

The Environmental Crisis



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The Environmental Crisis

Enduring Understandings

- Natural systems are interdependent.
- The actions of humans can impact the health of the environment.
- Humans can help protect the environment by limiting their waste.
- Risks to environmental and human health can be managed and reduced.
- A healthy and sustainable future for human communities on Earth is possible.

Essential Questions

- What is “waste”?
- How is human waste managed in different parts of the world?
- How does a landfill work?
- What are the environmental implications of a landfill such as Cateura?
- What happens to water supplies in nearby creeks as the result of the dumping of solid waste in massive amounts?
- What health hazards do landfill scavenger communities face?
- How are environmental issues in areas surrounding landfills exacerbated by seasonal flooding?
- What can be done to protect the environment from damage associated with landfill proximity?
- How can clean water supplies be conserved in communities close to landfills such as Cateura?
- What are the human health consequences for communities near landfills such as Cateura?

Part 3 is designed to help students synthesize some of the concepts they learned in the previous portions of the lesson surrounding the environmental and human health concerns of landfill operations. Students will examine how the flooding of 2014 in Paraguay exacerbated the environmental issues in Cateura. They will also explore options for protecting the environment in this region from further damage and restoring a clean water supply. Students will work collaboratively to analyze the problems associated with the Cateura landfill and develop viable solutions to improve the environmental situation in the region.

This portion of the lesson requires a class set of **HANDOUT 5: NGO Go!**, noting that the duration of this particular project can vary as a function of class and/or curriculum time available.

Additional Resources

Important Things to Know About Landfill Gas

https://www.health.ny.gov/environmental/outdoors/air/docs/landfill_gas.pdf

Living Off Trash in Latin America: Debunking the Myths

<https://revista.drclas.harvard.edu/book/living-trash-latin-america>

Puerto Rico Had Towering Landfills and Coal Ash Pollution. Then, Maria Hit.

<https://grist.org/article/puerto-rico-had-towering-landfills-and-coal-ash-pollution-then-maria-hit/>

Waste Land: Does the Large Amount of Food Discarded in the U.S. Take a Toll on the Environment?

<https://www.scientificamerican.com/article/earth-talk-waste-land/>

In World's Poorest Slums, Landfills and Polluted Rivers Become a Child's Playground.

<https://www.pbs.org/newshour/world/in-worlds-poorest-slums-landfills-and-polluted-rivers-become-a-childs-playground>

Trash City: Inside America's Largest Landfill Site

<https://www.cnn.com/2012/04/26/us/la-trash-puente-landfill/index.html>

The World's Trash Crisis, and Why Many Americans are Oblivious

<http://www.latimes.com/world/global-development/la-fg-global-trash-20160422-20160421-snap.htmlstory.html>

Environmental Protection Agency: Landfills

<https://www.epa.gov/landfills>

Landfills: Impact on Groundwater

<http://www.waterencyclopedia.com/La-Mi/Landfills-Impact-on-Groundwater.html>

COMMON CORE STANDARDS ADDRESSED BY THIS LESSON

History/Social Studies

CCSS.ELA-LITERACY.RH.9-10.1

Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.

CCSS.ELA-LITERACY.RH.9-10.3

Analyze in detail a series of events described in a text; determine whether earlier events caused later ones or simply preceded them.

CCSS.ELA-LITERACY.RH.9-10.4

Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social science.

CCSS.ELA-LITERACY.RH.9-10.7

Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.

CCSS.ELA-LITERACY.RH.9-10.8

Assess the extent to which the reasoning and evidence in a text support the author's claims.

Science and Technical Subjects

CCSS.ELA-LITERACY.RST.9-10.1

Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

CCSS.ELA-LITERACY.RST.9-10.2

Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

CCSS.ELA-LITERACY.RST.9-10.5

Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

CCSS.ELA-LITERACY.RST.9-10.6

Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

CCSS.ELA-LITERACY.RST.9-10.7

Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

CCSS.ELA-LITERACY.RST.9-10.8

Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

COMMON CORE STANDARDS ADDRESSED BY THIS LESSON

Writing

CCSS.ELA-LITERACY.WHST.9-10.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

CCSS.ELA-LITERACY.WHST.9-10.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCSS.ELA-LITERACY.WHST.9-10.7

Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

CCSS.ELA-LITERACY.WHST.9-10.8

Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

CCSS.ELA-LITERACY.WHST.9-10.9

Draw evidence from informational texts to support analysis, reflection, and research.

