# Creekside Choices

Compare designs for reducing nitrate runoff

**EN.ESS3.4** "Evaluate design solutions for a major global or local environmental problem that reduces or stabilizes the impacts of human activities on natural systems.*"

NAME _____ DATE _____

## 1 READ AND MARK

Read it twice

**YOUR JOB** Underline how each design reduces nitrate, circle one drawback of each, and write 1 and 2 beside two criteria the county will use to judge the designs.

### What Should Cedar Creek Do?

1. After heavy rain, Cedar Creek carries dissolved nitrate from fertilized fields into a coastal bay. Nitrate is a plant nutrient, but too much can fuel algal blooms. When algae die, decomposers use dissolved oxygen, leaving less for fish and other animals. The county wants to reduce nitrate entering the bay without ending food production. To judge a design, residents will consider how much nitrate it keeps out of the creek, how much farmland it takes, and whether it still works during storms. They also plan to measure nitrate in creek water before and after changes are made.

2. One proposal is to plant cover crops, such as rye, after the main crop is harvested. Their roots take up some nitrate that might otherwise wash out of the soil. Farmers can later cut the plants or mix them into the soil before planting the next crop, so these fields can remain in production. But seeds and planting cost money, and cover crops may grow slowly during cold months. A strong storm before their roots develop could still send nitrate into the creek. The county would need farmers across many fields to participate for this approach to affect the whole watershed.

3. Another proposal is a constructed wetland beside Cedar Creek. Channels would direct some drainage through shallow pools and plants. In wet soil, microbes can turn dissolved nitrate into nitrogen gas, which enters the atmosphere. A wetland could treat water from several farms, but it would replace some farmland and need maintenance. During a major storm, water might move through too quickly or bypass the wetland, leaving some nitrate untreated. Residents could combine both designs, then compare nitrate measurements upstream and downstream of the wetland over several seasons. Lower readings downstream would support its effectiveness, but rainfall differences would also matter.

## 2 ANSWER WITH EVIDENCE

Use the passage

1. How well could cover crops meet the county's nitrate goal? Explain one strength and one limitation.

2. How well could a constructed wetland reduce nitrate during a major storm? Explain your judgment.

3. If keeping farmland in production is the county's top priority, which design better fits that priority? What evidence supports your choice?

4. A neighbor says one low nitrate reading downstream proves the wetland works in all weather. Evaluate that claim using the passage.

## 3 YOUR TURN

Your own words

Design a third way to reduce nitrate entering Cedar Creek by changing when farmers apply fertilizer, without using cover crops or a wetland. Explain how your design could help, identify one trade-off, and name a measurement the county could use to test it.

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## PART 1 · READ AND MARK

Underline how each design reduces nitrate, circle one drawback of each, and write 1 and 2 beside two criteria the county will use to judge the designs. Accept any marking that follows this job and points at the right text.

## PART 2 · ANSWERS

| # | QUESTION | ANSWER |
|---|---|---|
| 1 | How well could cover crops meet the county's nitrate goal? Explain one strength and one limitation. | **Cover crop roots take up nitrate before it washes away, but a storm before the roots develop could still carry nitrate into the creek.** |
| 2 | How well could a constructed wetland reduce nitrate during a major storm? Explain your judgment. | **Wetland microbes can remove nitrate from drainage, but storm water might pass through too quickly or bypass the wetland.** |
| 3 | If keeping farmland in production is the county's top priority, which design better fits that priority? What evidence supports your choice? | **Cover crops better fit the priority because farmers grow them between main crops on fields that remain in production. A wetland would replace some farmland.** |
| 4 | A neighbor says one low nitrate reading downstream proves the wetland works in all weather. Evaluate that claim using the passage. | **One reading does not show how the wetland performs in all weather. Storm water might bypass it, and rainfall differences can affect readings, so measurements over several seasons are needed.** |

## PART 3 · YOUR TURN (SAMPLE ANSWER)

Farmers could apply fertilizer closer to the main crop's growing season and avoid applying it just before heavy rain is forecast. This would give crops more opportunity to take up nitrate before rain washes it away. Changing the schedule could create extra work during a busy planting period. The county could compare nitrate readings in creek water after similar rain events before and after the change.

Accept other supported evaluations that connect nitrate reduction to a stated limitation or criterion. For Part 3, accept a feasible change in fertilizer timing with a clear trade-off and a relevant way to measure nitrate.