

## *Notes to the Teacher on How to Use This Book*

**N**ew Mexico is a semi-arid state with limited water sources that are being subjected to increasing pressure from the water demands of a growing population and recurring drought. Water conservation will play a vital role in providing enough water to meet the growing demand.

This curriculum is intended to teach middle school and high school students, as well as their families, about:

- the importance of conserving water, and
- simple water-wise strategies for landscape water use.

### **Who is this curriculum for?**

The curriculum is designed for educators in grades 6-12. However, the curriculum can be adapted easily for younger grades and is highly recommended for alternative education situations such as after school programs.

### **How is it designed to be used?**

This curriculum can be used in its entirety, by chapters, or as individual activities to supplement and existing curriculum. It is not intended to compete with established all-encompassing science curricula but to complement what is already in place.

Each chapter is organized around a **Problem to Solve** that requires critical-thinking, decision-making, and problem-solving skills. The students are required to complete the activities in the chapters in order to solve the problem. All of the activities are interdisciplinary and hands-on. **Chapter One: Water Views** provides a global and local background on water and **Chapter Nine:**

**Community Outreach** gives students direction in applying what they have learned in their communities. These two chapters do not include a **Problem to Solve**.

### **What about Standards and Benchmarks?**

The curriculum has been aligned to State of New Mexico, Department of Education, New Mexico Content Standards, Benchmarks, and Performance Standards. As these Standards are updated regularly, the New Mexico Office of the State Engineer has chosen to provide the Standards for language arts, mathematics, social studies, and science as a supplement to this curriculum. The curriculum alignment will be updated as the Department of Education updates its Standards.

Please see the Office of the State Engineer's website at <http://www.seo.state.nm.us/water-info/conservation> or call 1-800-WATERNM for a copy of the latest Standards update.

### **How do we assess learning?**

There are very few set answers anywhere in the curriculum. The goal of this curriculum is not to get the students to the right answer but to get them thinking about the many ways a problem can be solved. However, the curriculum does provide ways to judge if the students are learning.

### **For the curriculum:**

**Your Dream Landscape**, found on page 17, is a pre-assessment activity for the entire curriculum. This activity is designed to allow the students to explore their knowledge of landscaping techniques prior to working on the curriculum. Students are given a blank site plan and allowed free reign to design

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any type of landscape they choose. Teachers should retain these initial designs so students can reevaluate their choices as they go through the chapters and the final project in **Chapter Eight: Planning and Design**. The final project uses the same blank site plan but gives the students a fictional family with specific requirements that need to be filled. Students can also choose to rework their pre-assessment landscape. If they choose to rework **Your Dream Landscape**, have them create their own list of requirements based on what they have learned in the curriculum. They can then compare their new plan to their initial attempt.

### For each chapter:

Each chapter that contains a **Problem to Solve** will also include an **Assessment of Problem to Solve** in the **Teacher's Notes**. This section provides advice to the teacher on what to look for in the student solutions to the **Problem to Solve**, and it is meant as a guideline, not as a set answer. In most cases, there will be several possible ways to approach the solution.

### For each activity:

Guidelines for the outcome of each activity are provided in the **Notes on the Activities** section in the **Teacher's Notes**. However, specific answers have not been provided for the **Student Worksheets**, as they will vary each time the students run the experiment. In addition, there are many open-ended questions that are designed to provoke creative thinking by the students. Again there are no set answers; all reasonable answers should be acceptable for these questions.