Duration of lesson

Three to five one-hour periods

Assessments

Completion of the *Portrait of a Place* journaling activity

Completion of the *Drowning in Trash* activity (thought questions and class discussion)

Completion of the *Up to our Waists in Waste* diagram assignment

Completion of the *Water Rising* assignment

Completion of the *NGO Go!* project

Group discussion

Student presentations

Materials needed

White board

White board markers

Computers with Internet connection

Projector

Blank index cards

Writing utensils

Markers

Colored pencils

Poster-board

HANDOUT 1: PORTRAIT OF A PLACE

HANDOUT 2: DROWNING IN TRASH

HANDOUT 3: UP TO OUR WAISTS IN WASTE

HANDOUT 4: WATER RISING

HANDOUT 5: NGO Go!

Procedure

Part 1: That's Rubbish! (1 one-hour class period)

1. Begin by asking students to consider what it might be like to live in Cateura, allowing them a few minutes to think about how the community is portrayed in the film *Landfill Harmonic*. Explain that they will be writing a journal entry through the lens of one of the students from the film, detailing the daily experience of life in a landfill-based community.
2. Distribute copies of **HANDOUT 1: PORTRAIT OF A PLACE** to each student, reviewing the instructions and allowing 15–20 minutes for journal entries to be completed. Be sure to remind students to focus on the elements of life in Cateura most associated with its proximity to the landfill.
3. When the journal entries are complete, divide students into groups of two and ask them to share their entries with each other. Allow 5–10 minutes for students to read and discuss each other's work. If time permits, invite several students to read their entries aloud. Ask the students to suggest one word which describes life near the landfill and record the responses on the board.
4. Host a brief discussion about life in the Cateura community using the journal entries, words on the board, and the following questions as a guide.
 - a. *How is the community of Cateura similar to where you live? What are some of the biggest differences?*
 - b. *What do you think it is like to live so close to a landfill? How might proximity to the landfill affect the people of Cateura?*
 - c. *How might you describe the smell of the air in Cateura?*
 - d. *Do you think the students in the film *Landfill Harmonic* are as aware of the waste in their community as you might be if you traveled there for the first time?*
 - e. *Would you be concerned about the health of the environment if you lived in Cateura?*
 - f. *Would you be concerned about your own health if you lived in Cateura?*
5. Distribute the blank index cards to the class, allowing 5 minutes for each student to make a list of the waste items they have generated today. Explain to the students that waste, in this case, is defined as anything thrown in a garbage can (as opposed to a recycling or compost container) and therefore destined for a landfill. Students should list as many items as possible in the time provided. If time allows, they can also write their items on the board. Ask the students to review their lists, circling anything that could have been recycled or composted. Ask the students the following question, allowing several minutes for open discussion.
 - a. *How would you define the term “waste”? Is waste different from garbage or trash?*
 - b. *How are recycling and composting related to waste?*
6. Ask the students to work with a partner to guess which five countries produce the most waste per person in the world. Share the online interactive *Most Wasteful Countries Map* with the class (<http://www.eco2greetings.com/c/most-wasteful-countries/>), either on a projector or via individual student computers. Data on which this map is based may be found by clicking on the data link at the bottom of the page. [Note: Map does not work on all servers.]

