

Nonpoint Source Pollution Mitigation

Part 1: Nonpoint Source Pollution Status

1. How is nonpoint source (NPS) pollution different from point source pollution? Select the best response. [1 point]
 - a. NPS pollution is regulated under the Clean Water Act, while point source pollution is not.
 - b. NPS pollution originates from diffuse landscape activities, while point source pollution is discharged from an identifiable source such as a pipe or ditch.
 - c. NPS pollution only occurs during storm events, while point source pollution occurs only during dry weather.
 - d. NPS pollution occurs primarily in rural areas, while point source pollution occurs only in urban areas.
2. Which of the following is an example of point source pollution in Oregon? [1 point]
 - a. Fertilizer runoff from farms in the Willamette Valley
 - b. Oil washed from Portland roads during rainfall
 - c. A permitted wastewater treatment discharge pipe emptying into the Columbia River
 - d. Sediment from forest roads entering streams during storms
3. Changes in a watershed can alter water movement and water quality in streams and wetlands. Match each watershed change (left) with its most likely result (right). [2 points, 0.5 points each]

Watershed Change	Result
<u> 3 </u> Increased impervious surfaces	1. Higher stream temperatures
<u> 1 </u> Removal of streamside vegetation	2. Increased nutrient loading
<u> 2 </u> Increased fertilizer application	3. More rapid rise and fall of stream flows during storm events
<u> 4 </u> Erosion of soil	4. Increased sediment in streams

_____/ 4 points

Use this information to answer questions 4 and 5:

Tillamook Bay is surrounded by forests, tidal wetlands, dairy farms, small towns, and rural residences. After heavy rainfalls, water monitoring often detects higher-than-normal bacteria levels at multiple locations in the Bay and in several rivers and streams flowing into the Bay. Designated water uses in the Tillamook Bay region are recreation, fisheries (particularly shellfish) and drinking water.

4. What is one likely nonpoint source of bacteria in Tillamook Bay? [1 point]

Possible answers:

- Runoff from dairy farms carrying animal manure into streams
- Failing or poorly maintained septic systems from homes
- Runoff from small towns washing pet waste into waterways
- Wildlife droppings in or near streams and wetlands

5. Choose one designated water use in the Tillamook Bay region and explain in 1 or 2 sentences how elevated bacteria levels can affect that use. [2 points]

[1 point for basic correct answer, 2 points for detailed correct answer]

Possible 2-point answers:

Recreation:

- High bacteria levels can make the water unsafe for swimming or boating because of increased risk of illness from pathogens.
- Beaches or water access points may be closed to protect public health when bacteria levels exceed safety standards.
- Unsafe water can reduce tourism and affect the local economy.

Fisheries:

- Elevated bacteria may contaminate shellfish, making them unsafe for consumption.
- Shellfish harvesting areas may be shut down due to contamination, impacting both ecosystems and local economies.

Drinking water:

- Increased bacteria levels can contaminate water supplies, requiring more treatment and posing health risks if not properly treated.

_____/ 3 points

Part 2: NPS in a Growing World and Your Role in It

Use this information to answer questions 6 and 7:

The Willamette River watershed in Western Oregon includes three dominant land uses:

- Urban: Inner city Portland and other urban areas
- Suburban: Suburban residential neighborhoods
- Agriculture: Grass seed and row crop farming

6. Rank from 1 to 3 the three land uses in terms of likely runoff volume during a heavy rain event. 1 is high. [1.5 points, 0.5 points each]

Runoff Volume (1 is high)

1. Urban
2. Suburban
3. Agriculture

7. After a heavy rainstorm, which land use is likely to have the highest nutrient load risk? Circle your answer. [0.5 point]

Urban

Suburban

Agriculture

8. The City of Bend has expanded rapidly over the past 20 years. Much of the growth has replaced forest and open land with roads, houses and businesses, and parking lots. Stormwater from these developed areas drains toward the Deschutes River.