### How is the curriculum organized?

Each chapter is formatted in the same way for ease of navigation, and contains the following sections:

- **Xeriscape Principle** – Seven of the nine chapters are centered around the seven xeriscaping principles. Each principle serves as the focal point of a chapter. The **Problem to Solve** and the activities that follow the principle are designed to give the students an opportunity to investigate and understand that xeriscape principle more fully. (**Chapter One: Water Views** and **Chapter Nine: Community Outreach** do not include a xeriscape principle.)
- **Key Concepts** – These are the main ideas that are contained in the chapter. There are usually three to six key concepts for every chapter.
- **Teacher's Notes** – A quick note to provide the teacher with an inside track to the chapter. This will include any special notes on the organization of the chapter, the **Problem to Solve**, or special things to consider while teaching.
- **Assessment of Problem to Solve** – This section provides assessment options, as well as suggestions for different paths the students can choose when investigating the **Problem to Solve**.
- **Notes on the Activities** – This section includes any special information on the activity and describes the primary learning experience. It also provides suggested assessments.
- **Complementary Activities** – The **Problems to Solve** are specific to each chapter or xeriscape principle but often encompass

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ideas presented in other principles. The activities listed in this box complement the **Problem to Solve** for each chapter. If there is only time to do one chapter, use of the **Complementary Activities** would help explain some of the other xeriscape principles.

- **Background Information** – This in-depth information is designed to assist the teacher in guiding the students in their investigations. This information is also presented in a simplified form in the **Student Handout** section of each chapter. (The Background Information can also be used as an alternative student handout for advanced students.)
- **Charts and Graphs** – Any charts or graphs that may be helpful to students or teachers have been placed in this one area. The charts and graphs have been provided in a format that is easy to duplicate or make into an overhead. Not every chapter will include charts and graphs.
- **Problem to Solve** – Students are introduced to a problem scenario in the form of a letter written by a fictional homeowner or an assignment for a start-up business. Students will need to apply the information they have learned through the activities and the **Student Handout** to solve the problem.

All of the **Problems to Solve** are based on fictional homeowners and situations. To bring the problem closer to home, allow the students to assess a problem on the school campus or neighboring location.

- **Project Cover Sheet** – This is an organizing device to help students keep track of the pieces of the unit they need to complete. The cover sheet contains two levels,

Level 1 and Level 2. Level 2 is a more demanding academic level. It requires the students to add components that are not required for Level 1, such as cost estimates or budgets. This structure makes it easier to adapt the curriculum to meet the needs of the class. Do not feel obligated to complete everything on the **Project Cover Sheet**. It is designed to include all components in the chapter; however, it can be easily adjusted to meet the needs of the student group or allotted time.

- **Tips for Getting Started** – This is a starting point for those students who do not know how to approach the **Problem to Solve**. The format of the tips varies for each chapter. There are question sets, outlines, and examples. Advanced students should attempt the **Problem to Solve** without the **Tips for Getting Started**.
- **Student Handout** – The student background information is designed to encourage reading for understanding and application of problem-solving skills. If more detailed information is desired, duplicate the teacher **Background Information** for the students.

There are two ways to approach the **Student Handout**. First, use the readings as a pre-chapter reading assignment. This will familiarize the students with the material to be covered. The second option is to allow the students to conduct the activities and the **Problem to Solve** without the background material. This allows the students to truly discover the material for themselves instead of reading about it in the handout. **The Student Handout** could then be used as reinforcement after the chapter is completed or not be used at all.

## Notes to the Teacher on How to Use This Book (continued)

- **Activities** – Each chapter has three to seven activities. Activities are presented with a uniform format, and every effort has been made to utilize materials that are easily found. However, some of the activities require materials that may not be in the classroom, so be sure to pre-plan time to collect or, in some cases, to grow materials. Check Appendix F for information on ordering free materials. (**Chapter Seven: Proper Maintenance** and **Chapter Eight: Planning and Design** have only the **Problem to Solve**; they do not have accompanying activities.)

Question sets are provided at the end of most activities. These can be used in a worksheet format (provided), to direct class discussions, or for student journaling. Keeping journals has become a popular way of improving students' writing and observation skills. It also allows the students to include diagrams or drawings to support their answers, benefiting students who are not as strong in verbal skills. Finally, journaling allows students to compile all of the information in one place, which will help them when they are completing the final project.

Each activity has a uniform outline.

