

EARTH FEATURES & PROCESSES



differentiated passages bundle

Weathering & Erosion Differentiated Passages

Types of Weathering and Erosion Questions

Name: _____ Date: _____

Types of Weathering and Erosion

Earth is constantly changing. Weathering and erosion are two natural processes that change Earth's features. Both of these are responsible for changing the landscape, but how they work is different. Write down three things that weathering and erosion do.

Rock Layers Differentiated Passages

Rock Layers

Name: _____ Date: _____

Rock Layers

Earth gives us clues about its history in its rock layers, or strata. There are three types of rocks found on Earth. Igneous rocks are made when molten rock cools and turns to a solid. Metamorphic rocks are the result of existing rocks being changed by heat, pressure, and mineral-rich fluids, or a combination of these. Sedimentary rocks are formed from pieces of rock that are loosened by weathering. These pieces, or sediments, get buried and pressed together and become cemented into larger pieces of rock called sedimentary rock layers, or strata. These layers are found on the surface of Earth.



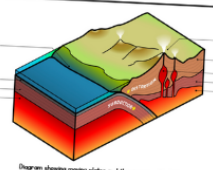

Mapping Earth's Features Differentiated Passages

Ring of Fire

Name: _____ Date: _____

Ring of Fire

The Ring of Fire is located in the Pacific Ocean and got its name from the many volcanoes on its borders. This horseshoe-shaped belt is about 25,000 miles long. It stretches along the western coasts of North and South America and heads north toward the Aleutian Islands. It then turns to the east and Southeast Asia through Japan, the Philippines, and New Zealand. Several mountain ranges such as the C Cordillera in the western United States and the Andes Mountains in western South America are part of the Ring of Fire.



Three volcanoes made up of eruptions in the Ring of Fire. Mount Saint Helens, a volcano in the Ring of Fire, erupted in 1980. Nearly 90 percent of Earth's major earthquakes since the 1800s have occurred in the Ring of Fire. The Ring of Fire has been the host of several major earthquakes. The 1906 San Francisco earthquake and the 2004 Indian Ocean tsunami of 2004. This natural disaster was the deadliest and one of the most powerful ever recorded.

Natural Hazard Design Solution Differentiated Passages


Manila Flood Plan

Name: _____ Date: _____

Manila Flood Plan

Manila is the capital of the Philippines. The Philippines is an island country in Southeast Asia in the Pacific Ocean. This city is on the island of Luzon along the shore of Manila Bay. It is the result of the Baguio River. Manila is the Philippine center for economic, political, and social activity. Around 14 million people live in this city. Flooding makes this area a difficult place to live.

Floods take lives, destroy buildings, and affect the landscape of Manila. There have been many deaths in this area. Manila floods for many reasons. One reason is that the Philippines gets hit with about 20 typhoons per year. These typhoons have also gotten worse due to climate change. Typhoons are circular storms that begin over warm, tropical waters. They have high winds and heavy rain. The paths of these typhoons have become unpredictable as well. They now travel over parts of the Philippines that did not have as many typhoons in the past. This leaves people unprepared for the wild weather.



Use the chart below to show the causes of flooding in Manila.

Cause	Frequency

2. How has urbanization affected flooding in Manila?

3. What plan has the government implemented to reduce flooding in Manila?

4th Grade NGSS 4-ES2-2-2



4th Grade Science

ABOUT LEXILE LEVELS



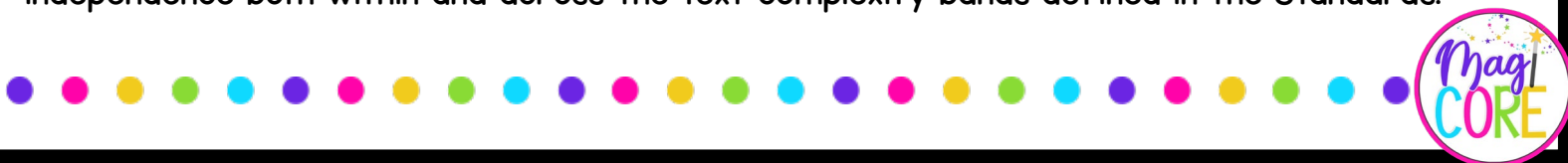
MagiCore Learning, LLC is a certified Lexile® Partner. These texts are officially measured and approved by Lexile and MetaMetrics® to ensure appropriate rigor and differentiation for students.

The Lexile Framework® for Reading measures are scientific, quantitative text levels. When the Lexile of a text is measured, specific, measurable attributes of the text are considered, including, but not limited to, word frequency, sentence length, and text cohesion. These are difficult attributes for humans to evaluate, so a computer measures them.

Common Core State Standards uses Lexile level bands as one measure of text complexity. Text complexity ranges ensure students are college and career ready by the end of 12th grade. Lexile measures help educators scaffold and differentiate instruction as well as monitor reading growth.