7. Divide the class into groups of two or three. Distribute copies of **HANDOUT 2: DROWNING IN TRASH** to each student. Play the 4 ½ -minute PBS NewsHour “Drowning in Trash” video clip from <https://youtu.be/oLIW75RCeYI>; students can access the file using individual computers in the absence of a projector. Review the instructions on the handout and allow students time to work on responses to the discussion questions provided. (Note: If time permits, you can also have students view the *Washington Post* video or read the related article; URLs are provided on the handout.)
8. Host a brief discussion using the discussion questions on the handout as a guide. Then, ask the following questions:
 - a. *What happens to the waste you generate at home? Please be specific.*
 - b. *Do you know how close you live to the nearest landfill in your region?*
 - c. *After watching the film Landfill Harmonic, are you concerned about environmental and human health impacts of having a landfill close by? Please explain.*
9. For homework, ask students to research a landfill close to their community. Students should determine the landfill name and location, as well as the proximity of the landfill to their homes.

Part 2: Trash Talkin’ (1-2 one-hour class periods)

1. Invite several students to share their landfill research from the assignment. Ask how many students already knew where their local landfills were compared to those who were determining location for the first time. Host a brief discussion, using the following questions as a guide for your conversation:

- a. *What is a landfill? How does a landfill work?*
- b. *How many of you have been to your local landfill? (Ask students to describe the experience.)*
- c. *In what ways do you think the landfill in Cateura might be different from your local landfill?*
- d. *What are the consequences to environmental and human health if a landfill isn’t operating correctly?*

2. Distribute copies of **HANDOUT 3: UP TO OUR WAISTS IN WASTE** and divide students into pairs. Explain to the students they will have the opportunity to learn how a landfill works, considering the impact of the Cateura landfill on the surrounding community specifically. Review the instructions for **HANDOUT 3**, paying special attention to the prompt and table students are asked to complete in Step 3. Students may find the example below helpful regarding instructions for the table. Keep in mind that student number assignments will be arbitrary.

No.	Description of Landfill Area	Environmental Health Impact	Human Health Impact
1	Plastic liner at the bottom of the landfill	If it fails, the leachate from the landfill could contaminate groundwater and damage the surrounding ecosystem.	Groundwater contamination from the leachate could lead to toxic conditions in nearby wells.

3. Play the “Environmental Impacts of Landfill Leachate” video cited in the Directions section of **HANDOUT 3** (<https://www.youtube.com/watch?v=QYBvntdO6YM>); students can access the file using individual computers in the absence of a projector. Allow students 15-20 minutes to complete **HANDOUT 3**.

4. When students are finished, invite several to share their diagrams with the class. Be sure they use as many of the required terms as possible in their explanations of how landfills work.

5. Project the Anatomy of a Landfill image from **TEACHER RESOURCE 1**. Invite several students to share their entries from the table in Step 3. Students should come to the board and describe the areas they chose using the Anatomy of a Landfill diagram. Encourage students to think about the connection between a poorly managed landfill, such as the one in Cateura, and the health of the surrounding environment and nearby community. As students present, ask them to circle the areas referenced on the Anatomy of a Landfill diagram. Host a discussion, using the following questions as a framework for the conversation.

- a. *What kinds of items would you find in the Cateura landfill?*
- b. *What is landfill “leachate”? What are some examples of items in the Cateura landfill that may contain some of the toxic chemicals found in leachate?*
- c. *After completing this activity, have your concerns about the environmental health impacts of landfills changed? How about human health? Please explain.*
- d. *Where do the residents of Cateura acquire drinking water? How do you think drinking water supplies from nearby creeks in Cateura are affected by the massive amount of solid waste in the nearby landfill?*

6. If time permits, play this Voice of America video about the people whose livelihood it is to scavenge landfills (<https://www.youtube.com/watch?v=suYUkzjpOk8>). Explain to students that the dump featured in the video is in Kenya, but it is similar to the Cateura landfill in many ways. Ask

the students to focus on the health hazards associated with this type of lifestyle while they watch. Then, host a post-video discussion where students voice their concerns about the health of children, adults, and families of Cateura who live and work on the landfill site.

7. For homework, students should complete **HANDOUT 4: WATER RISING**. Distribute one copy of the handout to each student, reviewing the instructions and explaining that the questions focus on the impact to the landfill, surrounding environmental conditions, and human health of flooding in the Paraguay River. Note: This activity requires an Internet connection; print copies of the article for students who may not have Internet access outside of school.

