted; aluminum

can be recycled; cloth, if cotton, silk, wool, or other all-natural fiber, can be reused or even mulched.

- D. Help students develop a class chart or bar graph using pictures to show what should be reused, recycled, or placed in a landfill.

*Note:* In Unit 2 in the K–3 Module, students will explore further the concepts of reusing and recycling.

- E. Ask students to write or to draw and label in their journals what they can do to keep garbage out of a landfill.

What I Can do to Reduce  
garbage that goes to  
the Landfill:  
give away my toys  
compost food  
reduce the amount of  
paper I use  
Reuse old chairs

Submitted by Debby Carter’s first-grade class at Coyote Valley Elementary School, Middletown Unified School District.

*Project Idea:* Look at the types of materials that are thrown away in the classroom. Determine what items do not need to be used (or bought in the first place). Use items that can be reused instead of those that become garbage after just one use. Reuse everything possible in the classroom. Recycle everything possible (that cannot be reused) in the classroom and take it to a recycling center.

### VARIATION

Have students weigh the garbage before they place it in their model landfills. Then once they have removed the garbage and separated it, have students calculate the total weight for items that could be reused, those that could be recycled, and those that need to be placed back in the landfill. This will indicate how much garbage by weight can be diverted. Students should know that landfills do not close because they “get too heavy”; they close because space is used up by the garbage. However, because volume is too difficult to measure (also, some garbage brought to the landfill is compacted,

whereas other garbage is not), trucks with garbage are often weighed at the landfill, and their drivers pay to dump their garbage based on the weight of the garbage.

## EXTENSIONS

- A. Have students make mini-compost containers to demonstrate what happens to garbage when it is exposed to air and water. Students should also make several model landfills and compare these to the mini-compost containers.
- B. Students could design their landfills to be kept from year to year and shared with the new classes.
- C. Students could develop a map showing where their garbage goes.

## RESOURCES

### Videos

*Bill Nye the Science Guy: Garbage.* Disney Educational Products, 1995 (50 minutes).

Bill Nye shows that garbage usually does not decompose in a landfill.

*Garbage, Garbage, Garbage.* The Green Earth Club series. Produced by TV Ontario, 1992.

Chatsworth, Calif.: AIMS Media (distributor) (15 minutes).

Shows a landfill site and explains what usually happens to garbage after it leaves our homes.

*Kids Talkin' Trash.* Alameda County Waste Management Authority, 1995. Distributed by the California Integrated Waste Management Board (14 minutes).

Students learn how to make less garbage and protect the environment by practicing the four R's: reduce, reuse, recycle, rot. Shows a landfill.

## Books

Fleming, Denise. *Where Once There Was a Wood.* New York: Henry Holt and Company, 1996.

A book for primary students about different animals that lived in a forest before the area was developed for a housing project. A landfill can be substituted for the housing tract.

Hadingham, Evan, and Janet Hadingham. *Garbage! Where It Comes From, Where It Goes.* New York: Simon & Schuster, Inc., 1990.

Contains information about problems of solid waste disposal, landfills, and incineration. Explains the importance of recycling. Contains colored photographs and illustrations.

Peet, Bill. *Farewell to Shady Glade.* Boston: Houghton Mifflin Company, 1966.

A story about a group of animals that are forced to move to another area when bulldozers come to change their habitat.