Grade Band	Lexile® Bands Aligned to Common Core Expectations
K-1	N/A
2-3	420L-820L
4-5	740L-1010L
6-8	1185L-1385L

Keep in mind when using any leveled text that many students will need scaffolding and support to reach text at the high end of their grade band. According to Appendix A of the Common Core Standards, "It is important to recognize that scaffolding often is entirely appropriate. The expectation that scaffolding will occur with particularly challenging texts is built into the Standards' grade-by-grade text complexity expectations, for example. The general movement, however, should be toward decreasing scaffolding and increasing independence both within and across the text complexity bands defined in the Standards."



Evidence from Rock Layers

4th grade

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2. Rock Layers (790L, 970L)
3. Cliffs at Whanganui (780L, 960L)
4. The Grand Canyon (780L, 950L)
5. Badlands National Park (780L, 980L)
6. Topanga Canyon Formation (780L, 980L)
7. Andes Mountains Fossils (750L, 960L)

Each passage set includes two differentiated passages on a fourth-grade level (one at the beginning of the band, one towards the end) and a question set geared towards comprehension and science mastery. The first question is differentiated to include a fill-in-the-blank diagram (lower complexity) or an open-ended diagram (higher complexity).

How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes six differentiated passages aligned to the following standard:

4-ESS1-1: Evidence from Rock Layers

Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.

Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.

Here are some suggestions for using these passages:

- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
- Use as a homework or review packet.
- Use as an intervention for students who need to revisit science concepts.



Rock Layers

Earth gives us clues about its history in its rock layers, or **strata**. There are three types of rocks found on Earth. **Igneous rocks** are made when molten rock cools and turns into a solid. **Metamorphic rocks** are the result of existing rocks being changed by heat, pressure, mineral-rich fluids, or a combination of these. **Sedimentary rocks** are formed from pieces of rock that are loosened by weathering. These pieces, or **sediments**, get buried deeply, creating layers like a cake. These layers get pressed together. They become cemented into larger rocks. Most of the rocks at the surface of Earth are sedimentary.



Each layer of sedimentary rock is a different color in this photograph

The fossils in the layers provide evidence about the plant and animal life that existed on Earth during different time periods. The fossils can be compared to what an area is like more recently. They show us how Earth has changed over time.

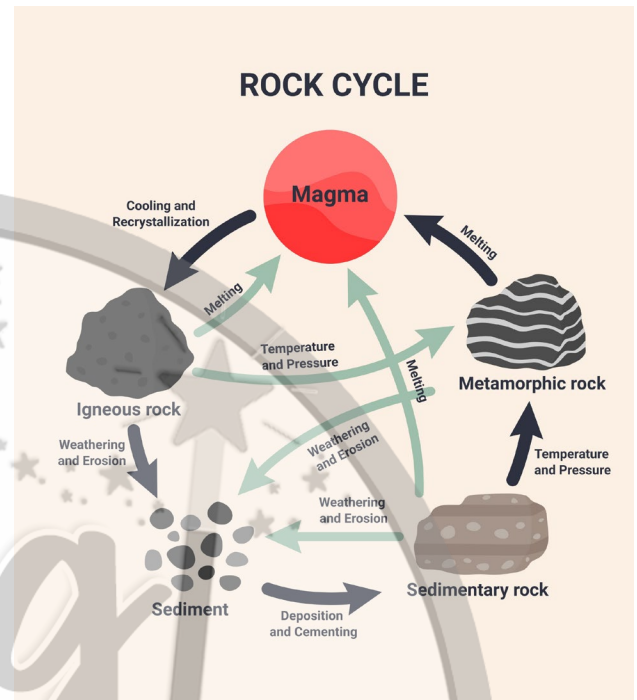


Diagram of the rock cycle.

Fossils are often found in sedimentary rock layers. The layers at the bottom are the oldest. The ones closer to the surface are the youngest. Think about cake again. The bottom layer goes down first then frosting or filling is added. A new layer of cake is placed on top of that. This is called the **law of superposition**. It allows scientists to figure out the age of the rock



Visible fault lines in rock layers.

Rock layers are made in an organized way. Rocks are originally laid down horizontally when they get deposited from above. Picture cake batter being poured into a pan. See it spread out into an even layer. This is

called the **law of original horizontality**. Sometimes scientists find rock layers that are not horizontal. The layers have all been shifted. The shift creates a break in the horizontal pattern. This tells scientists that some event happened to disrupt the layers. Examples of events that can affect original horizontality are an earthquake along a **fault line** or mountains building from shifting **continental plates**. Layers that are not horizontal tell a story. They help scientists figure out what was happening long ago.

Paying attention to layers of rock found on Earth allows humans to learn more about the planet's past. As scientists continue to study rock layers, more of Earth's secrets are revealed.

