Lesson 4: Put on Your Design Cap

Lesson Overview:

Purpose: To help students understand how to design a rain garden assuming that the students have selected the location, size, shape, and soil mix for their garden in the previous lessons.

Background:

Designing a rain garden on the school grounds is an exciting process that can improve the quality of water, provides wildlife habitat, and offer students a learning lab where they can learn more about plants, butterflies, bees, and birds. When locating the garden, it is important to observe the drainage patterns noting where water naturally runs over the ground. The rain garden should be located downstream from the flow or near downspouts that drain water from a roof. To avoid drainage issues, locate rain gardens at least 10 feet from any foundation and away from underground lines or pipes. It is best to call the 'Oops' phone number when you are considering locations so they can mark all of the underground utilities before you select a final site. If you are planning to capture large amounts of runoff from large parking lots or roads it is best to consult an engineer to aid you and your students with the design.

From a design perspective it is important to consider the surrounding landscape. Successful rain garden projects blend in with the surrounding landscape and relate to the other landscape features. Rain gardens are typically shaped in rounded shapes like ovals, kidney beans, and even dumb-bell shapes. When selecting a shape, it is a good idea to use a hose or a long rope to lay out the proposed shape onto the ground. Then stand back and look at the shape from various angles to see if it is going to look good from every angle. If possible, leave the hose or rope laid out and visit the proposed site at different times of the day and make notes. Is the garden sunny all day or is it shaded by buildings and trees during a portion of the day. Observe the foot traffic through the area. Do people use the proposed site as a cut through or for another purpose? Is there a purpose other than storm water control for the rain garden? Is it important for the rain garden to attract song birds, butterflies, or bees? Is it important for the rain garden to have a theme such as a scent garden, herb garden, edible garden, or garden with another theme? Is there already a color scheme established near the rain garden that needs to be matched?

Next, it is time to consider what plants work well in rain gardens and grow well in the area. Consider sunlight availability, moisture requirements, aggressive or invasive plant behaviors, and hardiness. Plants are very important in rain gardens because their roots loosen the soil, allowing oxygen and water to penetrate. Plants improve drainage in rain gardens as they mature and also help wick moisture from the soil through transpiration. Roots also hold soil together and help prevent erosion. Different plants have different types of root systems. Plants with deep and bushy root systems are ideal for rain gardens.   Native plants are a good choice because they are adapted to local climatic conditions, have deeper root systems, and require less maintenance. Non-natives can be used but it is best to plant hardier varieties that have strong root systems. Plants in rain gardens have to tolerate extreme conditions from inundation with water, prolonged wet periods in the spring and/or long dry spells in the summer. Unlike typical perennial gardens, rain gardens are not typically watered or fertilized on a regular basis so it is import to choose really hardy plants. It is also a good idea to select low maintenance, noninvasive, and deer resistant plants if you school is in a wooded community.

Now it is time to consider the design process. Rain gardens are typically designed with flat bottoms but some areas of the garden will be naturally wetter than others. For example, where the water flows into the garden or the inlet and sometimes the outlet or area near the berm are wetter than other areas. After inundation rain gardens typically dry out around the outside edge and work their way to the middle making a "target" pattern with the center being the wettest, the outer edge the driest, and the middle portion evenly moist Rain gardens planted on leveled out areas on slopes, the rear edge near the berm is often wetter. It is a good idea to consider moisture zones when siting plants.

The next step is to select the actual plants. Each plant has a different set of requirements for optimum growth and they all have different heights, spreads, bloom times, bloom colors, seed or fruit type, and winter character. Different plants also attract different birds, butterflies, bees, deer, rabbits, etc. So it is a good idea to research

