



BRIDGES

Lesson Plan: **Stormwater Runoff Management**

How can you manage stormwater runoff in a town watershed?

Alignment with STEM Framework

Inventor  **Investigator**  **Altruist**  **Tinkerer** 

Overview

Watersheds are areas of land that act as mediums for water to flow into different bodies of water such as streams, rivers, basins, etc. Stormwater runoff has polluting particles in it which can make bodies of water unhealthy. In this activity, youth use an EnviroScape to select, sample and budget simulations of best management practices regarding stormwater runoff.

Practice Goals

- Asking questions and defining problems
- Developing and using models
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating evidence

Content Goals

- How do you budget best management practices to efficiently address stormwater runoff?
- How do you learn through trial and error?
- How do you manage stormwater runoff in a large area?
- What management practices are best used in managing stormwater runoff?

Purpose

Watersheds are areas of land that act as mediums for water to flow into different bodies of water such as streams, rivers, basins, etc. Stormwater runoff has polluting particles in it which can make bodies of water unhealthy. In this activity, youth use an EnviroScape to select, sample and budget simulations of best management practices regarding stormwater runoff.

Teacher Background Information

The following are some BMPs for stormwater runoff:

Cisterns work as a secondary site for stormwater collection which allows for reuse as irrigation or water treatment. In the enviroscape cisterns are represented by sponges.

Permeable pavement is made of porous material to allow for water collection. In the enviroscape, permeable pavement is represented by paper towels.

Bioswales/Bio Retentions are used to redirect water or hold water from reaching critical infrastructure areas. In the enviroscape, bioswales are represented by twisted cotton balls.

Wet/Drylands are man-made places which act as secondary water collection sites housing wildlife and providing habitats. In the enviroscape Wet/Dryland are represented by sports towels.

Terraces are walls constructed to prevent erosion from water as well as directing runoff. These structures are also decorative in nature. In the enviroscape, terraces are represented by bath towel edges.

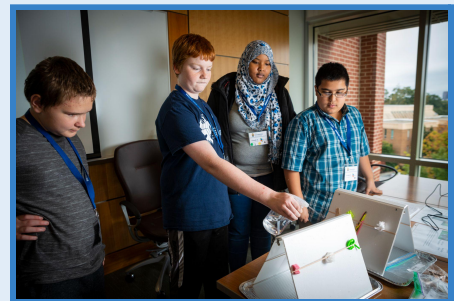
Rain gardens are planted areas that can be built on roofs, along driveways, parking lots, and other locations that are prone to flooding. Plants selected for rain gardens have root systems that absorb stormwater and prevent runoff into water sources. In the enviroscape, rain gardens are represented by felt pads.

Green roofs are roofs covered in plants to reduce stormwater runoff and help cool down the building. In the enviroscape, green roofs are represented by cotton cloths.

Sculpture gardens are purely decorative spaces in which artists can display their creations in open areas for people to view them. In the enviroscape, sculpture gardens are represented by foam pieces.

Culverts are designed for runoff to flow underground through pipeline passageways instead of into water sources. In the enviroscape, culverts are represented by paracords

Silt Fences allow for passage of stormwater into water sources through a filter. In the enviroscape, silt fences are represented by pipe cleaners.



Affinity Goals



I can act like an **Altruist** by working to maintain stormwater runoff into watersheds which will help people and other wildlife in your area.



I can act like a **Designer** by deciding where to place BMPs to maximize effectiveness and aesthetics.



I can act like a **Tinkerer** by “building” different structures within my enviroscape that help maintain stormwater runoff into watersheds.



I can act like an **Investigator** by studying the ways that runoff can get into watersheds within the EnviroScape and find ways to maximize the effectiveness of best practice methods.

Materials

- 2 or 3 large EnviroScapes
- 4 or 6 small spray bottles
- Chart paper, or premade group data charts
- Chart markers
- Container to capture run-off
- Mountain papers
- Tape
- Volumetric measuring tool
- Tape measure or Ruler
- BMP posters
- BMP Powerpoint
- Free journaling

Time Needed

45 Minutes



Instructional Sequence

Teacher will:

- Introduce youth to EnviroScape.
- Spray EnviroScape with ~100mL of “stormwater” (From a spray bottle) and ask youth what they observe.
 - Ideally water should all flow into the water sources from the watershed.
 - “What does this mean for the watershed?”
 - “What does this mean for the community?”
- Explain to youth that they are all civil engineers who are tasked with preventing stormwater from reaching the watershed in order to prevent flow into other water sources in the area.
- Tell youth they have a \$500 budget.
- Explain Best Management Practices to the youth.
- Explain to the youth that the items next to the posters are “prototypes” or models that represent the real thing in the picture.

