El Paso Water Education Series

Make it rain: create your own watershed Lesson Plan

Grade 6 – 8

Subject
Science

Duration
50 min

Skills
Students ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models

Vocabulary
Watershed, Xeriscaping, Recharge zones, Rainwater harvesting, Point source pollution, Nonpoint source pollution.

Science TEKS
8,5(D)(E)(G)
8,11(B)
6,1(G),6,5(B)
7,11(A,B)

For more lessons, activities, and to schedule a visit to EPWater's TecH$_2$O Water Resources Learning Center visit:

tech2o.org

Lesson Overview: Watersheds are vital to both the environment and human society. They determine the availability and quality of water, playing a central role in providing drinking water, supporting agriculture through irrigation, and sustaining natural habitats. Healthy watersheds act as natural filtration systems, reducing pollutants before they reach the Rio Grande and our local underground aquifers the Mesilla Bolson and Hueco Bolson. However, human activities can significantly impact watersheds, affecting both the quantity and quality of our water resources.

Objectives: Students will be able to explain the importance of watersheds, identify human activities that impact watershed health, and propose strategies to protect and conserve watersheds to ensure long-term water availability and quality. After watching assigned videos and conducting online research, students will create their very own watershed model, make predictions, answer questions, and create a plan to reduce pollution of their water resources.

Making Connections: Here in the arid Chihuahuan Desert, every drop of water is precious. Our watersheds, such as those feeding into the Rio Grande and replenishing the Hueco and Mesilla Bolsons, support not only human life but also fragile desert ecosystems. Any contamination from agriculture, industry, or urban runoff can have severe consequences. Paved surfaces in cities like El Paso prevent rainwater from soaking into the ground, leading to increased runoff and reduced aquifer recharge. Meeting watershed goals in the desert means embracing land conservation and protection, such as protections provided to the Knapp Land and Lost Dog Nature Preserves, and promoting smart water conservation strategies, such as passive rain harvesting in urban landscapes. As cities grow, the demand for water increases to meet the needs of expanding populations, businesses, and industries. In El Paso, our strong conservation culture has helped keep overall water demand nearly flat for decades despite continued population growth. This success is especially critical when our watersheds are enduring drought; however, it depends on our community's ongoing commitment to conservation, ensuring a sustainable water future for our desert city.

Engagement Questions:

1. Does anyone know what a watershed is?
2. Why do you think watersheds are important?

Materials:

- Washable markers
- Grid Handout
- Spray bottle
- Instruction card
- Internet access
- Tray
- Clear tape
- Handout answer sheet

Resources:

- Access EPA Website: Basic Information about Nonpoint Source (NPS) Pollution | US EPA
- Get to know your H2O Stormwater:

  https://youtu.be/o3Xvv4Gm3V8?si=evCWw6WPR9-46g_Q

Vocabulary:

To safeguard our watersheds, effective strategies include:

- **Water Conservation:** Encouraging efficient irrigation. Fixing leaks, and reducing water waste in homes and businesses.
- **Sustainable land use**: Reforestation, green infrastructure, and eco-friendly agriculture help maintain watershed health.
- **Pollution reduction**: Enforcing stricter regulations, improving waste treatment, and promoting best practices for waste disposal.
- **Rainwater harvesting:** the process of capturing and storing rainwater from surfaces like rooftops for later use, such as irrigation.
- **Xeriscaping:** is the process of landscaping, or gardening, that reduces or eliminates the need for irrigation.
- **Using native plants:** that require less water.
- **Natural recharge zones:** a specific land surface area where water from sources like rainfall, streams, or irrigation infiltrates the ground and replenishes an underlying aquifer, eventually entering the saturated zone of the groundwater system.
- **Preserved open space**: an area of land protected from development, for various purposes. In El Paso, we have the Rio Bosque Wetland, and Knapp Land Nature Preserve among other preserved open spaces.
- **Point source pollution:** any contaminant that enters the environment from an easily identified and confined place. Examples include smokestacks, discharge pipes, and drainage ditches.
- **Nonpoint source** (**NPS**) **pollution:** diffuse contamination (or pollution) of water or air that does not originate from a single direct source. This type of pollution is often the cumulative effect of small amounts of contaminants gathered from a large area.