Rock Layers Questions

1. Use the chart below to name and define the main types of rocks presented in the text.

Type of Rock	Definition
Igneous	
	Made when existing rocks are changed by heat, pressure, mineral-rich fluids
Sedimentary	

2. Which of the following are events that can affect original horizontality? (choose all that apply)

- a. Heavy rain
- b. Earthquakes
- c. Tsunamis
- d. Mountains shifting

3. Look at the image from the article again. Imagine scientists found fossils at point A and at point B. Which fossils would be older? Use text evidence in your answer.



Rock Layers

Earth gives us clues about its history in its rock layers, or **strata**. There are three types of rocks found on Earth. **Igneous rocks** are made when molten rock cools and turns into a solid. **Metamorphic rocks** are the result of existing rocks being changed by heat, pressure, mineral-rich fluids, or a combination of these. **Sedimentary rocks** are formed from pieces of rock that are loosened by weathering. These pieces, or **sediments**, get buried deeply, creating layers like a cake. These layers get pressed together and become cemented into larger rocks. Most of the rocks at the surface of Earth are sedimentary.

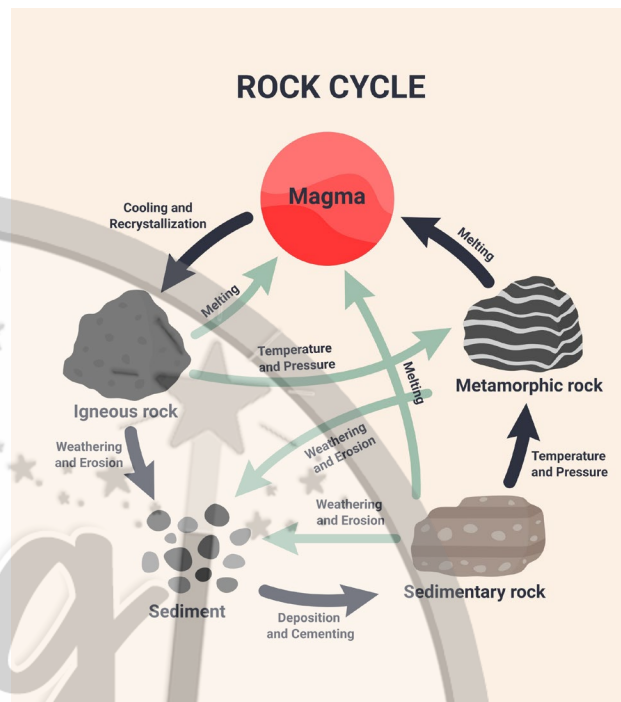


Diagram of the rock cycle.



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provide evidence about the plant and animal life that existed on Earth during different time periods. The fossils can be compared to what an area is like more recently and show us how Earth has changed over time.

Fossils are often found in sedimentary rock layers. The layers at the bottom are the oldest while the ones closer to the surface are the youngest. Thinking about cake again, the bottom layer goes down first then frosting or filling is added. A new layer of cake is placed on top of that. This is called the **law of superposition**, and it allows scientists to figure out the age of the rock layers. The fossils in the layers



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Rock layers are created in an organized way. As rocks get deposited from above, they are originally laid down horizontally. Picture cake batter being poured into a pan and spread out into an even layer. This is called the **law of original horizontality**.

Sometimes scientists find rock layers that are not horizontal. The layers have all been shifted, creating a break in the horizontal pattern. This tells scientists that some event happened to disrupt the layers. Examples of events that can affect original horizontality are an earthquake along a **fault line** or mountains building from shifting **continental plates**. Like fossils, layers that are not horizontal tell a story that helps scientists figure out what was happening long ago.

Paying attention to layers of rock found on Earth allows humans to learn more about the planet's past. As scientists continue to study rock layers, more of Earth's secrets are revealed.

Rock Layers Questions

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Weathering and Erosion

4th grade

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1. How to Use This Resource
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3. Shrinking Glaciers (760L, 960L)
4. Curving Rivers (770L, 970L)
5. Root Wedging (760L, 970L)
6. Shoreline Weathering (760L, 960L)
7. Cappadocia, Turkey (750L, 960L)

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How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes six differentiated passages aligned to the following standard:

4-ESS2-1: Weathering and Erosion

Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (Cause and Effect)

Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.

Assessment Boundary: Assessment is limited to a single form of weathering or erosion.

Here are some suggestions for using these passages:

- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
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Curving Rivers

If you were to view a section of a river from its bank, you might think it flows in a straight line. Getting an **aerial** view of the river from a height, however, will show that the river curves. It bends along its length.

Geologists call these loops **meanders**.



Aerial view of the meanders in the Mississippi River.



A bend in a river, the erosion on the right side is caused by swift flowing water.