Describe two ways that urban expansion can alter the water cycle and thus increase the likelihood of NPS pollution in places like Bend. Keep each answer to 1 sentence. [3 points, 1.5 points each]

a. Possible answers:

- More pavement reduces infiltration and increases runoff
 - Loss of vegetation lowers natural water absorption and filtration
- Storm drains move untreated runoff directly into rivers
 - Faster water flow erodes stream banks and adds sediment

_____/ 5 points

9. Circle one of the household activities from the list below and briefly explain how it can cause water pollution in your local watershed. [2 points]

Household activities:

- Pressure-washing patios or driveways
- Using de-icing products (ice melt, sand) on sidewalks
- Washing outdoor equipment (bicycles, garden tools, grills)
- Using cleaning chemicals (bleach, detergents) outdoors

Explanation:

Answer should include that the activity can lead to runoff of sediment or chemicals (depending on the activity) that can flow into streams, groundwater, or other waterways [1 point] and affect water quality, ecological balance and/or aquatic life [1 point].

10. For your chosen activity in question 9 above, propose a realistic behavior change that would reduce NPS pollution, and explain in a few words how it would help. [2 points, 1 for proposed behavior change and 1 for explanation]

Proposed behavior change:

How it would help:

Possible answers:

Pressure-washing patios or driveways

- Behavior Change: Collect water or direct it onto grass or gravel
- How Helps: Soil filters out dirt and chemicals before they reach streams

Using de-icing products

- Behavior Change: Use less or choose eco-friendly products
- How Helps: Reduces harmful salt and particles in runoff

Washing outdoor equipment

- Behavior Change: Wash on grass or gravel instead of pavement
- How Helps: Soil and plants filter soap and dirt

Using cleaning chemicals outdoors

- Behavior Change: Use safer products or clean over soil/mulch
- How Helps: Keeps harmful chemicals out of stormwater

_____/ 4 points

Part 3: Role of Individuals & Communities

11. Local governments provide a range of services that can help reduce NPS pollution. Which of these services would NOT reduce NPS pollution? [1 point]

- a. Paving park roads for vehicle access.
- b. Installing bioswales or rain gardens to treat stormwater in commercial areas
- c. Providing leaf and yard debris pickup for neighborhoods
- d. Issuing building permits that require erosion control for new construction

12. Match each community action (left) with the pollutant it is most likely to reduce (right). [2 points; 0.5 point each]

Community Action	Pollutant
<u> 1 </u> a. Requiring regular inspection of septic systems	1. <i>E. coli</i>
<u> 3 </u> b. Requiring the recycling of used motor oil	2. Fertilizer nutrients
<u> 4 </u> c. Increasing street-sweeping frequency on urban roads	3. Hydrocarbons
<u> 2 </u> d. Promoting native plant landscaping	4. Sediment

Use the following information to answer questions 13 and 14:

Water quality monitoring in your community has detected elevated levels of the herbicide atrazine in streams that drain mixed agricultural and residential areas.

Two approaches have been proposed to address this issue:

- **Action 1: Voluntary Pesticide Reduction**

An education program for homeowners and small farms that provides information on different alternatives to reduce pesticide use, an approach called integrated pest management (IPM).

- **Action 2: Regulatory Buffer Ordinance**

A local ordinance that requires a 35-foot no-spray buffer along streams.

_____/ 3 points

13. Compare the two actions. For each criterion below, indicate which action is likely to be more effective and briefly explain your reasoning. [6 points, 2 per criterion]

Criterion	More effective – 1 or 2?	Explanation
Enforceability – Ease of monitoring and enforcing the action	2	Legal requirements are easier to monitor and enforce than voluntary programs.
Direct protection of streams – How well the action prevents pesticides from entering streams	2	The buffer physically prevents pesticide applications near waterways.
Long-term behavior change – Likelihood of changing pesticide practices over time	1	IPM training can permanently change pest management habits over time.

14. For now, your community has enough funding for just one of these actions. Considering all three criteria, which action would you recommend to reduce atrazine in the watershed, and why. [2 points]

Tip: Either action can be supported if you clearly explain **why** it would be more effective for certain criteria and how any trade-offs influence your recommendation.