Procedure:

Introduce students to the vocabulary ether by having them look them up or by any method of your choosing. Then have students explore the EPA website about Point Source and Nonpoint Source pollution. Explain that a watershed is an area of land where all the water that falls, like rain or melted snow, drains into a common body of water, such as a river, lake, or ocean. Everything that happens on the land within a watershed - like pollution, construction, or farming - can affect the

quality of the water that flows through it. Water quality is influenced by both natural processes and human activities. In some regions, the greatest threat comes from agricultural runoff containing pesticides, fertilizers, or animal waste, which can wash into waterways and introduce harmful chemicals and excess nutrients. In El Paso and other urban areas, the primary concern is urban runoff, oil from streets, illegal dumping of paint and household chemicals, and even trash that flows into stormwater systems and ultimately drains into the Rio Grande. Protecting watersheds means protecting the lifeblood of our communities. By preserving water quality and availability, we also preserve the ecosystems and people who rely on them every day. There are two ways that our drinking water can become contaminated. It's important to understand that we all live in a watershed and our actions have a direct impact on it.

1. Give each group one sheet of grid paper, one set of markers (for best results use Crayola Washable Markers), one tray, and a spray bottle filled with water, instruction card, hand out.
2. Each group is to read the "Instruction Card", and fill their watershed with cars, farms, etc.
3. Once the grid paper is filled have students crumple the sheet of paper as shown in the photos. Do not ball up the paper, only lightly compress it towards the center as to create ridges and valleys.
4. Students will gently pull on the edges so that the paper still has ridges and valleys but is not completely flat; then tape each corner down on top of additional paper. Use photo as example.
5. Students will then trace every ridge using the blue marker, then place in tray. See photo.
6. Have students gently spray water over the watershed to simulate rain. Have them spray more water if needed but do not saturate the paper completely; just enough for the marker to run.
7. Students will then observe and answer the questions provided.
8. After they have answered all the questions, have students watch the final video, "Get to know your H2O Stormwater".

Checking for understanding:

Have students present their findings to the class or to another group. Another option is a gallery walk. This would allow all students to observe the different solutions to watershed pollution problems from fellow classmates.

Instruction Card

On your grid, draw the following symbols. drawn symbols in their assigned color. Randomly Draw 5 cars, 5 houses, 1 city, 3 factories and, 1 Landfill Symbols should be no larger that 1/4 of an inch.

Car = black City = brown House = green Factory = red Landfill = orange

- Draw each symbol randomly on your watershed. Make sure you draw all 15 symbols in their assigned color. No overlapping symbols- one symbol per cell. See example.
- With the paper flat on the table, use your two hands to crush the paper towards its center. Do not lift your watershed as you do this.
- Pull paper from the edges to flatten but do not pull completely flat. The paper should have ridges and valleys like a 3D map. Tape down four corners to extra paper.
- With a blue marker, color all the ridges, the darker the better. Then place map in the tray.

- Take this time to observe your watershed and make predictions about what would happen if it would rain. Write your predictions on the answer sheet.
- Take your spray bottle and from above, spray your watershed evenly. Make sure you are a least 12 inches away from the paper as you spray. Do not completely soak paper.
- Allow some time for the colors to run. Apply more water if needed but do not over soak the paper. Just enough to make the colors run.
- Answer the remaining questions on your worksheet.

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Watershed Experiment Questions

Predictions Before the Experiment:
Before you simulate rainfall on your watershed, write down two predictions about what you think will happen if it were to rain on your watershed.

Prediction 1: _____

_____

Prediction 2: _____

_____

Observations After the Rainfall Simulation:
What are two results you noticed after simulating rainfall?

Observation 1: _____

_____

Observation 2: _____

_____

Did a prediction come true? Yes / No – Explain:

_____

_____

Water Collection Points:
Using grid coordinates (e.g., A-3, B-4), where did most of the water collect?

Collection Points: _____

Contaminated Areas:
Which of the collection points are contaminated? (e.g. A-3, B-4)
What is the source of contamination for each? (e.g. A-3 was contaminated by the cars)

Contaminated Point (s): _____

_____

Source (s) of Contamination: _____

_____

Watershed Experiment Questions

Clean Water Collection Points
Are there any places where water collected **without contamination**? Yes or no.
Give their grid coordinates and explain why they avoided contamination.

Clean Point (s): _____

_____

Reason (s) they stayed clean: _____

_____

Planning to Prevent Pollution
Can city planners and engineers use this type of watershed knowledge to prevent water pollution?
Think about both **point source**, (from a specific location) and **non-point source** (from a wide area) pollution.

Answer: _____

_____

_____

_____

Redesigning Your Grid
Relocate pollution sources like factories, farms, or ranches to help protect your water? (e.g. A-3 Factory to B-3).
List new grid coordinates for each and explain your reasoning.