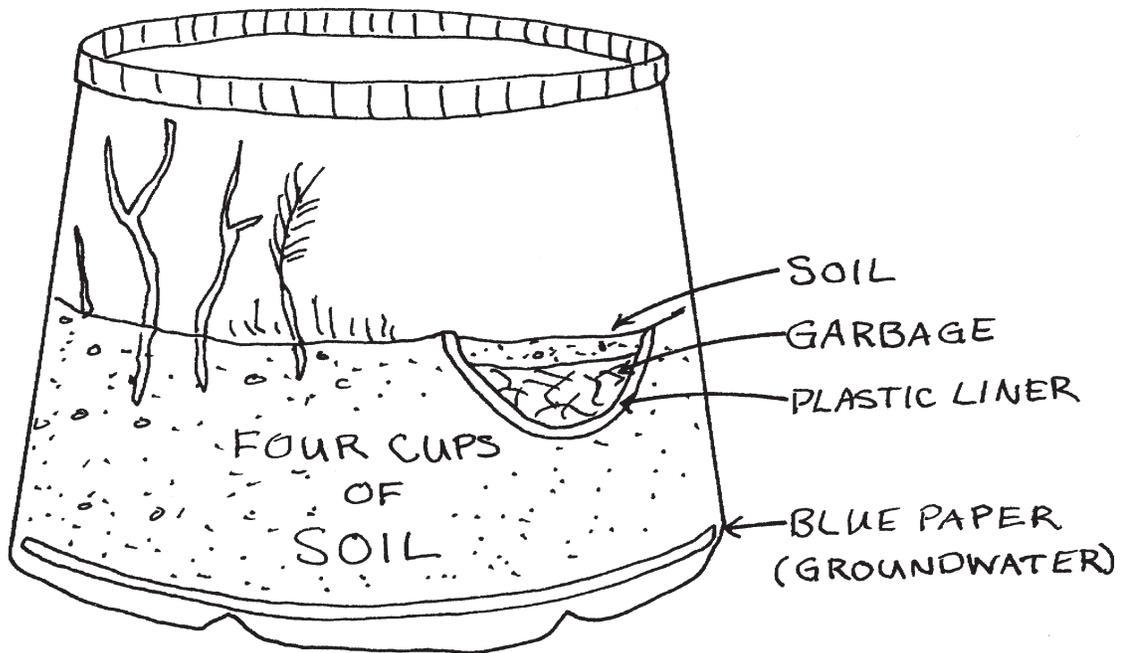
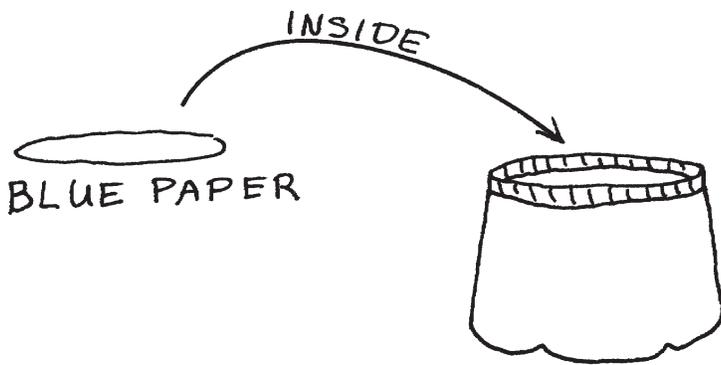
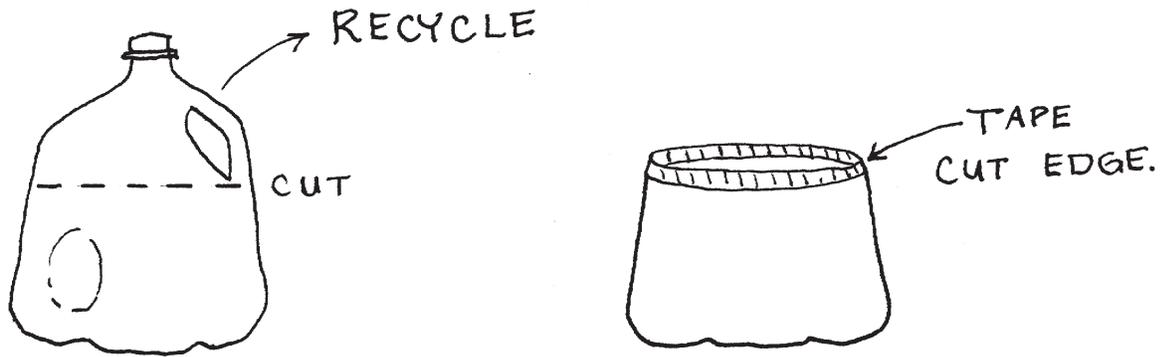
Showers, Paul. *Where Does the Garbage Go?* Let's-Read-and-Find-Out Science series. New York: HarperCollins Children's Books, 1994.

Describes landfills and how materials can be recycled into new products.

