Clean It Up!

Background: We have been learning how to take care of our natural resources. We can create a clean environment or a dirty environment. Recycling and reusing are ways to take care of our world. When our environment is dirty, it harms the wildlife, and we need to clean it up!

Design Challenge: Design and build a device to keep 10 pieces of trash from flowing downstream in a "river." Your teacher will provide the "river" and the trash.

Criteria: You will

☐ build a device that will stop trash from flowing down the river

☐ record how many pieces of trash were stopped by your device

☐ have 3 turns to stop the trash.

Materials: Select from the list below.		**Tools:** Select from the list below.
• cardboard	• string	• hole punch
• clothes	• straws	• scissors
• fabric	• tape (6-inch piece)	
• foil	• toothpicks	
• glue	• yarn	
• pipe cleaners		

Tips for Teachers

Targeted Standards of Learning:

Science 1.8   The student will investigate and understand that natural resources are limited. Key concepts include
         b) factors that affect air and water quality.

Supporting SOL: Science 1.1; English 1.1; History and Social Science 1.10

Targeted Standards for Technological Literacy:

13   Students will develop the abilities to assess the impact of products and systems.

Supporting STL: 4, 9

Prior Knowledge & Skill	Materials & Preparation	Safety Issues	Class Management	Materials Provided	Design Process
• Knowledge of natural resources	• Ideas for trash: water bottle lids, pieces of straw, Styrofoam packing peanuts, paperclips • Show the students the trash before they build. • Ideas for the "river": milk cartons cut in half and connected, deep meat trays • Two buckets for "river" water: Pour the water from bucket at the top of the river, and collect at the bottom for reuse. • Use a sieve when testing, so that items that are not stopped by devices do not interfere with other students' testing	• Use of scissors	• Partners or groups	• Design Brief • Guided Portfolio (adapt as appropriate/ optional) • Rubric Assessments	Follow the Design Process: • Restate the problem. • Brainstorm solutions. • Create the best solution. • Test the solution. • Evaluate the solution.

Tips for Teachers, continued

Extension Ideas:

Make a field trip to wetlands or a river to observe trash and pollution and the flow of the water.

Have students design and create the river to be used for testing.

Guided Portfolio

Name _____

Group Members _____

1.   What is the problem? State the problem in your own words.

_____

_____

_____

_____

_____

_____

_____

_____

Name _____

2. **Brainstorm solutions.** Sketch and/or describe some possible solutions.

Name _____

3. Create the solution you think is best.

Keep notes about your problems and how you solve them. Make sketches if they help.

_____

_____

_____

_____

Name   _____

4.   Test your solution.

Did your device stop any trash?   YES   NO

How many pieces of trash did your device stop?

	8 -10 pieces	**4 – 7 pieces**	**0 – 3 pieces**
First test:			
Second test:			
Third test:			

Name _____

5. Evaluate your solution.

Was it the best solution? Why or why not?

_____

_____

_____

What would you have done differently? Why?

_____

_____

_____

Rubric for Clean It Up!

Name _____ Date _____

0—no evidence; 1—limited understanding; 2—some understanding with room for improvement; 3—good understanding with room for improvement; 4—substantial understanding

Student Evaluation	0	1	2	3	4
Oral Presentation: The student					
• used complete sentences.					
• used descriptive words.					
Guided Portfolio: The student participated in					
• restating the problem.					
• brainstorming solutions.					
• creating a solution.					
• testing the solution.					
• evaluating the solution.					
Team Skills: The student					
• used appropriate voice.					
• encouraged team members.					
• listened to team members.					
• was involved in all aspects of the project.					
• respected team members.					

Tested Criteria	YES	NO
The student's device stops trash from flowing down the river.		
The student recorded the number of pieces of trash stopped by the device.		
The student tested the device three times.		

Standards of Learning

English (2010)

Oral Language

1.1 The student will continue to demonstrate growth in the use of oral language.
   a) Listen and respond to a variety of electronic media and other age-appropriate materials.
   b) Tell and retell stories and events in logical order.
   c) Participate in a variety of oral language activities, including choral speaking and reciting short poems, rhymes, songs, and stories with repeated patterns.
   d) Participate in creative dramatics.
   e) Express ideas orally in complete sentences.