Possible answers:

Supporting Action 2: The buffer ordinance is easier to enforce and provides direct, immediate protection to streams. Although it may not change long-term behavior, it would reliably reduce atrazine entering waterways.

Supporting Action 1: The education program encourages long-term changes in pesticide use across the entire watershed. While it is less enforceable, it can reduce overall atrazine use more broadly over time.

Also acceptable – a combined approach: A simplified version of both actions—if kept within budget—such as a smaller buffer combined with basic IPM education, could provide immediate stream protection while promoting long-term reductions in pesticide use.

Scoring guidance: 1 point for explanation tied to at least one criterion. 1 point for explanation indicating tradeoffs. Full credit can be earned for either option, if reasoning is supported

_____/ 8 points

Part 4: Strategies to Evaluate NPS Sources, Issues & Solutions

15. Match each water-quality test with what it most directly indicates about nonpoint source pollution. [2.5 points, 0.5 each]

Water-Quality Test	What It Indicates about NPS Pollution
2 A. Turbidity	1. Elevated nutrients from fertilizers, manure, or failing septic systems
5 B. <i>E. coli</i>	2. Sediment from erosion, construction sites, or disturbed soils
4 C. Conductivity	3. Loss of riparian shading
1 D. Nitrate concentration	4. Road salts, dissolved ions, or de-icing chemicals
3 E. Temperature	5. Fecal contamination from pet waste, livestock, or storm-driven sewer overflows

16. A monitoring team finds elevated *E. coli* in a stream after storms, but at no other time. Which NPS source is most consistent with this pattern? [1 point]

- a. Leaking septic systems in the neighborhood
- b. Wildlife in the riparian zone next to the stream
- c. Pet waste on impervious surfaces**
- d. Leaf litter decomposition in the forested area

17. After a fall storm, a stream shows a sharp spike in turbidity and phosphorus, but no increase in *E. coli*. Which source is most consistent with this pattern? [1 point]

- a. Livestock access to the stream
- b. Eroding cropland with recent tillage**
- c. Failing septic systems
- d. Urban pet waste accumulation

____ / 4.5 points

Part 5: Legislation, Regulations & Voluntary Measures

18. Which federal law provides the main framework for managing nonpoint source pollution in Oregon? [1 point]
- a. Safe Drinking Water Act
 - b. Resource Conservation and Recovery Act
 - c. **Clean Water Act**
 - d. Coastal Zone Management Act
19. Which statement BEST describes how federal and state laws and regulations work together to manage nonpoint source pollution in Oregon? [1 point]
- a. Federal laws control all nonpoint source pollution; state laws only give advice.
 - b. **Federal laws provide a national legal framework for controlling nonpoint source pollution, while state laws implement these in a regionally specific way.**
 - c. State laws are voluntary, and federal laws only cover wetlands.
 - d. Federal laws control NPS on federal land, and state laws control NPS everywhere else.
20. Which of the following is an example of a voluntary measure to reduce nonpoint source pollution in Oregon? [1 point]
- a. Oregon Department of Environmental Quality (DEQ) tracking farm nutrient levels and notifying landowners if limits are exceeded
 - b. City inspections of construction sites for proper erosion and sediment controls
 - c. State agencies setting sediment limits for agricultural operations to comply with water quality standards
 - d. **Farmers participating in a cost-share program to install riparian buffers**
21. What is the purpose of a **Total Maximum Daily Load (TMDL)**? Select the best response. [1 point]
- a. **To determine the maximum amount of a pollutant a water body can receive while still meeting water quality standards**
 - b. To monitor only pollution coming from point sources such as factories or wastewater treatment plants
 - c. To eliminate all nonpoint source pollution from the watershed immediately and completely
 - d. To divert polluted water from streams and rivers directly to municipal treatment facilities

____ / 4 points

Use the following information to answer questions 22-25.

Three land uses were monitored during a storm and the findings are summarized in the table below. The runoff volume is the total stormwater from each land use, and the nitrate concentration represents the average amount of nitrate measured in that runoff during the storm.