Part 3: Taking a Stand (1-2 one-hour class periods)

1. Begin by inviting students to share their work on **HANDOUT 4: WATER RISING**, using their responses to the questions provided as a framework for a quick discussion. Then, ask the students the following questions.

- a. *How does knowing more about the environmental situation in Cateura make you feel?*
- b. *How does knowing more about the environmental situation in Cateura influence the decisions you will make at your home about the trash you generate?*
- c. *What should be done to protect the people and environment of Cateura?*
- d. *Who should be responsible for preventing further environmental damage related to the landfill in Cateura?*

2. Divide students into new pairs; distribute copies of **HANDOUT 5: NGO Go!**. Explain to students that they will be assuming the role of an NGO (Non-Governmental Organization) that is working to help find solutions to the landfill-related environmental issues in Cateura. Review the instructions for **Handout 5**, focusing on the definition of an NGO and the requirements for the poster students will be creating. NOTE: This project is designed to span 1-2 class periods but can easily be adapted as a longer-term assignment depending on the total time available.
3. When the posters are complete, student groups should hang them around the room for a gallery walk. Give each group two minutes to present their NGO; all groups should then take 10-15 minutes to view other posters for the gallery walk.
4. When the gallery walk is finished, host a final discussion where students are asked to share positive feedback on each other's work. Ask the students to share (1) which NGO they liked best and (2) why they think that NGO will be effective in helping solve some of the environmental issues in Cateura.

Extension Activities

1. Host a discussion about the rights of children around the world, focusing on communities in areas of poor environmental health such as Cateura. Invite students to explore the UN Convention on the Rights of the Child at <http://www.ohchr.org/Documents/ProfessionalInterest/crc.pdf> for evidence of the rights of children relating to environmental health. The following questions may be used as a framework for your discussion.
 - What needs do children have?
 - What rights do children have? Do rights for children change as they get older?
 - Should all children have access to healthy environmental conditions?
 - Who is responsible for making sure children have access to healthy environmental conditions?
 - Who is responsible for promoting the rights of children?
 - What actions could be taken to protect the rights of children?
2. Invite students to research and discuss waste management practices in different parts of the world. Research questions could focus on general waste management types (dumps vs. sanitary landfills), waste composition by percentage, or related questions generated by students.