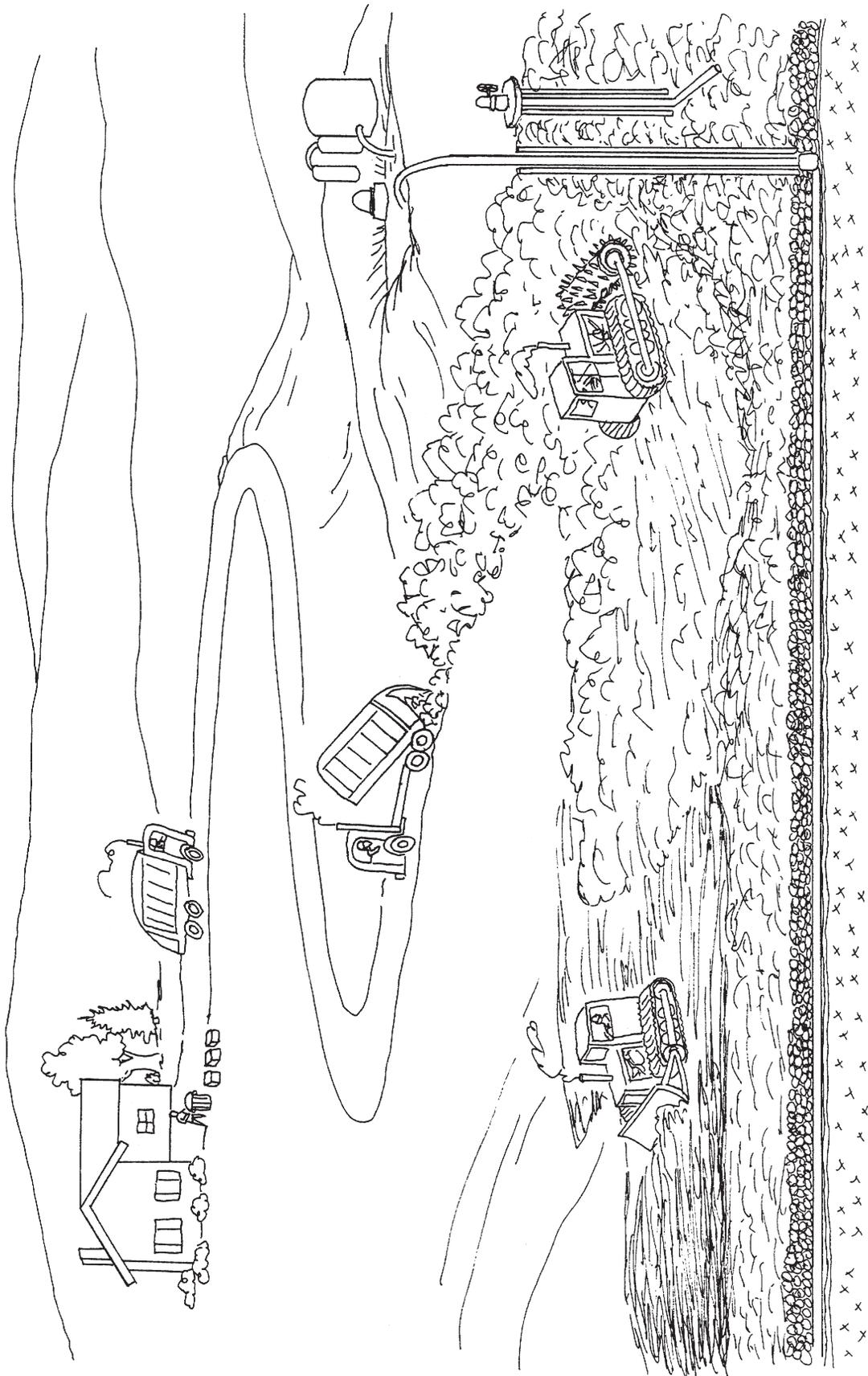
Wilcox, Charlotte. *Trash!* Minneapolis: Carolrhoda Books, Inc., 1988.

Shows a garbage truck, a landfill, and a plastic liner in a landfill.

# DIAGRAM OF A LANDFILL IN A JUG



# A SIMPLE DIAGRAM OF A LANDFILL



## BACKGROUND INFORMATION FOR THE TEACHER

Waste management was once a simple task. You took all of your garbage, dumped it in a big pile or pit, and when the smell was too overwhelming, you just moved on. Then, as cities developed, waste was taken to remote dumps. These open dumps were often burned to make space for more garbage. When cities expanded, these dumps were no longer remote, and the problems associated with these dumps needed to be solved. Because of potential hazards to the health of humans and the environment, open dumps have been illegal in California for many years.

New landfills are required by law to incorporate special design features. One of these features includes using a synthetic membrane to keep the toxic liquid, which accumulates when rainwater leaches through the garbage, from contaminating groundwater. The liquid, also known as leachate, is collected and treated at a waste water treatment facility. Methane gas, generated by the decomposition of organic matter in the landfill, is also collected through pipes in the landfill and is either burned off or used for energy.

Once landfill sites have reached capacity, they must be capped (closed with layers of clay and soil) and monitored. Such sites are often landscaped and used for parks and housing develop-

ments. In older landfills there have been some problems that have resulted from the buildup of explosive methane gas and the settling of buried garbage. Engineers and scientists are working on ways to make these sites safe for people and wildlife.

Instead of being treated as raw materials to make new products, landfilled materials are buried, potentially lost to us forever. (It is possible that in the future some landfills may be “mined” to extract materials, such as aluminum and steel.) In addition, large areas of land are used for landfills. These areas were once natural ecosystems, providing habitats for wildlife and plant life. In this lesson, students determine that garbage takes up space in a landfill and that landfills are located in areas that are or once were habitats for people and wildlife.

For information about the environmental concerns posed by landfills, such as groundwater pollution, see the “Background Information for the Teacher” in the 4–6 Module, Unit 1, Lesson 2; in the 4–6 Module, Unit 4, Lesson 2; and in “Appendix B–IV, Landfill Issues,” in this guide.



A garbage truck deposits solid waste into the Eastlake Sanitary Landfill, owned and operated by Lake County in northern California.