Youth will:

- Select 1 or 2 BMPs to test. They’ll only need one or two of the items.
- Assemble the paper mountain (see assembly instructions on the paper),
- Place their BMP on their mountain
- Spray the mountain with 8 sprays from the spray bottle and observe how much water their prototype BMP allows to run down the mountain.
- Record their observations on the observation sheet.

Teacher will:

- Bring the group back together around a whole-group data sheet. Teachers will ask youth to share what their BMP is (the actual name, like cistern) and what they observed when testing it. Add youth ideas to the data sheet.
- Lead group in a discussion:
 - What do you notice?
 - What worked well? What didn’t? Why do you think that happened?
- Once youth understands what works and what does not, the teacher will split youth up into smaller groups and assign each group their own EnviroScape.
- Youth should now understand what each BMP does and what works best.
- Groups will choose 12 BMPs to place on their own EnviroScape and they will test the effectiveness of their selections and record their observations.

If the total cost of your design is more than \$500, you are over budget and must redesign until it is under budget.

Cost Score

The cost of our design is:

\$ _____

The Cost Score for our design is:

Pollution Reduction Score

Our design reduced pollution and saved us:

\$ _____

The Pollution Reduction Score is:

Water Score

How much water made it into the water supply?

The Water Score for our design is:

Total Score

Add all of the scores in the right-hand column to get your total score.

Remember that a LOWER score is better!

Environmental Program	Explanation	What You Get Back	Figure Out Your Savings
HarvestH2o Incentive	This rebate program is to encourage a permanent reduction in the amount of clean, filtered water used inside and outside of the home through the installation of cisterns .	\$10 tax incentive	___ cisterns X \$10 = \$ ____
Save the River Rebate	Homeowners who remove impervious surfaces and replace them with permeable pavement to reduce and treat storm water runoff from impervious surfaces on their property are eligible for a rebate.	\$2 per square foot (per piece) rebate	___ permeable pavement pieces X \$2 = \$ ____
Arts Council Honorarium	Sculpture gardens beautify neighborhoods and bring new visitors to different areas of our city. The Arts Council will give any community member installing a sculpture garden an honorarium.	You receive a plaque honoring your beautification initiative	___ sculptures X \$0 = \$ ____
Bio Beautify Grant	This grant program financially supports homeowners who install bioswales to help control urban run-off such as gas, oil and salt.	\$5.00 grant	___ bioswales X \$5= \$ ____
RiverSmart Rebate Program	Recipients receive rebates per square foot of rain garden and/or green roofs when they are installed to decrease the environmental	\$3 rebate per square foot (per piece) of rain garden \$10 rebate for each green roof	___ rain gardens X \$3 = \$ ____ ___ green roofs X \$10 = \$ ____
Total Savings for Reducing Pollution: \$			_____

Pollution Reduction Score

(Use the **Environmental Program** table to see how much money you get back for reducing pollution in the water. Then use the table below to determine your **Pollution Reduction Score**)

Savings	Score
More than \$81	1
\$61-\$80	2
\$41-\$60	3
\$21-\$40	4
Less than \$20	5

Water Score

Use the table below to figure out the **Water Score** for the total amount of water that flowed into the water system.

Amount of Water	Score
69ml or less	1
70ml-79ml	2
80ml-89ml	3
90ml-100ml	4

How can you manage stormwater?

Scoring Guide:

- Measure how much water makes it way into the water supply to find your score. The lower the score, the better your design.

0-10mL of water	10-30 mL of water	30-50 mL of water	50-70 mL of water	70-90 mL of water	90-100 mL of water
5	2	1	3	4	5

Trial #1:

What **Best Management Practices** did you use?

Score: _____

Trial #2:

What **Best Management Practices** did you use?

Score: _____

Trial #3:

What **Best Management Practices** did you use?

Score: _____

Trial #4:

What **Best Management Practices** did you use?

Score: _____

Group A	Members:
Type of material	Observations
Sculpture garden	
culverts	
wetlands/drylands	
terraces	
cisterns	
Rain garden	
Green roof	
Permeable pavement	
bioswale	

Group B	Members:
Type of material	Observations

Sculpture garden	
culverts	
wetlands/drylands	
terraces	
cisterns	
Rain garden	
Green roof	
Permeable pavement	
bioswale	
Silt fence	

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