- **Main Question** – The question that starts the students thinking about what they are trying to answer through the activity.
- **Objectives** – What the students are trying to achieve.
- **Subjects** – The subject matters the activity covers.
- **Time** – The estimated time frame for completing the activity.
- **Vocabulary** – The vocabulary words that are introduced in the activity. All definitions can be found in the glossary.

- **Materials** – A list of the materials necessary for the activity.
- **Advance Preparation** – Any preparation that is recommended for the teacher to accomplish before initiating the activity. Read these well in advance of starting an activity.
- **Setting the Stage** – Questions to ask the students to “jump-start” their brains before beginning the actual activity.
- **Activity Procedures** – The steps for completing the activity.
- **Discussion** – For activities that do not have **Student Worksheets**, discussion questions have been provided.
- **Extension** – Recommended extension to the activity. This is the best place to find suggestions for diversifying the curriculum to meet the needs of the students.
- **Student Worksheet** – Most of the **Student Worksheets** have been provided for data collection. Most of them also include discussion questions that can be used as an assignment, for in-class discussion, or as part of journaling.
- **Resources** – The resource section of each chapter outlines additional curriculum, websites, books, and other sources of information that teachers and students might find helpful.
- **References** – The reference section includes the sources that were used to research and develop each chapter.

## Notes to the Teacher on How to Use This Book (continued)

**Appendices** – The following Appendices are included at the back of this book:

- A. Glossary – All of the vocabulary words listed in the activities are included in Appendix A. The definitions used are those that relate to xeriscaping or landscaping. There may be alternate definitions that would apply in another context.
- B. Cooperative Extension Service Directory – Names, locations and phone numbers of all of the New Mexico offices.
- C. Charts and Tables – Monthly rainfall amounts and evapotranspiration figures for selected areas in New Mexico.
- D. In the News – Various newspaper articles on water conservation issues to supplement some of the activities.
- E. Installing a Garden at School: Where to Find the Information – A resource list for teachers who want to install a school garden.
- F. Free Materials from the Office of the State Engineer – How to obtain free resource materials.
- G. Resources – The complete list of resources that are listed at the end of each chapter.
- H. Grants – Includes a list of known grants that favor gardening-oriented projects.
- I. Xeriscape Curriculum Web Pages – Additional web pages sorted by topic that might assist the teacher or student with research for the activities and **Problems to Solve**.
- J. Maps – Maps from the Office of the State Engineer and websites for additional maps.
- K. Xeriscape Gardens – A list of xeric

gardens that demonstrate the principles of water-thrifty landscaping.

- L. Office of the State Engineer – Background information on the goals and responsibilities of the Office of the State Engineer.
- M. References – The complete list of references that are listed at the end of each chapter.
- N. Metric Conversions

### How can I get additional copies of this curriculum?

This curriculum, along with additional water conservation information and teaching materials, can be obtained for free (while supplies last) from the New Mexico Office of the State Engineer.

For more information, check Appendix F, call 1-800-WATERNM (1-800-928-3766), or visit the website at <http://www.ose.state.nm.us/water-info/conservation/index.html>.



## *Introduction to Xeriscape*

**T**he arid states of the western U. S. have a long history of water issues. According to Mark Twain, “Whiskey is for drinking and water is for fighting over.” This fight for water has included rerouting whole rivers, building dams, and establishing stringent water laws. The water is needed for growing crops, raising livestock, mining minerals, and quenching the thirst of rapidly expanding municipalities.

In recent years, the West has taken a hard look at the water used by these emerging and growing cities. A large portion of the municipal water is used on landscapes. In the early 1980s, Denver, Colorado, was experiencing rapid growth. The city proposed the creation of a task force to look at the use of landscape water and develop plans to make that use more efficient. They coined the term “xeriscape” (“xeri” from the Greek work for dry and “scape” meaning vista) to refer to the correct use of landscape water in an arid region. Xeriscaping uses seven easy-to-apply steps that help reduce the amount of water used in landscapes. The concept caught on and, by 1986, a National Xeriscape Council was created. By the early 1990s, xeriscape education programs had appeared in more than 60 cities in 42 states and three foreign countries. Today, an Internet search for “xeriscape” produces an abundance of sites from all parts of the world. Xeriscape has developed into a worldwide landscaping movement that involves conscious decisions about landscaping to maximize beauty while conserving water.