plants beforehand and select the best choices for your purposed. Now it is time to lay out the planting scheme. There are existing layouts to select from that can be adapted to your area or students design a custom layout. To do this, draw the garden site on graph paper to scale. Be sure to note important thinks like shading and building or walkway locations. Then make a list of potential plants. Just like furniture placement schemes for the home, circles of plant types can be draw to scale showing the plants spread. Drinking straws can be scaled to the mature heights of the plants glued onto the circles so height can be considered in the design process. If desired, the plant representations can be colored to show bloom color. Bloom time can be written on the circle or the back of the circle if having a garden with multiple seasons of bloom is important. To show moisture preferences, put a W for wet, a D for dry, and an M for moist on the circles. Then move the plant representations around in the space to see what works well. As a general rule, graduate the heights of the plants so they do not shade each other out. One option may be to go from front to back with short to tall plants. Another option may be to start in the middle with tall plants and graduate to the edge with shorter ones. Gardens also look better when they are planted fewer varieties so there are masses of color and texture. Choose 3 or less plant bloom or foliage colors, and plant the plants in larger groupings or clumps. The more plant types and colors, the more "wild" (or cottage style) the garden will look. When students have designed a garden they think will work, glue the plants onto the graph paper or re-draw the rain garden bed design to scale. Then make a complete list of the plants including the botanic names so the plants can be purchased them at a nursery. Nurseries prefer botanic names to common names so be sure to take both names with you and a picture of the intended plants if possible to avoid confusion It is also a good idea to select alternative plants in advance in case the plants you selected are not available.
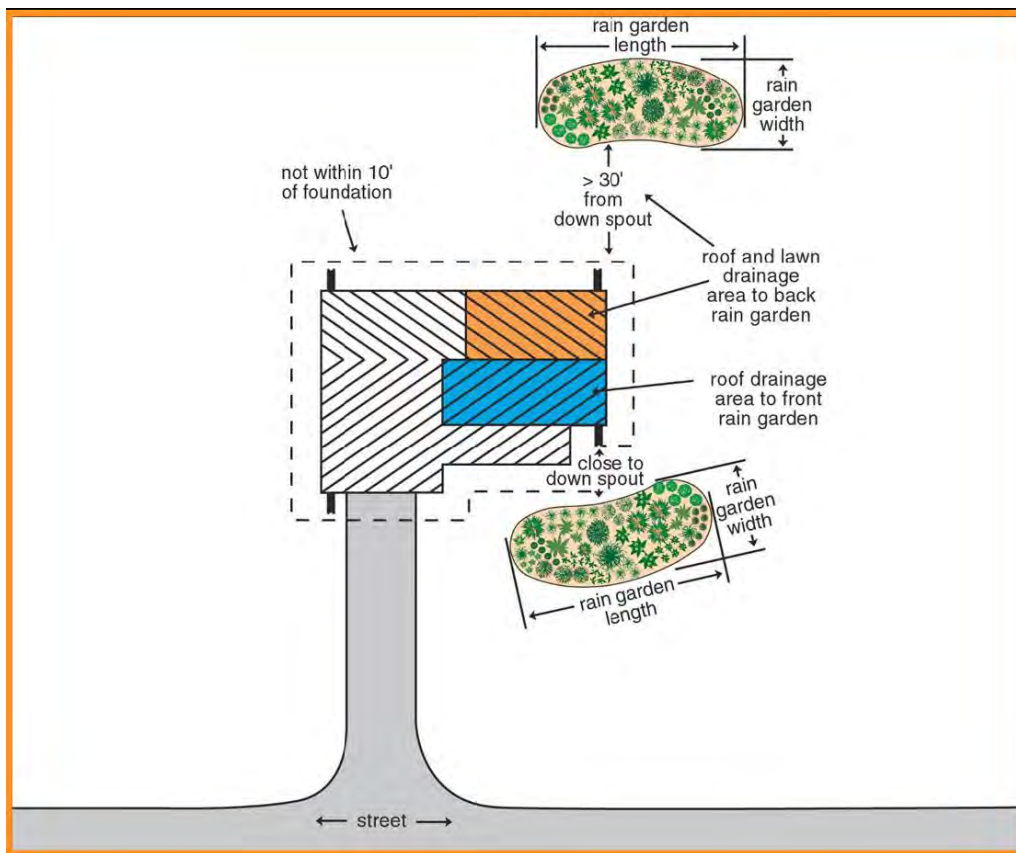

Illustration Source: Rain Gardens A How to Manual for Homeowners, UW-Extension offices, Cooperative Extension Publications, University of Wisconsin, 2003.

Rain Garden Lesson Guide – CSWCD OEEF General Grant F-09G-18

Lesson Descriptions:

Option 1: Elementary School

Objectives: Students will:

1) Evaluate their rain garden site to determine slope, sun exposure, water inlets and outlets, wet and dry zones, and other factors such as proximity to buildings and windows that will influence their design;
2) Develop a list of design criteria for their garden including color schemes, shade tolerance, garden height, plant types (shrub, grasses, perennial), plant maintenance requirement, and other desired uses such as butterfly garden, wildlife garden, scent garden, edible plant garden, etc;
3) Use a hose or line to create the rain garden shape on the actual school grounds and make a map to scale of the garden shape and size including water inlets and outlets;
4) Using a list provided of plants available, research which plants would work in the garden and meet the criteria;
5) Working in teams, design the garden in color on paper and critique the designs as they relate to the design criteria;
6) Create a 3-dimensional model of the garden that shows plant height, color, shape, spread, and spacing between plants; and
7) Work with a professional landscaper to critique their designs and select one design to install at the school.