Rivers such as the Mississippi and the Ohio, along with thousands of others, have a steady flow of water over nearly flat land. This land includes soft, loose soil. Such soil is easily **eroded** by swiftly moving water. The landscape is changed

when this soil shifts and crumbles. Rivers naturally have small bends. Water traveling around these bends is thrown to the outside of the turn. That water chips away at the riverbank on the outside of the bend. The land is worn down and widened over time. The water gets deeper here. Water flows more slowly on the inside of the bend. **Sediment** traveling in the water tends to settle there. This builds up the riverbank and makes the water shallower. The eroding at the outside of the bends and the **depositing** at the inside of the bends causes the river to create loops in the land.

Bigger loops are made as the river travels through these curves. Eventually, the water will find the shortest distance across the loops. It will cut across the narrowest part. The eroding and depositing process will start again once this happens. The part of the river that got cut off forms an **oxbow lake**. The pattern will continue if nothing interferes with this process. The river will make more curves.



A river flowing through a rocky, mountain area.

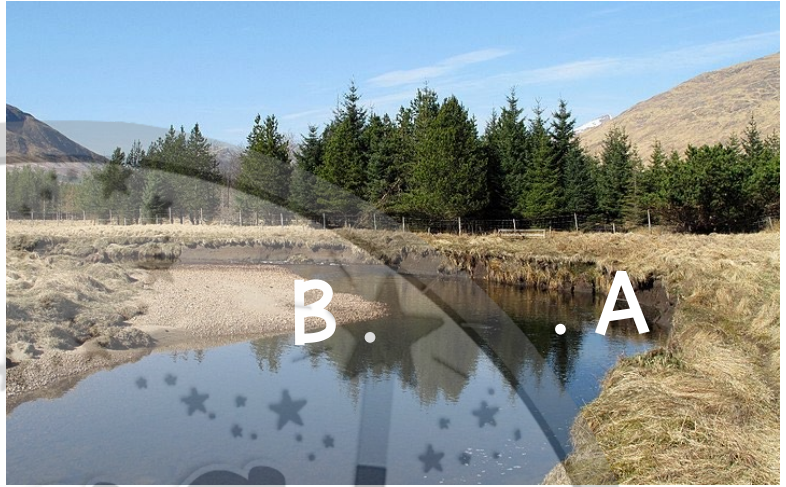
Rivers flowing through mountain areas such as Vermont have a harder time shaping the land in this fashion. Their riverbanks are often rocky. Their courses are more set in stone. Rocky coasts are able to be **weathered** and eroded to create curves, though. It is a longer process than in

places where the land is flat and the riverbanks are made of more moldable soil.

The power of moving water is another force that changes planet Earth. Rivers shape the land through which they travel. They alter the landscape in many ways.

Curving Rivers Questions

1. Look at the image below again. Is the water moving faster at point A or point B? Explain how you know.



2. Explain why mountain rivers cannot shape the land as easily as rivers in other, flat areas.

3. Imagine you are a paleontologist looking for fossils in and near the river above. Based on the following sentence, where do you think you would find the most fossils? Explain why.

“Water flows more slowly on the inside of the bend. Sediment traveling in the water tends to settle there.”

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As the river travels through these curves, it makes the loops bigger. Eventually, the water will find the shortest distance across the loops and cut across the narrowest part. The eroding and depositing process will start again once this happens. The part of the river that got cut off forms an **oxbow lake**. If nothing interferes with this process, the pattern will continue, and the river will make more curves.



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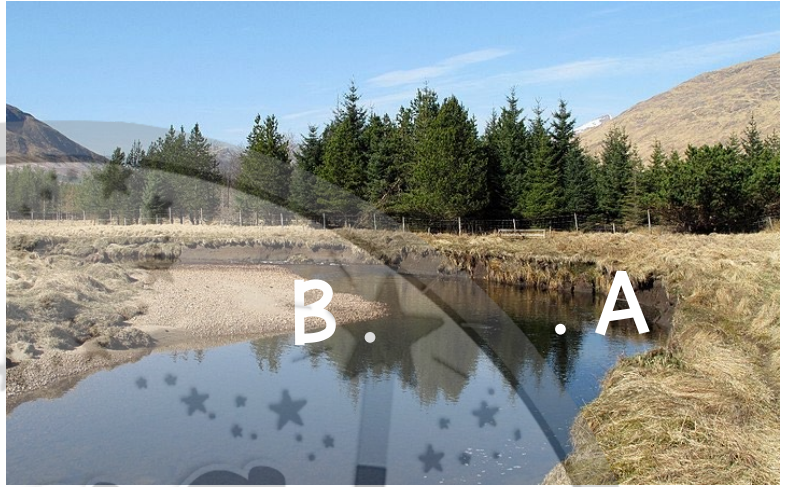
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Mapping Earth's Features

4th grade

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4. Ojos del Salado (780L, 1010L)
5. The Hawaiian Islands (790L, 980L)
6. The Alps (790L, 980L)
7. The Rocky Mountains (780L, 990L)

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How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes six differentiated passages aligned to the following standard:

4-ESS2-2 Mapping Earth's Features

Analyze and interpret data from maps to describe patterns of earth's features.

Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.

Assessment Boundary: None

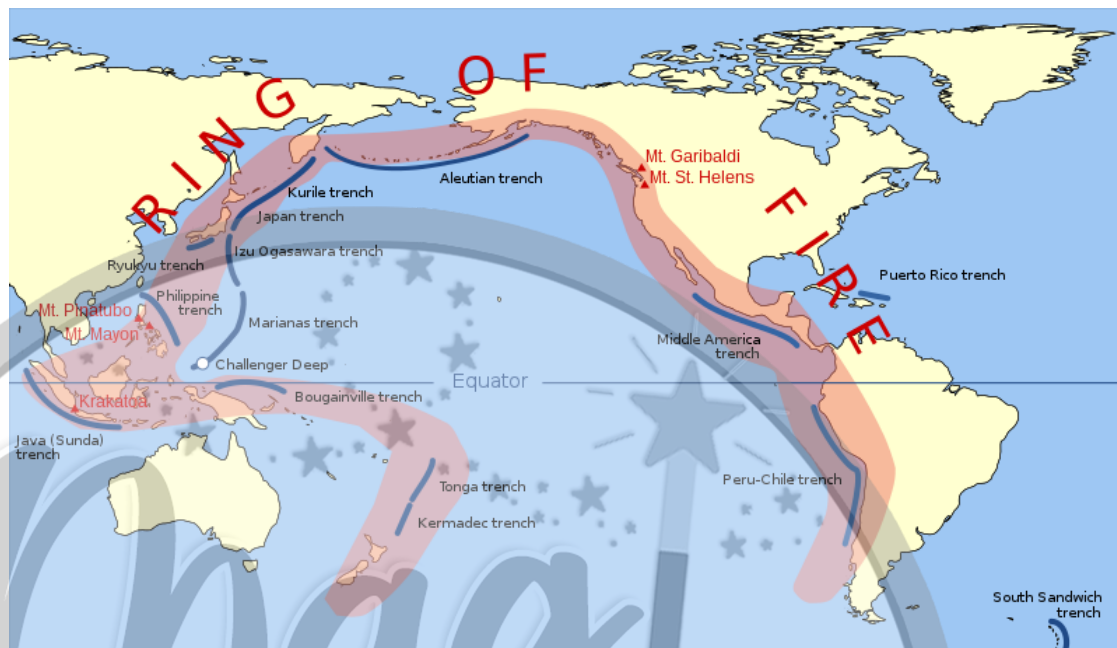
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Ring of Fire

The Ring of Fire is located in the Pacific Ocean. It got its name from the many volcanoes on its borders. This horseshoe-shaped belt is about 25,000 miles long. It stretches along the western coasts of North and South



Map of the Pacific Ocean, the Ring of Fire shown in the shaded area.

America. It then heads north toward the Aleutian Islands. The Ring of Fire goes south from there to the islands of East and Southeast Asia through Japan. Finally, it turns slightly east toward New Zealand. Several mountain ranges, such as the Cascade Mountains in the western United States, are part of the Ring of Fire.



Mount Saint Helens, a volcano in the Ring of Fire

Three-fourths of the world's active volcanoes are found in the Ring of Fire. It is made up of more than 450 volcanoes. Mount Tambora and Mount Saint Helens are part of the Ring of Fire. They have had major eruptions since the 1800s. Ninety percent of

Earth's earthquakes happen here, as well. The Ring of Fire has had several of the largest earthquakes. The Chile earthquake of 1960 and the Japan earthquake of 2011 happened in this area. An undersea earthquake that happened in the Ring of Fire also caused the Indian Ocean tsunami of 2004. This natural disaster was responsible for much destruction.