Xeriscaping is truly an idea whose time has come.

### **Xeriscaping in New Mexico**

New Mexico is an ideal place to implement xeriscapes. The hot, dry weather with limited rainfall, along with the high winds that dry up the soil, make traditional landscaping almost impossible. High-water-use or non-adapted plants will not survive the harsh conditions. In addition, water supplies in New Mexico are very limited. The surface water in the state has already been allocated for various farming, ranching, mining, and municipal uses. Although the state has a reasonably good supply of ground water, it is not as abundant as was once thought and is not easily accessible in certain parts of the state. The ground water supply also includes brackish water that is not usable without using a very expensive desalination process. All of these factors force New Mexicans to make careful decisions about how they use their water.

Within the xeriscape movement, there are seven basic principles that look at a landscape as a system. These principles consider the relationships between soil, plants, water, and ecosystems. Xeriscaping improves these relationships to minimize water use. The seven principles are: planning and design, soil, turf, plants, irrigation, mulch, and maintenance. Each of these principles is given a chapter in this curriculum.



## Introduction to Xeriscape (continued)

### The Principles of Xeriscaping



#### Soil Improvements

Producing a thriving landscape requires knowledge of the site's soil characteristics, the needs of specific plants, and the ability to know when and how to amend the soil for water retention and plant nourishment. New Mexico's soils are quite varied, ranging from almost pure sand to heavy clay. The water-retention abilities of most New Mexico soils are improved with the addition of organic matter and other soil amendments. When landscaping with native plants, however, soil amendments may not be necessary. Some well-adapted xeric plants prefer not to have too rich a soil. For these plants, doing as little as loosening the soil is all the soil preparation that is needed.



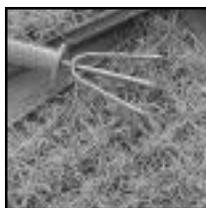
#### Efficient Irrigation

The way that landscapes are watered is as important as plant selection in achieving water-use efficiency. Designing irrigation zones and choosing proper irrigation equipment are essential. Irrigation zones should be designed so low-water-use plants receive only the water they require. For the most efficient use of water, turf areas (lawns) should be irrigated with sprinklers, and should be watered separately from other plantings. Trees, shrubs, flowers, and groundcovers can be watered efficiently with low-volume drip emitters, sprayers, and bubblers. Underground drip systems exemplify the new innovations that are making great strides in irrigation.



#### Mulching

Using materials to cover the soil in landscaped areas also increases water savings. Mulches will minimize evaporation, stabilize soil temperatures, reduce weed growth, and slow erosion. They can add visual interest and offer protective covering until plants mature. There is a wide choice of organic mulches, such as bark chips, wood grindings, and pecan shells. Inorganic mulches, such as river rock and granite gravel, are also used.



#### Appropriate Turf Areas

Large, green expanses of turf have been the standard for American landscapes for many years. Now, both homeowners and commercial groundskeepers are rethinking the appropriateness of large lawns in semi-arid climates. As water conservation becomes more important, turf areas are being evaluated and redesigned so they use less water. Instead of using a lawn to cover large areas, it is important to choose a lawn size and species of grass to fit the specific needs of the site. Drought-tolerant grasses, such as buffalo-grass and blue grama grass, may be substituted for water-thirsty bluegrass in many situations. Reducing the size of a lawn and planting water-wise groundcovers and shrubs instead is a wise, water-efficient move.



#### Low-Water-Use Plants

Whenever possible, choose native and other low-water-use plants. The Southwest offers a large palette of low-water-use plants that thrive

## Introduction to Xeriscape (continued)

in New Mexico's landscapes. These plants are as beautiful as any traditional, high-water-use plant, and they offer the extra benefit of using less water. When plants with similar water needs are grouped into specific irrigation "zones," landscapes can use water more efficiently. Plants should also be matched to the soil, sun, and water characteristics of the site's micro-climates. Taking advantage of cooler micro-climates created by walls and shade trees will provide areas of interest and diversity.