Materials:
Reference books on rain garden plants
Plant list of rain garden plants for this area
Access to computer connected to internet
Hose or string
Graph paper
Colored construction paper (optional)
Clip Board
Pencils with erasers
Colored Markers or crayons
Scotch Tape
Glue Sticks
Plastic Straws

Follow Up
None

Extension
Poster board
Pictures of plants
Scotch Tape
Glue sticks
Colored construction paper

Activity Time:
1-2 class period

Topics Covered: Problem Solving, Experimental (Rain Garden) Design, Map Making, Garden Themes, Plant Selection Criteria, Garden Orientation, Design Evaluation Criteria, Modeling, and Oral and Written Presentations

State Standards: (See Appendices – Rain Garden Lesson Guide Correlations by Grade)

Introduction: It is time to work on designing the rain garden. The first thing they need to do is to figure out what kind of rain garden they want. Have students suggest rain garden themes. Once a theme is selected, ask the students what they need to do next? (learn more about gardens with the theme they have chosen)

Rain Garden Lesson Guide – CSWCD OEEF General Grant F-09G-18

Hands On:

1) Conduct research into their garden theme. What types of plants go with their theme? Do they need to add other items to the garden besides plants (water bowl or resting box for butterflies, nesting boxes for birds, etc.)? Generate a list of plants they like or might work for their garden.

2) Assign the responsibility of researching one or more plants for the rain garden to each student. Have them check the internet, nurseries, and libraries. Find out the following: Plant name, botanic name, height, spread, bloom time, bloom color, sun/shade preference, moisture requirements, and use in the theme. Put all of their information and a picture on a single page and tape them up in the classroom for everyone to use as a reference.

3) Visit the rain garden site and use a hose or string to layout the garden. Look at the garden from every angle. If they like the layout, have them make a sketch. Locate a point in the center and measure to the edges so they can re-create their drawing to scale when they return to the classroom.

4) Have students work in teams and recreate the layout on a piece of graph paper noting sun/shade area and proximity to buildings, walkways, and other prominent features.
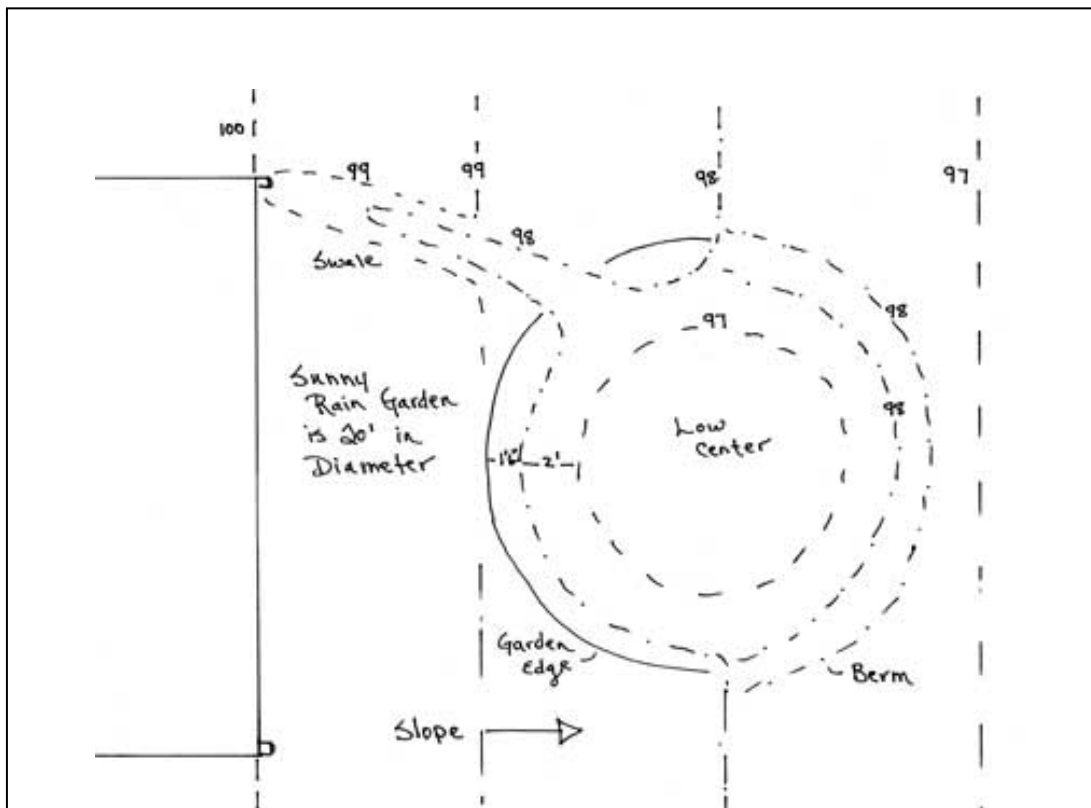
5) Have students select plants they like and make models to scale. Label the models with the name, sun/shade preference, moisture requirement, and bloom time. Color the model with the bloom color. Cut out pieces of straws and to glue to the center of each to represent the height. Have the students experiment the layouts. When they have a layout they like, have them glue down the pieces and put the designs up on the wall.