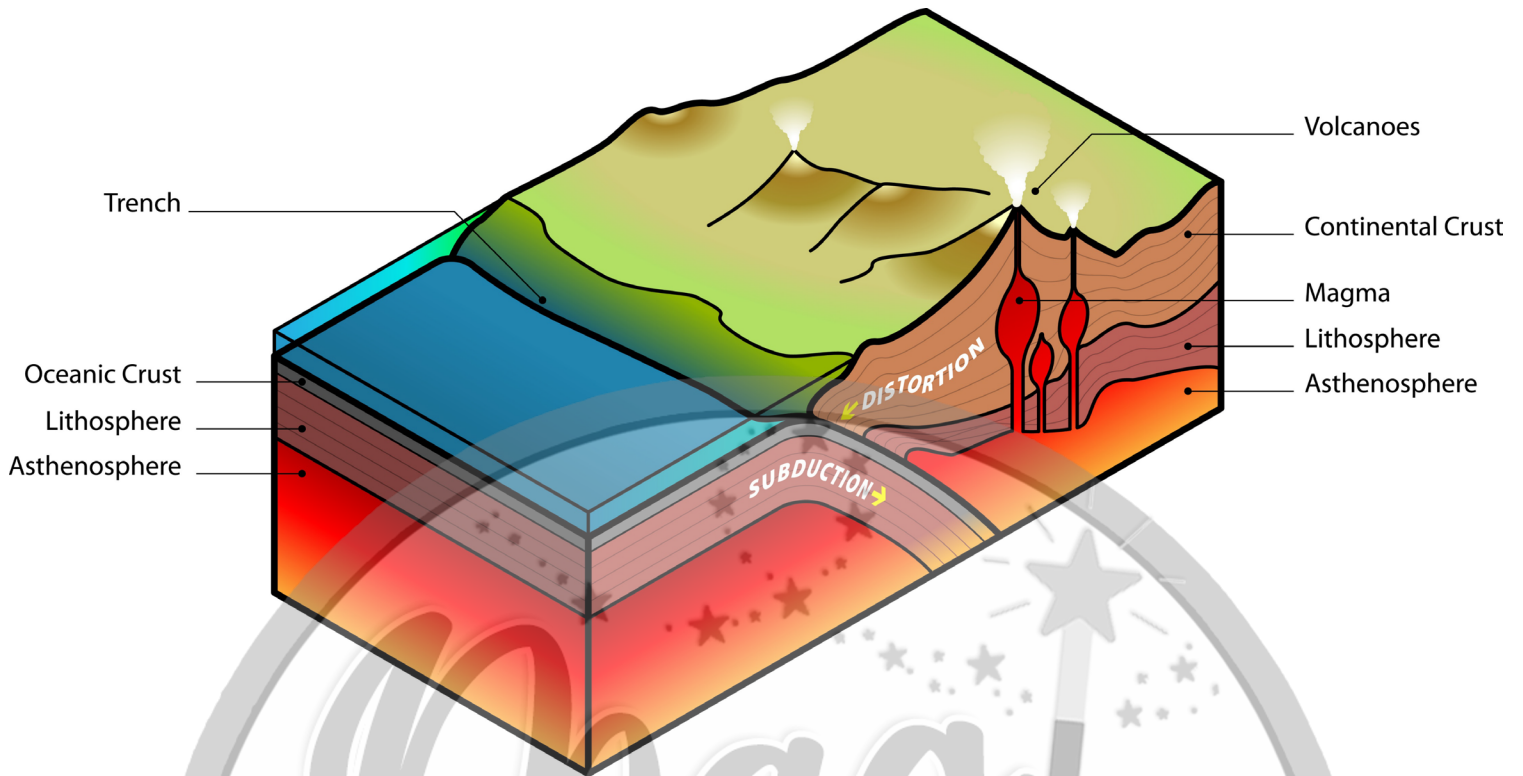


Diagram showing moving plates and the process of subduction

Tectonic plates are the reason the Ring of Fire was formed. These large slabs of the Earth's **crust** move constantly above a layer of solid and molten rock called the **mantle**. A process called **subduction** formed the volcanoes. This is when a plate is shoved under another plate into the Earth's mantle. Melting of the plates makes **magma** that shoots up through the overlapping plates. This creates an erupting volcano. It is at the scraping and bending of these plates that earthquakes occur as well. Ocean **trenches** also form here. The Ring of Fire is home to the deepest one. The Mariana Trench is almost 7 miles deep and located east of Guam.