Factory new location: _____

House new location: _____

Landfill new location: _____

How will relocating these structures reduce pollution?:

_____

_____

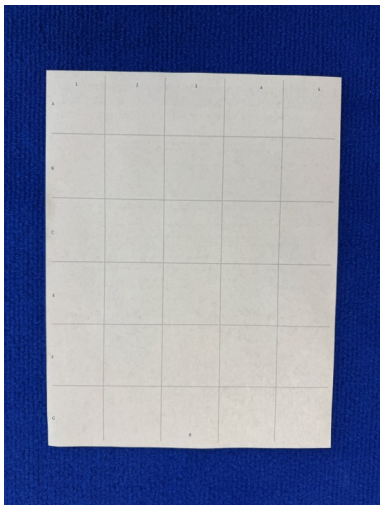
_____

_____

	1	2	3	4	5
A					
B					
C					
E					
F					
G			7		

Visual instructions for paper watershed

1



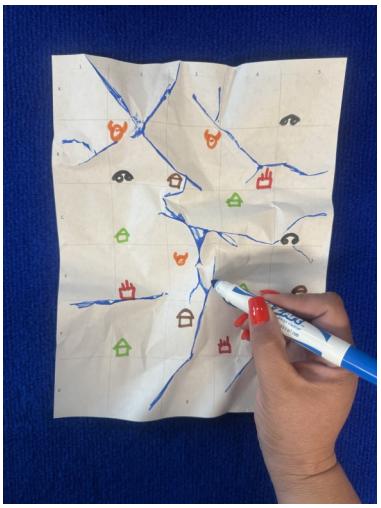
2

3

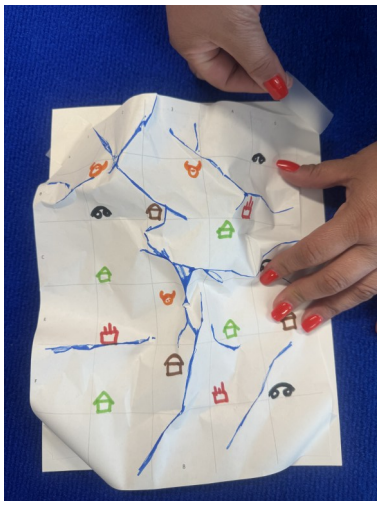
4

5

6

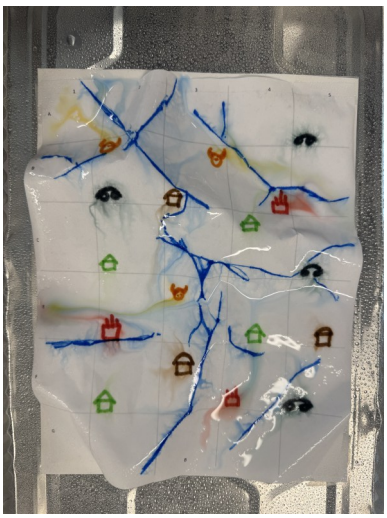


7



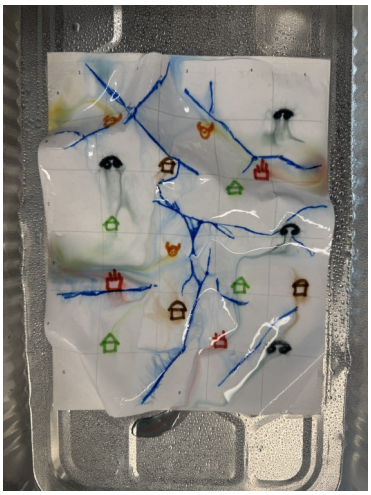
8

9



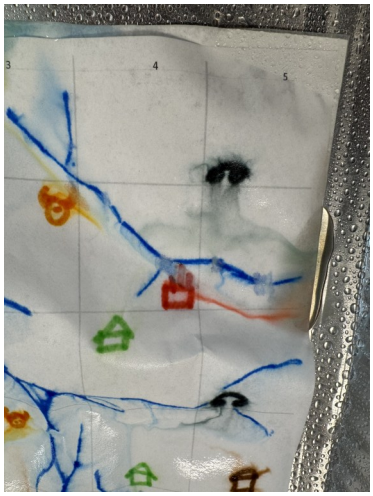
Visual instructions for paper watershed (2)