6) Have each team present their design to the class, explaining why they designed the garden the way they did. Did the class prefer any one design? If not how would they modify the designs? Have the class work as a team to come to consensus on a design. If necessary, modify the winning design and put it up in the classroom for all to view.

Rain Garden Lesson Guide – CSWCD OEEF General Grant F-09G-18

Sunny Garden
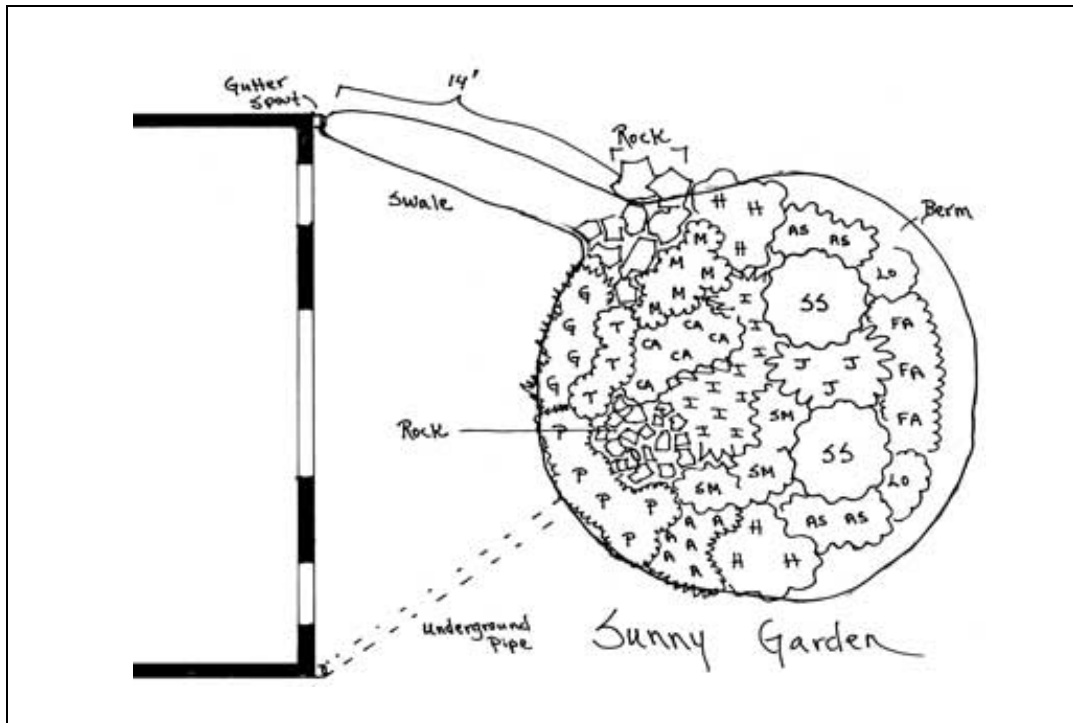
7) Based on the winning design, make a list of plants to purchase. Then have the students research what it would cost to obtain the plants needed for their design.

Follow-up: Have a landscape design professional review the designs created by the class and critique them. Are the plants they selected placed in the right place in the garden to do well? Are their plants that might work better in this area. Are their good plants that relate to the theme that they have not considered. Based upon this critique have the students modify the design.