### Proper Maintenance

Maintenance is sometimes the forgotten step in landscaping. However, proper maintenance is necessary for the long-term success of a xeriscape. Although most xeriscapes are low maintenance, they are not no maintenance. Keeping a xeriscape beautiful and water-thrifty through a program of well-timed mowing, fertilizing, pruning, pest control, and weeding will ensure that the landscape will mature beautifully. To ensure water savings over time, keep the irrigation system properly maintained, adjust watering amounts and duration for time of year, monitor for leaks, and discontinue watering native plants after they have become established.



### Planning and Design

A beautiful xeriscape starts with a good design. A well-planned design will help ensure the installation of a landscape that meets lifestyle needs, retains its aesthetic appeal over time, and remains water-efficient. The physical characteristics of the site to be

landscaped should be considered, as well as how the site will be used and the aesthetic preferences of its inhabitants. The following items should be considered when designing a landscape: amount of sun received, function of lawn and patio areas, views to be protected or blocked, and amount of time allotted to maintenance.

### A Word About Zoning

Although zoning is not one of the principles of xeriscaping, it is a concept that is used throughout all of the principles. Zoning is the practice of placing plants together that have similar water, soil, and sunlight needs. Zoning the landscape allows for a large variety of landscaping options while still minimizing the amount of water that needs to be applied.

The entire landscape should be divided into three different zones: high-water-use, medium-water-use, and low-water-use. The high-water-use zones should be close to the building or in a frequently used area that can be continuously monitored. This is the zone for turf, water features, or fussy plants. Ideally, it should be the smallest of the three zones. The medium-water-use zone is the transition area and is a good place for trees, shrubs, and some of the flowering plants. The medium-use zone usually blends into the low-water-use zones that require little or no water.

# Your Dream Landscape

**Main Question:**

If you had free reign to design your own yard or landscape, what would you do?

**Objectives:**

- To engage interest in landscaping
- To determine existing knowledge of landscaping techniques

**Subjects:**

art, math, language arts

**Time:**

1 hour

**Vocabulary:**

landscape, site map

**Advance Preparation:**

- This is a pre-assessment activity. Do not give the students any advance material or discussion on xeriscaping or water issues.

**Setting the Stage:**

- Ask the students if they have ever paid attention to landscaping. If so, what did they like or not like about the landscapes they have noticed?
- Ask students to talk about their landscapes or their personal experience with landscapes and yard work.
- Ask students what their yard will look like when they get to make their own decisions. Get them discussing their “dream yard.” Would they want a soccer field or a large patio? Would a pond or a garden of flowers be more attractive?