Handout 1 ► P. 1

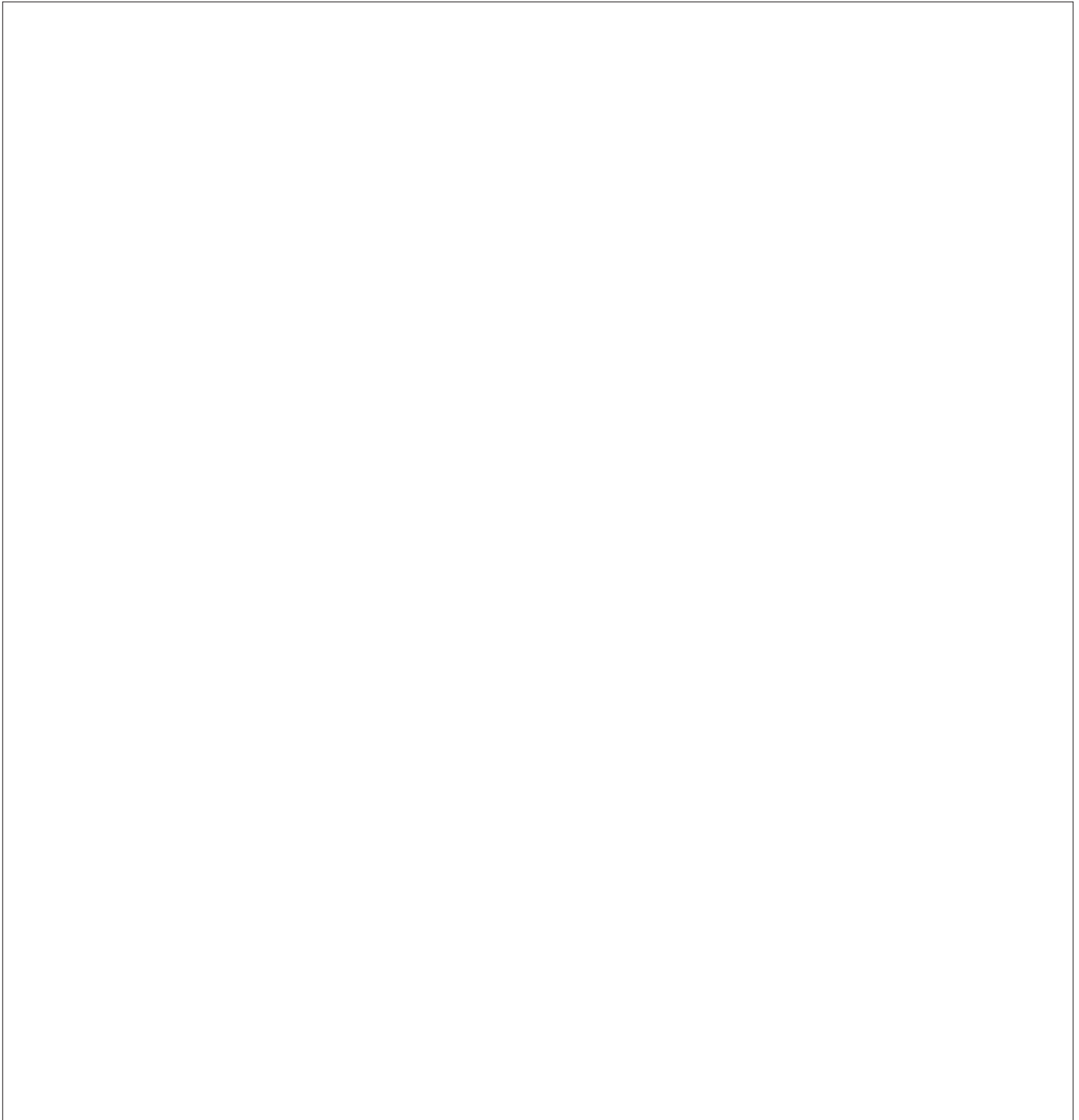
Portrait of a Place

Directions:

Imagine you are one of the students featured in the film *Landfill Harmonic*. How do you think it feels to live so close to the Cateura landfill? Think about how it affects your home, commute to school, extracurricular activities, food, health, family, scenery, etc. How does the impact of the landfill on your life make you feel? In the space provided, write a journal entry which describes a day in your life as a young person living near the Cateura landfill.

Handout 1 ► P. 2

Portrait of a Place



Handout 2 ▶ P. 1

Drowning in Trash

Directions:

Watch the PBS NewsHour “Drowning in Trash” video clip taken from a 2017 Washington Post article: <https://youtu.be/oLIW75RCeYI>. Use the information from the video to complete the discussion questions below to the best of your ability. (For further information, the entire Washington Post video report can be accessed at https://www.washingtonpost.com/graphics/2017/world/global-waste/?utm_term=.02c835c57aed. An accompanying story can be found at https://www.washingtonpost.com/world/africa/the-world-is-drowning-in-ever-growing-mounds-of-garbage/2017/11/21/cf22e4bd-17a4-473c-89f8-873d48f968cd_story.html?utm_term=.70555f390882.

**Discussion Questions**

1. In the *PBS Newshour* video, the reporter Kadir van Lohuizen recalls his experience of seeing trash on a remote Pacific island beach that had come from somewhere else. It was the first time he thought about what happens to trash after it is collected from his home. How often do you think about what happens to the trash you generate at home?

2. Van Lohuizen says that trash is often invisible in the Westernized part of the world. What does this mean?

Handout 2 ▶ P. 2

Drowning in Trash

3. Are you surprised by the fact that New York City ranks as the leading producer of trash compared to any other place in the world? Why does New York City generate more trash than other cities with the same population, such as the Nigerian city of Lagos?