History and Social Science (2008)

Civics

1.10 The student will apply the traits of a good citizen by
   a) focusing on fair play, exhibiting good sportsmanship, helping others, and treating others with respect;
   b) recognizing the purpose of rules and practicing self-control;
   c) working hard in school;
   d) taking responsibility for one's own actions;
   e) valuing honesty and truthfulness in oneself and others;
   f) participating in classroom decision making through voting.

Science (2010)

Scientific Investigation, Reasoning, and Logic

1.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
   a) the senses are used to observe differences in physical properties;
   b) observations are made from multiple positions to achieve a variety of perspectives and are repeated to ensure accuracy;
   c) objects or events are classified and arranged according to characteristics or properties;
   d) simple tools are used to enhance observations;
   e) length, mass, volume, and temperature are measured using nonstandard units;
   f) inferences are made and conclusions are drawn about familiar objects and events;
   g) a question is developed from one or more observations;

h) predictions are made based on patterns of observations;
i) observations and data are recorded, analyzed, and communicated orally and with simple graphs, pictures, written statements, and numbers; and
j) simple investigations and experiments are conducted to answer questions.

Earth Resources
1.8 The student will investigate and understand that natural resources are limited. Key concepts include
a) identification of natural resources;
b) factors that affect air and water quality; and
c) recycling, reusing, and reducing consumption of natural resources.

Standards for Technological Literacy

Standard 4: Students will develop an understanding of the cultural, social, economic, and political effects of technology.

Standard 9: Students will develop an understanding of engineering design.

Standard 13: Students will develop the abilities to assess the impact of products and systems.

Please give us some feedback.

Complete the form below to let us know how this design brief worked for you and your students. Please be specific so that we might use your suggestions to improve the activity. *You can fill this out on your computer, or you can print it, fill it out manually, and scan it.*

Teacher: _____

School: _____

School division: _____

Design brief title: _____

Background *Put an X in the appropriate column:*	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use
Does it set the context for the activity?			
Is it age-appropriate in language, length, and complexity?			
Does it reference prior learning and/or research that the students did that will facilitate designing a solution to a problem?			
Is it detailed enough that an adult will understand the purpose for the design brief?			
COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.*			

Design Challenge	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use
Does the challenge support your curriculum?			
Is it age-appropriate in language, length, and complexity?			
Is it detailed enough that an adult will understand the purpose for the design brief?			
COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.*			

Criteria Criteria are part of the challenge. They set the limitations for the design. They are not directions.	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use	N/A
Are the limitations age-appropriate?				
Do the limitations encourage critical thinking?				
Is the application of mathematic knowledge/skills integrated into the criteria? If not, should the skill area be addressed?				
Is the application of science knowledge/skills integrated into the criteria? If not, should the skill area be addressed?				
Is the application of social studies knowledge/skills integrated into the criteria? If not, should the skill area be addressed?				
Are language skills integrated into the criteria? If not, should the skill area be addressed?				
COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.*				

Materials Materials help set the limitations for the design. The list should include materials that might work.	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use	N/A
Does the materials list encourage a variety of design solutions?				
Does the materials list include a variety of choices for joining items?				
Does the materials list include materials that force students to make decisions?				
COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.*				

Tools Tools can be used in the construction of the designed product. They are used to manipulate materials. They cannot become part of the product.	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use
Are the tools listed age appropriate?			
Are all tools needed for the activity included?			
COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.*			

Standards of Learning	Yes	No
Does the design brief reinforce the targeted Standard of Learning(s)?		
Are the supporting Standards of Learning appropriate?		
What Standards of Learning would you add or remove?		

Standards for Technological Literacy	Yes	No
Does the design brief reinforce the targeted Standard(s) for Technological Literacy?		
Are the supporting Standards for Technological Literacy appropriate?		
What Standards for Technological Literacy would you add or remove?		

Tips for Teachers	Yes	No
Are the tips listed in the chart helpful for a first-time teacher?		
What tips would you add?		

Guided Portfolio	Needs to be rewritten	Needs minor adjustment	Is ready for classroom use
Are the instructions and questions age appropriate and clear?			
In the "Test your solution" section, do the questions force students to thoroughly test their solutions?			
In the "Evaluate your solution" section, do the questions force students to honestly evaluate their solutions			
COMMENTS. *If any of the questions above are marked other than "ready for classroom use," please provide suggestions here.*			

Additional Comments
Please use this area to provide general suggestions for improving this design brief.