Land Use	Runoff Volume (m ³)	Nitrate (mg/L)
Forest	40	0.9
Suburban	65	2.8
Row-crop agriculture	55	3.1

The watershed's total allowable nitrate load (TMDL) for a storm of this size is 0.35 kg.

22. Calculate the **nitrate load (in kg)** contributed by each land use. (Hints: 1 mg/L $\times$ 1 m³ = 1 g. Remember that 1 kg = 1000 mg.) Circle the land use area that contributed the largest nitrate load. [3 points, 0.5 per calculation and 1 for largest load]

Forest: 0.036 kg

Suburban: 0.182 kg

Row-crop agriculture: 0.171 kg (0.1705 also acceptable)

23. Calculate the **total nitrate load** from all three land uses. [1 point]

Total nitrate load: 0.389 kg (0.3885 also acceptable)

24. Does the watershed exceed the TMDL? How do you know? [1 point]

Yes. The total nitrate load exceeds the TMDL of 0.35 kg. [0.5 point for Yes, 0.5 point for explanation]

25. For the land use with the largest nitrate load, suggest one realistic action to reduce nitrate runoff, and provide a brief 1-sentence explanation of how that action would reduce it. [2 points, one for action and one for explanation]

Action: Possible action: Install rain gardens or vegetated swales

Explanation: Possible explanation: Slows runoff and filters nitrates from stormwater before entering streams.

____/ 7 points

Part 6: Best Management Practices (BMPs)

26. What is the definition of Best Management Practices (BMPs) for reducing nonpoint source pollution? Choose the best response. [1 point]

- a. **Methods, devices or structures that remove pollutants and prevent impacts to water quality**
- b. Adding chemicals to rivers to remove pollution after it occurs
- c. Activities that improve safety in outdoor recreation
- d. Permits that require people to follow water quality standards

27. Match each BMP in Column A to how it reduces NPS pollution in Column B [2.5 points, 0.5 each]

Column A - BMP

3 A. Buffer strip

2 B. Rain barrel

1 C. Cover crop

4 D. Bioswale

5 E. Fencing livestock
out of stream

Column B - How Reduces NPS Pollution

1. Reduces nutrient leaching by keeping soil covered

2. Captures roof runoff for reuse

3. Filters sediment before it reaches streams

4. Treats and slows stormwater along roadways

5. Prevents bank erosion and direct manure inputs

28. The Oregon Garden was originally designed, in part, to cool and filter treated water from the City of Silverton before it enters local waterways. Which of the following best describes how the Garden functions as a BMP? [1 point]

- a. It diverts treated water around natural areas so that it reaches streams more quickly.
- b. It stores treated water in underground pipes until it can be discharged downstream.
- c. **It allows the slow movement of water through shaded areas to lower the temperature.**
- d. It channels treated water directly into nearby streams without altering its temperature.

_____ / 4.5 points

29. During a field visit to the Oregon Garden, you notice that a section of the Garden's parking lot frequently forms puddles after rain. Runoff from this area flows toward a small stream, potentially carrying sediment into the stream.

Suggest one BMP that could help reduce runoff from this parking area. Explain how it would work to reduce runoff into the stream. [3 points, 1 for BMP and 2 for explanation]

Scoring guidelines:

BMP: 1 point for identifying appropriate BMP (e.g., rain garden, vegetated swale, pervious pavement)

Explanation: 1 point for a basic correct explanation of how it reduces runoff (e.g., infiltrates water, slows water flow, filters sediment); **2 points** for providing a detailed correct explanation.

Example 3-point Answer:

BMP: Vegetated swale [1 point]

Explanation: Captures runoff from the parking lot, slows water flow, and infiltrates stormwater into the soil, reducing sediment getting carried to the stream. [2 points]

Example 2-point Answer:

BMP: Vegetated swale [1 point]

Explanation: Captures runoff from the parking lot so it doesn't go into stream [1 point]

_____/ 3 points