4. Van Lohuizen claims that many of the garbage incinerators in the United States are outdated and dangerous. What are the environmental and human health implications of using old technology like this?

5. The interviewer in this clip states that trash changes as countries develop. What does this mean? What examples does Van Lohuizen offer in response to this statement?

6. On average, Americans throw away their own body weight in trash every month. In Japan, the typical person produces only two-thirds as much. What do you think might account for this difference between countries?

Handout 3 ▶ P. 1

Up to Our Waists in Waste

Directions:

Watch the “Environmental Impacts of Landfill Leachate” video at <https://www.youtube.com/watch?v=QYBvntdO6YM> and respond to the prompts below using what you learned. Additional print or online resources may be used for your research.

1. Use the space on the next page to create a diagram showing how a landfill works. Your diagram should be *colored* and *labeled* with the following terms:

groundwater	health	polyester	gas
freshwater	decompose	debris	bacteria
odor	leachate	drainage	methane
plastic liner	chemicals	gravel	atmosphere
soil	compacted clay	pipes	gas burning
PVC	contamination	drinking water	gas venting

2. Use your diagram to explain how a landfill works to a partner from class. Your explanation should be detailed and include as many of the terms displayed above as possible.

Handout 3 ► P.2

Up to Our Waists in Waste

Landfill Diagram

(see Step 1 on the preceding page for instructions)