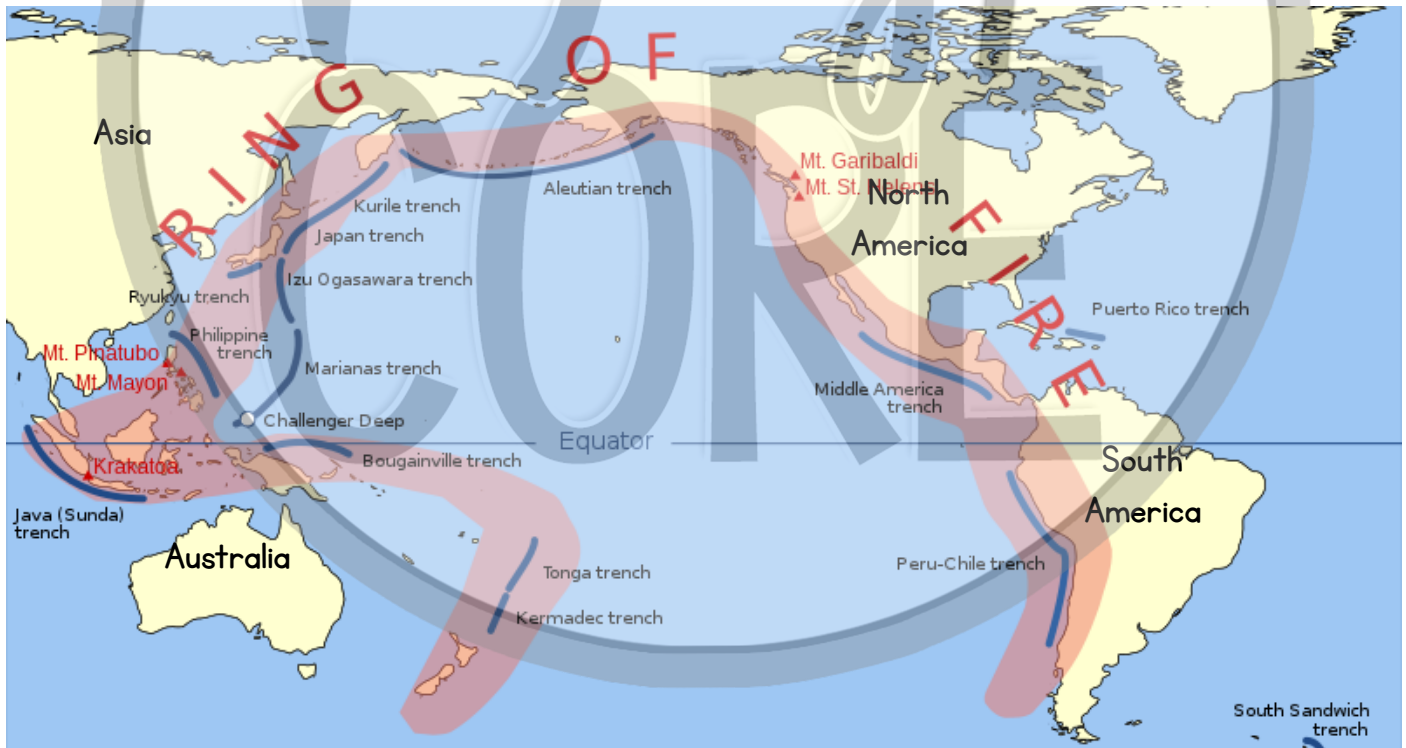
The Ring of Fire is very active **geologically**. It's an area that has mountains, volcanoes, earthquakes, and ocean trenches. The movement of Earth's plates in the Ring of Fire keeps scientists busy studying what might happen next there.

Ring of Fire Questions

1. How was the ring of fire formed?

2. What causes a trench?

Use the map to answer the following questions:



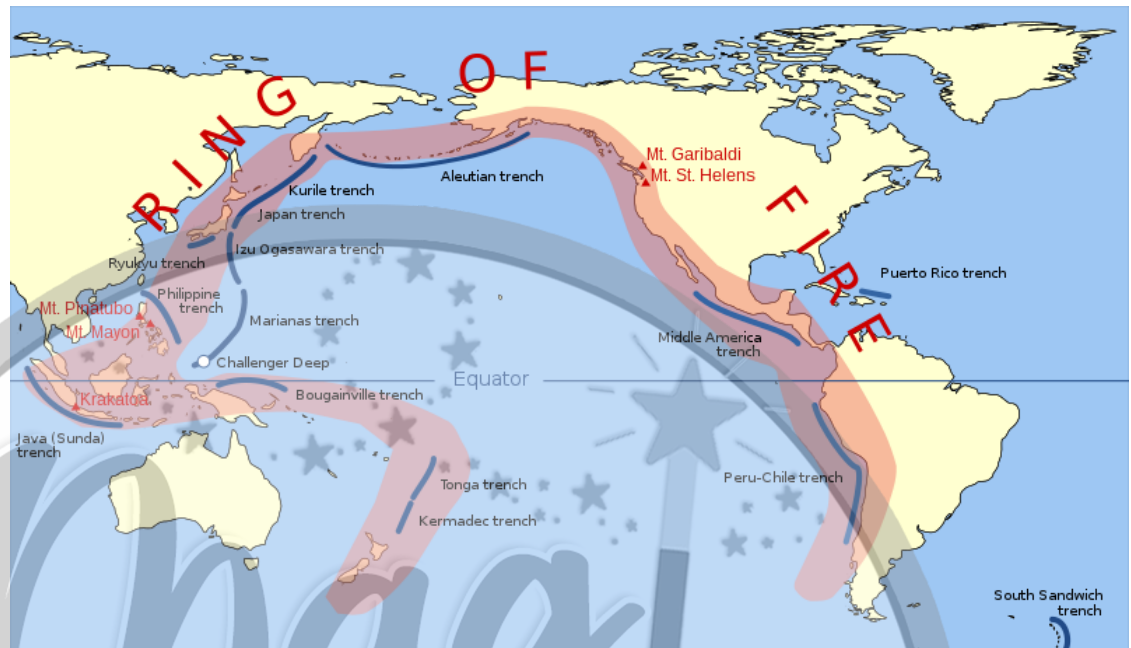
3. Which continent is Mt. St. Helens located in? _____

4. Which continent is home to the Peru-Chile trench? _____

5. Which continent has the most trenches? _____

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Map of the Pacific Ocean, the Ring of Fire shown in the shaded area.