1

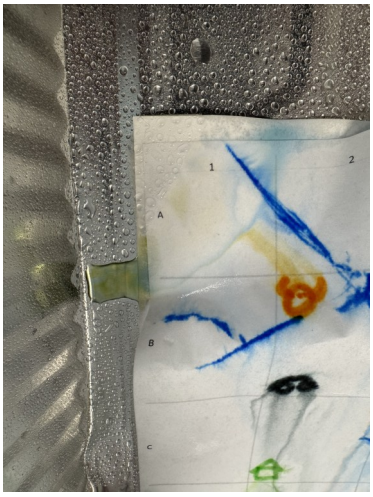


2

3



4



Tarjeta de Instrucciones

En tu cuadrícula, dibuja los siguientes símbolos. Dibuja los símbolos en el color asignado. Dibuja al azar 5 coches, 5 casas, 1 ciudad, 3 fábricas y 1 basurero. Los símbolos no deben ser más grandes de 1/4 de pulgada.

Carro = negro Ciudad = cafe Casa = verde Fábrica = rojo Basurero = anaranjado





- Dibuja cada símbolo de manera aleatoria en tu cuenca hidrográfica. Asegúrate de dibujar los 15 símbolos en su color asignado. No pongas símbolos superpuestos: un símbolo por celda. Mira el ejemplo.
- Con el papel extendido sobre la mesa, usa tus dos manos para aplastar el papel hacia su centro. No levantes tu línea de drenaje mientras haces esto.
- Tira del papel desde los bordes para aplanarlo, pero no lo estires por completo. El papel debe tener crestas y valles como un mapa en 3D. Fija las cuatro esquinas con cinta al papel extra.
- Con un marcador azul, colorea todas las crestas, cuanto más oscuro mejor. Luego coloca el mapa en la bandeja.

- Toma este tiempo para observar tu cuenca hidrográfica y hacer predicciones sobre lo que sucedería si lloviera. Escribe tus predicciones en la hoja de respuestas.
- Toma tu botella de spray y, desde arriba, rocía tu cuenca hidrográfica de manera uniforme. Asegúrate de estar al menos a 12 pulgadas de distancia del papel mientras rocías. No empapes completamente el papel.
- Permite que los colores se mezclen un poco. Aplica más agua si es necesario, pero no empapes demasiado el papel. Solo lo suficiente para que los colores se corran.
- Responde las preguntas restantes en tu hoja de trabajo.

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Preguntas del Experimento de la Cuenca

Predicciones Antes del Experimento:

Antes de similar la lluvia en tu cuenca, escribe dos predicciones sobre lo que crees que ocurrirá si llueva en tu cuenca.

Predicción 1: _____

_____

Predicción 2: _____

_____

Observaciones Después de la Simulación de lluvia:

¿Cuáles son dos resultados que notaste después de simular la lluvia?

Observación 1: _____

_____

Observación 2: _____

_____

¿Se cumplió una predicción? Sí / No – Explica:

_____

_____

Puntos de Recolección de Agua:

Usando las coordenadas de la cuadrícula (por ejemplo, A-3, B-4), ¿dónde se acumuló la mayor parte del agua?

Puntos de Recolección: _____

Areas Contaminadas:

¿Cuáles de los puntos de recolección están contaminados? (por ejemplo, A-3, B-4)

¿Cuál es la fuente de contaminación de cada uno? (por ejemplo, A-3 fue contaminado por los coches)

Punto (s) Contaminado: _____

_____

Fuente (s) de contaminación: _____

_____

Preguntas del Experimento de la Cuenca

Puntos de Recolección de Agua

¿Hay lugares donde el agua se haya acumulado sin contaminarse? Sí o no.

Proporcione sus coordenadas de cuadrícula y explique por qué evitaron la contaminación.

Punto (s) limpio: _____

_____

Razón (es) por las que se mantuvieron limpios:

_____

_____

Planificación para Prevenir la Contaminación

Pueden los planificadores urbanos e Ingenieros utilizar este tipo de conocimiento sobre cuencas hidrográficas para prevenir la contaminación del agua?

Piensa tanto en la contaminación de fuente puntual (proveniente de un lugar específico) como en la de fuente no puntual (proveniente de un área extensa).

Respuesta: _____

_____

_____

_____

Rediseñando tu Cuadrícula:

¿Reubicar fuentes de contaminación como fábricas, granjas o ranchos para ayudar a proteger tu agua? (por ejemplo, Fábrica A-3 a B-3).

Enumere nuevas coordenadas de la cuadrícula para cada una y explique su razonamiento.

Nueva Ubicación de la Fábrica: _____

Nueva Ubicación de la Casa: _____

Nueva Ubicación del Basurero: _____

¿Cómo reducirá la contaminación el reubicar estas estructuras?

_____

_____

_____