

# Portside vs. Fairway Harbor: Phosphorus for the Rest of Us?

## Overview

Point source pollution is a common issue that may affect our water sources. Unlike types of pollution where we may not know the source or cause, point source pollution comes from a place that can be traced back to the point of origin such as a particular industry or sewer system. This activity presents a scenario where students have to role play as citizens of a community facing a large influx of phosphorus from a neighboring town.

## Background

Phosphorus is a key element that is needed for living organisms to function and survive. In soils, it is present as water-soluble dissolved phosphorus and particulate-bound phosphorus. It moves through soil with the help of water from rain or flooding events. Phosphorus can be carried by surface water runoff or by leaching deeper into the soil profile. Gravity aids in this process as water travels from higher to lower elevations. The flow of phosphorus from its original source through groundwater can create a plume, or an area in the soil where concentrated phosphorus becomes present. Eventually, phosphorus will make its way into surface and groundwater sources.

Large concentrations of phosphorus can enter the environment from a variety of sources. The main pollutants are detergents, waste, and fertilizers. Household detergents and soaps that contain phosphates can make their way into rivers and streams when they are not properly managed. Pet waste and sewage also contain high levels of phosphorus that can be environmentally harmful if they are improperly disposed of, or if there are leaks in drainage systems. Livestock farms output large amounts of organic waste that can be carried downstream or leach into soils. Fertilizers are used for agriculture, household lawns, gardens, parks, sporting fields, and more. The Department of Agriculture has also conducted research on the impact of golf courses on surrounding surface waters. The study found that seasonal variations in nutrient concentrations of nitrogen and phosphorus were present in runoff and drainage water leaving the golf course (USGA, 2015). When the phosphorus from fertilizers is not used by plants, it can be washed away with rainfall or storm water runoff.

Because phosphorus is a nutrient, too much phosphorus in water is harmful for aquatic ecosystems because it causes algae and plants to overproduce. This process is called eutrophication. Plants and algae on the surface of the water form a thick layer that blocks fish from receiving dissolved oxygen and submerged plants from receiving sunlight. Underneath the surface, animals and plants may die off.

## Objectives

### Students will be able to:

- Describe the importance of phosphorus in the environment.
- Explore the challenges of excessive use of fertilizers in a community.

### Duration:

1-2 class periods (60 minutes each)

## Materials

Story about Portside vs. Fairway Harbor

Role playing cards

Images for Explore portion of the activity (see list below)

## Engage

Show images of the following to students and have them discuss what comes to mind or how it makes them feel. Try to invoke a feeling of beautiful spaces and recreational opportunities.

- Neighborhood with manicured lawns
- Wild flowers
- Garden bed
- Dogs and puppies
- Lush farmlands
- Golf courses
- Kayaker on calm lake
- Marina with boats
- Hiking trails

Then show the following images and once again ask the students to explain their thoughts and feelings.

- Hogs on a farm
- Retention ponds with algae bloom
- Fish kill in a river
- Dogs pooping (or poop bags in natural places)
- Spraying fertilizer on lawns and crops
- Poultry farms
- Industry dumping

Lead a brief discussion comparing and contrasting the two sets of images. How are the images connected?

## Explore

Read the background story to the class and have the students listen carefully to *identify* the stakeholders in this scenario. After sharing the story, have students brainstorm all people in the community that would need to have a say at the town hall meeting.

Portside is a popular town flanked by rolling farmlands and a beautiful coastal harbor. The citizens of this town were approached by a business owner that is interested in purchasing hundreds of acres of land just North of the town. Fairway Harbor, a lavish golf resort, proposes a sprawling oasis nestled within the heart of this beloved community. With meticulously designed fairways, lush greens, and state-of-the-art amenities, it promises an unparalleled experience for golf enthusiasts and leisure seekers alike. Not only will there be golf courses, but there will also be a lake for

kayaking, trails, and recreational fields for other sports. The trails will traverse throughout the golf course and down through the community and neighborhoods, and lead down to the marina at the harbor. However, beneath the surface of this idyllic resort lies a debate as citizens of Portside express deep concerns about its potential impact on their community and water quality. All citizens are encouraged to attend the upcoming town hall meeting where the owners of Fairway Harbor will be in attendance to discuss the purchase and development of the area.