Extension: Choose one or more themes and have the students work in teams to design rain gardens with various themes. Have the class critique the designs and the teams use the critiques to create final designs. Have students make posters with their designs and pictures of the plants including a brief description of the theme and plants used. Then place the garden designs in a hallway with a box so teachers and students in the schools can cast their vote for the winning design. Tally the results and form teams to implement the selected design on your school campus.

Rain Garden Lesson Guide – CSWCD OEEF General Grant F-09G-18

Option 2: Middle School

Objectives: Students will:
1) Evaluate their rain garden site to determine slope, sun exposure, water inlets and outlets, wet and dry zones, and other factors such as proximity to buildings and windows that will influence their design;
2) Develop a list of design criteria for their garden including color schemes, shade tolerance, garden height, plant types (shrub, grasses, perennial), plant maintenance requirement, and other desired uses such as butterfly garden, wildlife garden, scent garden, edible plant garden, etc.;
3) Use a hose or line to create the rain garden shape on the actual school grounds and make a map to scale of the garden shape and size including water inlets and outlets;
4) Complete Rain Garden Species Selection Criteria Worksheet.
5) Using a list provided of plants available, research which plants would work in the garden and meet the criteria;
6) Working in teams, design the garden in color on paper and critique the designs as they relate to the design criteria;
7) Create a 3-dimensional model of the garden that shows plant height, color, shape, spread, and spacing between plants; and
8) Work with a professional landscaper to critique their designs and select one design to install at the school.

Topics Covered: Problem Solving, Experimental (Rain Garden) Design, Map Making, Garden Themes, Plant Selection Criteria, Garden Orientation, Design Evaluation Criteria, Modeling, and Oral and Written Presentations

Activity Time:
1-2 class periods

State Standards: (See Appendices – Rain Garden Lesson Guide Correlations by Grade)

Materials:
Rain Garden Species Selection Criteria Worksheet (see appendices)
Reference books on rain garden plants
Plant list of rain garden plants for this area
Access to computer connected to internet
Hose or string
Graph paper
Colored construction paper (optional)
Clip Board
Pencils with erasers
Colored Markers or crayons
Scotch Tape
Glue Sticks
Plastic Straws

Follow Up
None

Extension
Topographic map of school site
Cardboard, Foam core board, or craft foam sheets
Utility scissors, dry wall saw, serrated knife or jig saw
Wood rasp
Hot glue gun with glue sticks or craft glue
Sand
Silk plants
Colored construction paper of craft foam sheets
Acrylic paints
Craft paint brushes (various sizes)
Permanent markers

Introduction: Discuss the steps in designing a rain garden and ask if rain gardens can serve dual functions. For example, the Rain Garden might be used to attract birds, butterflies, or wildlife. Discuss design criteria and develop a list of criteria for their rain garden. Based on their criteria, have the students research out plant species and select the appropriate plants for their purposes. Then the students will construct an architectural model of their rain garden design.

Hands On:
1) Visit the rain garden site and make notes about the site. For example, they need to consider sunlight availability, moisture requirements, aggressive or invasive behaviors, and hardiness. If possible, visit the rain garden site every hour and record how the sunlight changes at different times of the day.

Rain Garden Lesson Guide – CSWCD OEEF General Grant F-09G-18

2) Use a hose or string to layout the garden. Look at the garden from every angle. If they like the layout, have them make a sketch on graph paper. Have them locate a point in the center and measure to the edges so they can re-create their drawing to scale when they return to the classroom.
3) Return to the classroom and have the students evaluate what purposes they want the rain garden to serve in addition to storm water management. Based on their purpose or purposes, develop a list of criteria for their design. For example, if they are in an area with a deer problem, the criteria might be deer resistant plants. If the garden is at the main entrance of the school, the criteria might be formal manicured appearance. If there is already an established color scheme, the criteria might be plants with those colors. Or if the garden is 50% sun and 50% shade, the criteria might be shade plants on the north side and sun plants on the south side.
4) Next, students will complete a Rain Garden Species Selection Criteria Worksheet to help them understand the environmental conditions at their site and the plant requirements (see Rain Garden Species Selection Criteria Worksheet in the Appendix).
5) Make a list of plants students think may work well in their garden and assign the responsibility of researching one or more plants for the rain garden to each student. Check the internet, nurseries, and libraries. Have them find out the following: Plant name, botanic name, height, spread, bloom time, bloom color, sun/shade preference, moisture requirement, and use in the theme. Complete the Plant Evaluation Table. Optional: Have the students put all of their information about a single plant and a picture on a single page and tape them up in the classroom for everyone to use as a reference. (see Plant worksheet in Appendix).
6) To create the actual design, divide the students into teams and give each team all of the plant and design criteria information. Have each team develop a design on paper. Post their designs and have the class vote for one of the designs.
7) Using the winning design, develop a list of plants to order.

