Family edition

Watershed Lab: Find the Source

Ages 11-14 · about 45 minutes, in one sitting

Your child solves a pollution mystery in Watershed Lab: something is wrong at the beach, and by testing creek water in a few vials they work upstream to the farm, house or business that is to blame.

What you need

- A computer or Chromebook with a current browser.
- The lesson link: mytekdev.com/try/watershedlab?lesson=find-the-source&ref=fam-watershedlab-3. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/watershedlab?lesson=find-the-source&ref=fam-watershedlab-3. A short guide opens over the app, on a mystery: a new valley with six to eight places on its creeks, one of them leaking.

1. **The story.** The card names what is wrong at the beach and what to test for: E. coli, nitrate, mud or oil.
2. **A vial.** With `Take a sample` picked, click the creek. A numbered pin shows the reading, and the kit below the list shows the test: spots on an E. coli dish, a nitrate strip, a turbidity tube, an oil tray.
3. **A hint.** `Hint` costs a vial and puts a blue flag where one vial rules out about half the places still possible.
4. **Name it.** Pick `Name the source` and click the place. Right: the app shows the leak's path to the beach and how many vials it took. Wrong: it says which vial rules that place out.

> The moment that lands is the first clean vial above a confluence: a whole branch is cleared at once, and children see the strategy.

The ideas, in plain words

Water quality staff find pollution sources the way the mystery does: sample above and below each place where streams join, and follow the branch that tests high. Water carries what leaks into it downstream only, so a clean sample clears everything upstream of it. Choosing spots that split the remaining places in half is the fastest plan, the same idea as a binary search.

The tests: E. coli is counted as purple spots on a dish of 1 mL, times 100 for a reading per 100 mL; above 235 per 100 mL a beach posts a swimming advisory. Nitrate is read against a color chart; above 10 mg/L it is not safe to drink, especially for babies. Mud is read with a turbidity tube; a clear creek reads under 10 NTU. Oil shows as a sheen.

Simplifications to know: E. coli is an indicator, and other germs that come with it cause most illness; a beach lab tests 100 mL, not 1; a sheen shows oil is there, not how much. Common mistakes: testing next to every place, and thinking a high reading far downstream points at the nearest place. The valley is a model with numbers of the right size, not a real place. The runoff uses the curve numbers engineers use, and the storms are real ones for central Iowa.

Do it together

1. Open mytekdev.com/try/watershedlab?lesson=find-the-source&ref=fam-watershedlab-3 together. A short guide opens over the app. Read the story on the right aloud.

   > **You'll know it worked when:** You both know what to test for and what the line is.

2. Press `Hint`, then click the creek at the blue flag. Read the vial on its test kit.

   > **You'll know it worked when:** A pin shows the reading, green for clean or red for high.

3. Pick the next spot yourselves. Ask: if this vial is clean, what does it rule out?

   > **If you get stuck:** Water only carries a leak downstream. A clean vial means the leak is not above that spot.
   >
   > **You'll know it worked when:** The places still possible get fewer with each vial.

4. When only one place is left, pick `Name the source` and click it.

   > **You'll know it worked when:** The app shows the leak's path to the beach and how many vials it took.

5. Press `Next mystery` and try one without hints. Ask: can you beat par?

   > **You'll know it worked when:** Your child explains why they tested where they did.

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- Your vial was clean. What does that rule out?
- Why test just above where two creeks join?
- Which two vials prove the source?
- Is that reading over the line? What is the line for?
- Why might a reading at the beach be lower than one right below the leak?

> The third question is the real test: a source is proved by a clean vial just above it and a high one just below.

For younger and older kids

Younger: For a younger child, open Setup and pick grades 2 to 5, so the kits read in words.

Older: For a teenager, solve two mysteries without hints and compare plans.

Keep going

- Solve a mystery in par or fewer without hints, and explain the plan.
- Explain why testing above a confluence rules out about half the places, the same idea as guessing a number by halves.
- Write the beach sign the county should post, with the reading.

Bring it into other subjects

- Math: eight places, and each vial clears about half. How many vials should it take at best? Compare with your count.
- Computer science: write the plan as steps a robot could follow, and test it on the next mystery.
- Health: read your state's beach monitoring page and find what reading closes or posts a beach.
- English: write the report to the county: the problem, the evidence, the source, in five sentences.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	Watershed Lab: Find the Source
SUBJECTS	Earth science
TIME	45 minutes
WHAT WE DID	Traced a water pollution source upstream by sampling a creek, reading water quality tests against their limits, and naming the source with evidence.
SKILLS PRACTICED	Water quality testing; Pollution sources; Using evidence

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/watershedlab?lesson=find-the-source

Essential question: Something upstream is fouling the beach. How can a few tests of the water find it?

Warm-up: How would you find which place upstream is making swimmers sick? _____

1. **Vocabulary.** Sample, upstream, confluence, point source, E. coli: write each in your own words.

2. **The vial log.** For each vial: where _____; the reading and its unit _____; clean or high ____; why you tested there _____. One vial on each line.

1. Which place did you name, and which two vials prove it?

2. Why does a clean vial rule out everything upstream of it?

Quick check

Name: _____

1. A vial just below a farm is clean. The leak is (A) at the farm (B) not at the farm or anywhere above that vial (C) at the beach

2. The best place for a vial is often (A) right at the beach (B) just above where two creeks join (C) next to the biggest building

3. A vial reads 2,800 E. coli per 100 mL. The line is 235. What does that tell you, and what would you do next?

Answers

QUESTION	ANSWER	WHY
1	B	Water carries a leak downstream only, so a clean vial clears everything above it.
2	B	One vial there tells you which branch the leak is on.
3	The leak is upstream of that vial	It is far over the swimming line, so the source is above it; test farther up, above the next place or confluence. Naming only that it is high is half.

If your state or umbrella school asks, this lesson covers NGSS MS-ESS3-3.

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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