At first glance, Fairway Harbor appears as a beacon of recreation and relaxation, boasting world-class golf courses, upscale accommodations, and fine dining establishments. The resort's proponents argue that it will attract tourists, stimulate economic growth, and elevate the status of this community. Yet, such promises are met with skepticism by residents who fear the consequences of excessive traffic and maintenance which could result in phosphorus runoff into local water sources.

Phosphorus, a key component in fertilizers used to maintain the lush greenery of golf courses, poses a significant threat to water quality when it leaches into rivers, lakes, and groundwater. Excessive phosphorus levels can trigger algal blooms, deplete oxygen levels, and harm aquatic life, jeopardizing the delicate balance of ecosystems. Concerned citizens worry about the potential degradation of waterways, which not only serve as sources of drinking water but also sustain local wildlife and recreational activities. Local conservation groups are also concerned about various bird species that use the area for nesting and migration routes. The community's apprehensions are compounded by fears of environmental degradation, loss of biodiversity, and disruption of natural habitats. Moreover, some citizens voice concerns about the strain on infrastructure, increased traffic congestion, and potential loss of property value.

In response to mounting opposition, proponents of Fairway Harbor emphasize their commitment to sustainability and environmental stewardship. They pledge to implement advanced irrigation systems, utilize eco-friendly landscaping practices, and adhere to strict water management protocols to minimize the resort's ecological footprint. Additionally, they promise to engage with the community in transparent dialogue, address concerns, and collaborate on mitigation strategies. As the debate continues, the community stands at a crossroads, grappling with competing visions of progress and preservation. The decision regarding Fairway Harbor's fate will shape the future of our landscape. Will they prioritize economic prosperity at the expense of environmental integrity, or will they chart a more sustainable path forward that balances development with conservation?

- Distribute the role playing cards in a manner that accommodates the size of the class. Ideally, you would like to have a group of students working together to represent each role card. Provide a copy of the scenario for each group to refer to as well.
- Give a brief overview of how a town meeting may be run with a moderator. The moderator may be the instructor or used as another role for a group of students in the class.
  - Setting the Agenda: Sets the agenda or topic of discussion for the meeting or debate, ensuring that it stays focused and on track.

- Managing Speaking Turns: Regulates speaking turns, ensuring that each participant has an opportunity to speak without interruption. They may enforce time limits for speakers to keep the discussion moving forward efficiently.
- Encouraging Participation: Encourages active participation from all attendees, including quieter or less assertive individuals, by prompting them to share their perspectives or ask questions.
- Enforcing Rules of Conduct: Maintains decorum by enforcing rules of conduct, such as prohibiting personal attacks, ensuring respectful communication, and discouraging disruptive behavior.
- Keeping Time: Keeps track of time to ensure that the discussion stays within the allotted time frame.
- Summarizing Key Points: Summarizes key points discussed and highlights areas of agreement or disagreement among participants.
- Remaining Neutral: Remain neutral and unbiased throughout the discussion, refraining from expressing personal opinions or taking sides on the issues under debate.
- Allow students time to read their role cards and ask questions in order to understand how they contributed to this situation. They may research their role in order to get facts and data to support their claims. As a group, the students should think about their roles and be prepared to share their written statements during the town hall meeting.
- Remind students that they should take on the stance of their role card even if it may not align with their personal beliefs.
- As each stakeholder group shares their concerns during the meeting, the Town Council Members should listen carefully and then vote on whether or not the Fairway Harbor Resort should be built in their community.