**Materials:**

- 4 copy of site map for each student or student group
- 4 art supplies



## Your Dream Landscape

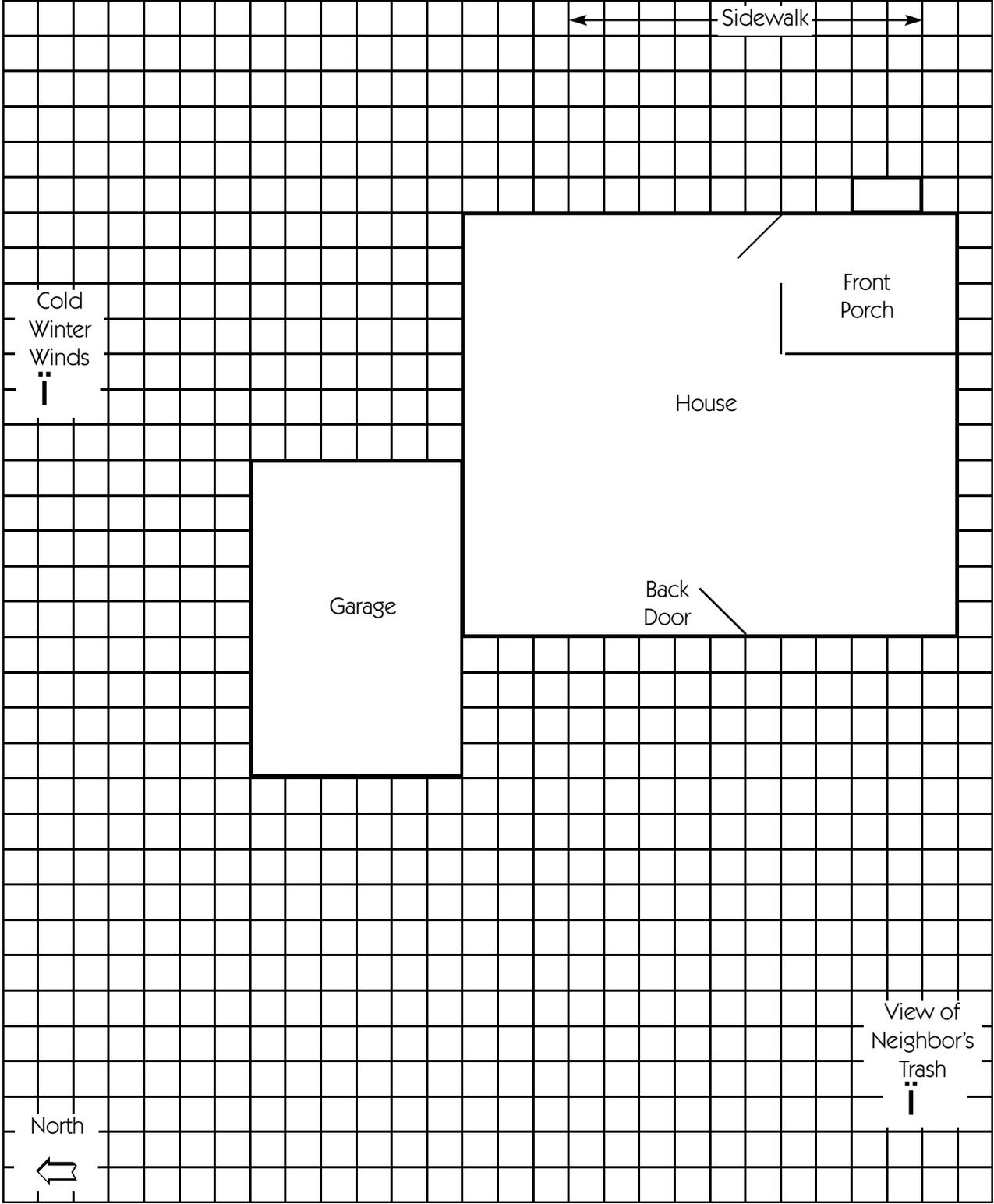
### **MAKING A PLAN –**

1. Make a list of what is personally desirable or undesirable in a landscape.
2. Using the **Site Plan: Your Dream Landscape**, develop a landscape plan. This should be personal to each student. Do not be afraid to think big.
3. The scale on the site plan is: 1 square equals 2 square feet.
4. Color or decorate the site plan as desired.

### **OPTIONS**

1. Compose a short essay explaining your dream landscape instead of completing the attached site plan.
2. Instead of using the attached site plan, develop your own site plan and design a landscape to fit.

# Site Plan: Your Dream Landscape



Scale: 1 square = 2' per side

## Your Dream Landscape (continued)

### **Discussion:**

- Did any questions arise that the students were not able to answer?
- Were there any problems that arose when the students started to design their landscapes?
- Would the students do anything differently if they were to start over?
- How much do the students think their landscapes would cost to install?
- How much water will their landscapes use throughout the year?
- Place the landscape designs around the classroom or in a visible spot so the students can return to them throughout the curriculum.

### **Extensions:**

- Use the school grounds instead of the site plan.
- Have the students redesign their own yards.
- Pick a local business, commercial property, or public park to design.