Follow-up: Have a design professional visit the class and critique your rain garden design. Using this input, have the students modify the design.

Extension: Have the students create a 3-dimensional model of the winning rain garden design to share with the school, parents, and community. Decide on the model scale. Then create the basin in the same way they created the topographic map model in the No Place to Run High School Follow Up using foam core board. Find the area on the topographic map where the rain garden will be located and enlarge that section so that the rain garden is at least 9 inches by 12 inches or the size chosen. Have Start from the largest layer and work to the middle cutting out all of the layers. Then glue the layers together. Use a wood rasp to file off the edges and then paint the model with glue and sprinkle with sand as a base. Make structures like the school out of cardboard and paint them. Paint the sand to show parking lots and roads. Use pieces of silk plants to represent the plants in the rain garden.

Rain Garden Lesson Guide – CSWCD OEEF General Grant F-09G-18

Option 3: High School

Objectives: Students will:

1) Conduct a site evaluation of their rain garden site to determine slope, sun exposure, water inlets and outlets, wet and dry zones, and other factors such as proximity to buildings and windows that will influence their design;
2) Develop a list of design criteria for their garden including color schemes, shade tolerance, garden height, plant types (shrub, grasses, perennial), plant maintenance requirement, and other desired uses such as butterfly garden, wildlife garden, scent garden, edible plant garden, etc.;
3) Use a hose or line to create the rain garden shape on the actual school grounds and make a map to scale of the garden shape and size including water inlets and outlets;
4) Complete the Rain Garden Species Selection Critera Worksheet.
5) Using a list provided of plants available, research which plants would work in the garden and meet the criteria;
6) Working in teams, design the garden in color on paper and critique the designs as they relate to the design criteria;
7) Create a 3-dimensional model of the garden that shows plant height, color, shape, spread, and spacing between plants; and
8) Work with a professional landscaper to critique their designs and select one design to install at the school.

Topics Covered: Problem Solving, Experimental (Rain Garden) Design, Garden Themes, Plant Selection Criteria, Garden Orientation, Design Evaluation Criteria, Modeling, and Oral and Written Presentations

Activity Time:
1-3 class periods

State Standards: (See Appendices – Rain Garden Lesson Guide Correlations by Grade)

Introduction: Introduce the project the same way as in the Middle School Option

Hands On:

1) Repeat steps 1-5 of the Middle School Option.
2) Instead of Designing the Rain Garden on paper as they did in Step 6 of the Middle School Option, have the students design the rain garden using their computers using free online landscape design software like http://www.showoff.com/; Michigan Rain Garden Design Tour http://www.ewashtenaw.org/government/drain_commissioners/dc_webwaterquality/rain_gardens/tour.html; Rain Garden Design Templates http://www.lowimpactdevelopment.org/raingarden_design/templates.htm or take advantage of free trials of Landscaping Programs such as www.ideaspectrum.com. New programs are

Materials:

Rain Garden Species Selection Criteria Worksheet (see appendices)
Reference books on rain garden plants
Plant list of rain garden plants for this area
Access to computer connected to internet
Free, shareware, or trial versions of landscape design software
Hose or string
Graph paper
Colored construction paper (optional)
Clip Board
Pencils with erasers
Colored Markers or crayons
Scotch Tape
Glue Sticks
Plastic Straws

Follow Up
None

Extension
Access to computers and internet
Access to power point software
Access to computer projection system

47

Rain Garden Lesson Guide – CSWCD OEEF General Grant F-09G-18

being offered all the time so have your students conduct an online search for free or free trail garden design software. SmartDraw provides traditional landscape and residential design models http://www.smartdraw.com/specials/landscapedeck.asp. Google Sketchup is a free garden design download that allows the gardener to take a virtual walk through a three-dimensional seeting and runs on Mac and Windows platforms at http://sketchup.google.com/download/gsu.html. You might also contact a nonprofit gardening organization or local landscape architects in your area to see if they have an online garden program that your students could use.

3) Repeat step 7 of the Middle School option.

Follow-up: Follow up the project the same way as in the Middle School Option

Extensions: Have the students develop a power point presentation of the winning design to share with the rest of the school, their parents, and the community.

Rain Garden Lesson Guide – CSWCD OEEF General Grant F-09G-18