Description of roles in this community. (See role-playing cards for distribution)

Roles in Community	Description
Portside Homeowners	Residents living in the community of the proposed golf resort site express worries about the potential environmental impact, particularly regarding water quality due to excessive phosphorus runoff. They fear disruptions to their way of life and the degradation of their community's natural beauty. They do enjoy manicured lawns and gardens. Many of these citizens are avid pet owners.
Town Council Members	Elected officials face the challenging task of balancing economic development with environmental protection. They must navigate conflicting interests, listen to citizen concerns, and make decisions that benefit the community as a whole.
Soil & Water Conservation Group	Environmental agencies provide expertise on the potential ecological impacts of the golf resort project. They conduct studies, offer recommendations for mitigating harm, and ensure compliance with environmental regulations.

Small Business Owners	Local entrepreneurs voice diverse opinions on the proposed golf resort's impact on the community. While some see it as an opportunity for increased tourism and economic growth, others worry about potential disruptions to existing businesses and ecosystems.
Audubon Bird Society	Individuals passionate about environmental conservation rally fellow citizens to oppose the golf resort's construction. They organize protests, create awareness campaigns, and advocate for sustainable development practices to protect local ecosystems. They are concerned about conserving nesting sites for local bird species as well as the habitats that are used by migratory species.
Farmers	Farmers in the vicinity of the proposed golf resort raise concerns about the potential impact on their livelihoods. They worry about increased competition for water resources and potential contamination of soil and crops due to phosphorus runoff. Some express fears of encroachment on farmland and loss of agricultural space and subjection to strict regulations on the farm. They follow best practices for soil and water quality.
Wastewater Treatment Operators	Operators of wastewater treatment facilities in the community are tasked with ensuring compliance with environmental regulations and maintaining water quality standards. They assess the potential impact of the golf resort's development on local water systems and may express concerns about increased demand on treatment infrastructure and potential contamination risks.
Local Scientists	Environmental experts study the potential impacts of the golf resort on the surrounding ecosystem, particularly in relation to phosphorus runoff and water quality. They provide data-driven insights to inform decision-making and recommend strategies for minimizing ecological harm.
Owners/Investors of the Fairway Harbor Resort	Financial backers of the golf resort project seek a return on their investment. They may pressure developers to prioritize profitability over environmental concerns, or conversely, support environmentally responsible development practices to mitigate risks and maintain public goodwill.
Developers & Landscapers of Fairway Harbor Resort	The developers of the golf resort propose plans that promise economic benefits for the community, including job creation, increased property values, and revenue from tourism. They may also offer commitments to environmental sustainability to address citizen concerns. They want to include a lake, trail system, ball fields, dog parks, etc.
Moderator Group (Optional) *Teacher *Student group	The moderator's role is to lead the town hall meeting in an orderly manner by: Setting the agenda; Managing speaking turns; Encouraging participation; Enforcing rules of conduct; Keeping time; Summarizing key points; and Remaining neutral.

## Explain and Extend

Discuss how individuals and communities can contribute to phosphorus sustainability. Ask students how they can be part of the solution (refer to the article, "[Is our phosphorus use sustainable? Most stakeholders doubt it](#)").

### Debriefing questions:

How did you feel playing your role?

Which characters felt the most strongly one way or the other?

What if this were your own town? How would changing the use of chemical lawn fertilizers affect you or someone you know? .

## Evaluate

After completing the activity, have students answer the following questions:

1. What is the effect of fertilizers on water quality?
2. Are there any similar scenarios in your local community?
3. What can you and/or your family do to lessen the effect of fertilizers on water quality?

## Teaching Resources

Bock, E. & Easton, Z. (2020). Export of nitrogen and phosphorus from golf courses: A review. *Journal of Environmental Management*, vol. 255.

"[Prevent Phosphorus Learning the Golf Course](#)" United States Golf Association, February 27, 2015. <https://www.usga.org/course-care/prevent-phosphorus-from-leaving-the-golf-course-21474859739.html#:~:text=In%20fresh%20water%20systems%2C%20the,both%20fresh%20and%20saltwater%20systems>.

## References

"[Is our phosphorus use sustainable? Most stakeholders doubt it.](#)" NC State News, July 2023  
Grieger, K, Merck, A., Deviney, A., & Marshall, A., "What are stakeholder views and needs for achieving phosphorus sustainability?" May 26, *Environment Systems and Decisions*.