Handout 3 ▶ P. 3

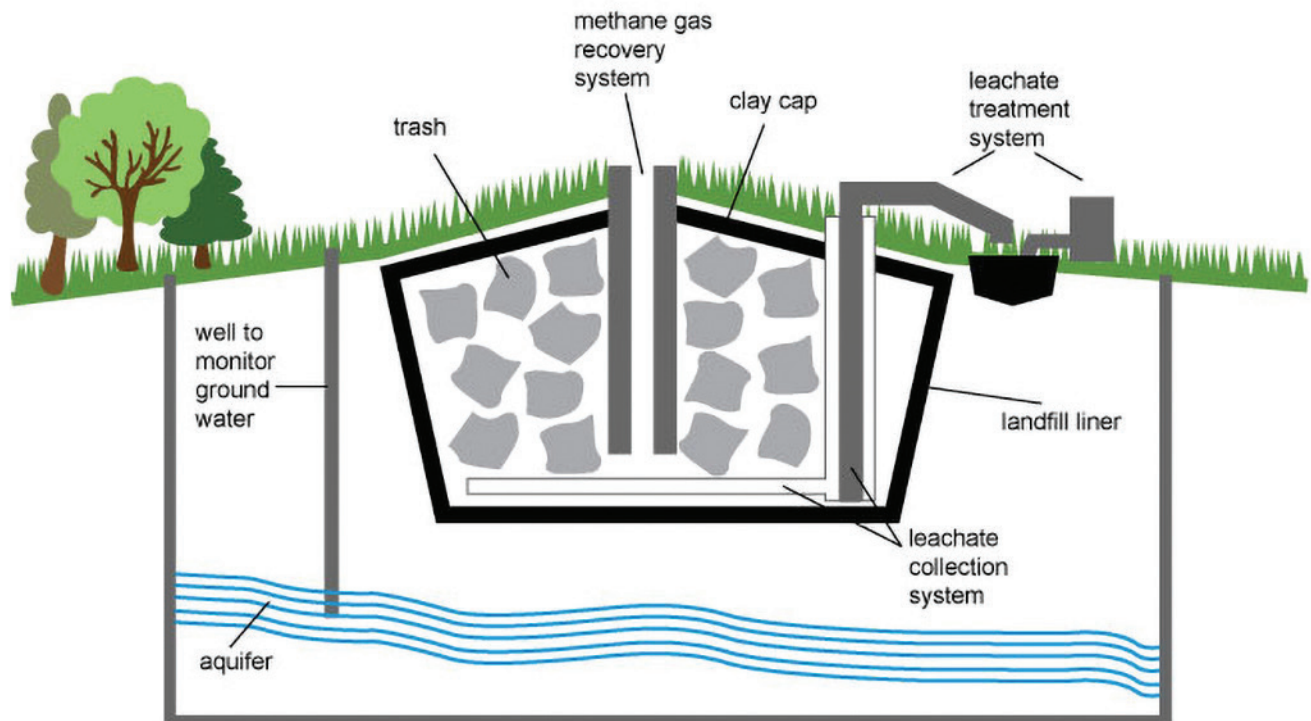
Up to Our Waists in Waste

3. Review the diagram you created. Consider problems with the design of a landfill which might lead to contamination of the surrounding environment. Number three areas on your diagram where structural failure or poor construction could occur. In the table below, list each area and describe what the impact(s) to environmental and human health might be.

Number	Description of Landfill Area	Environmental Health Impact	Human Health Impact

Teacher Resource 1 Anatomy of a Landfill

Modern landfill



Source: Adapted from National Energy Education Development Project (public domain)

Handout 4 ► P. 1

Water Rising

Directions:

Read the article “Paraguay Floods—Asunción Faces Environmental Disaster as River Threatens to Flood Toxic Dump” at <http://floodlist.com/america/paraguay-floods-asuncion-faces-environmental-disaster-river-flood-toxic-dump>. Please answer the questions below to the best of your ability, using the information from the article.

1. This article was published on the website *Floodlist* following the major flooding of the Paraguay River documented in the film *Landfill Harmonic*. According to the article, what water level (in meters) was considered “normal”? At what level was the river at the time the article was written?

2. In the article, a member of Parliament and leader of the committee of Ecology, Natural Resources, and Environment in Paraguay was quoted as saying that if the river waters mixed with the toxic residues it could lead to an “environmental catastrophe with international consequences.” What did this mean?

3. Why was a state of emergency declared after the flood waters began to rise near Cateura?

Handout 4 ► P. 2

Water Rising

4. According to the article, how long were the flood waters expected to remain high after the initial event? What do you think some of the long-term concerns about water this high were for the community of Cateura?

5. What was the source of flooding documented in both this article and the film *Landfill Harmonic*? Do you think flooding in this region is still an environmental problem near this landfill today? Please explain.

Handout 5

NGO Go!

Directions:

When the landfill of Cateura was made famous by the film *Landfill Harmonic*, organizations known as NGOs began partnering with the community to help its residents find more sustainable ways of living. An NGO, or Non-Governmental Organization, is a non-profit, volunteer-based citizens' group with a social mission. NGOs exist in all parts of the world, and are typically involved in environmental, advocacy, and human rights work.

For this project, you will work with your group to design an original NGO whose mission it will be to help improve the environmental conditions related to the landfill in Cateura. Your NGO must choose one of the following environmental issues as your main mission in Cateura.

- Restoring the clean water supply.
- Educating the public about the health hazards of landfill scavenging.
- Preventing long-term impacts of flooding near the landfill.
- Ensuring that the landfill infrastructure is more reliable.
- Preventing air pollution related to methane gas venting from the landfill.
- Reducing the amount of trash which ends up in the landfill.
- Choose your own environmental issue relating to the landfill in Cateura which is not listed here (with teacher permission).

Spend time researching methods you can use and planning your NGO with your group during the time your teacher provides. Make sure your plan is practical and sustainable and that it will be acceptable to the people of Cateura.

Your group must create a poster which advertises the work of your NGO. Finished posters must include the following information:

1. The name of your NGO.
2. An original logo for your NGO.
3. Detailed information about the mission of your NGO (an action plan). Please address the following:
 - a. What specific landfill-related environmental issue are you going to solve in Cateura?
 - b. What are you planning to do to solve this environmental issue? (This is the most important part of the poster.)
 - c. How will your work affect human health in Cateura?
 - d. How will you know when you have achieved your goal?
 - e. What will be the long-term impact of your work on the environment?
 - f. Why is the work of your NGO so important?



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