America and heads north toward the Aleutian Islands. The Ring of Fire arcs south from there to the islands of East and Southeast Asia through Japan. Finally, it shifts slightly east toward New Zealand. Several mountain ranges, such as the Cascade Mountains in the western United States and the Andes Mountains in western South America, are part of the Ring of Fire.



Three-fourths of the world's active volcanoes are found in the Ring of Fire. It is made up of more than 450 volcanoes, and eruptions have occurred here. Mount Tambora, Krakatoa, and Mount Saint Helens

are all part of the Ring of Fire and have had major eruptions since the 1800s. Ninety percent of Earth's earthquakes happen here as well. The Ring of Fire has been the host of several of the largest earthquakes. The Chile earthquake of 1960, the Alaska earthquake of 1964, and the Japan earthquake of 2011 all happened in this area. An undersea earthquake that happened in the Ring of Fire also caused the Indian Ocean tsunami of 2004. This natural disaster was responsible for much destruction and loss.

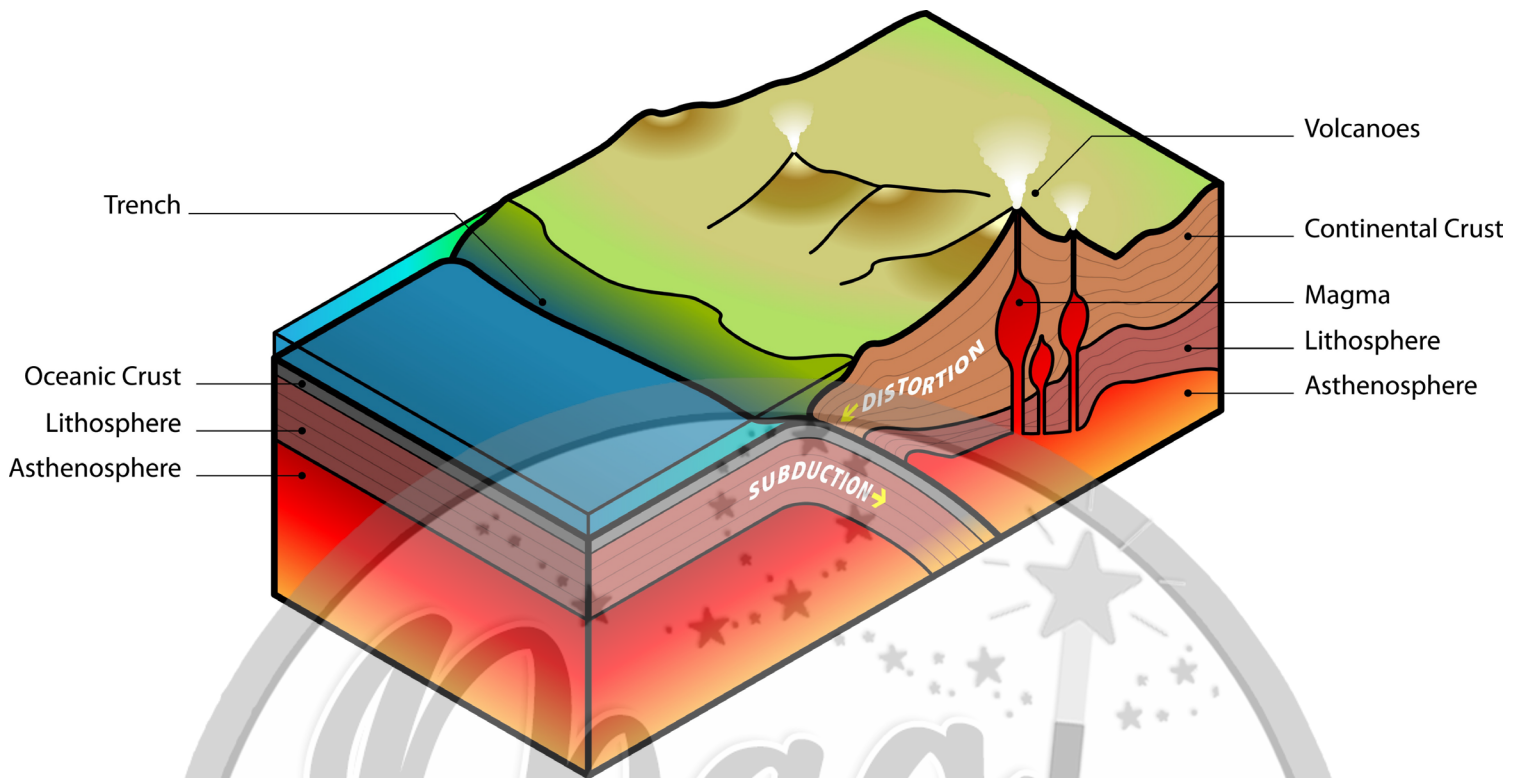


Diagram showing moving plates and the process of subduction

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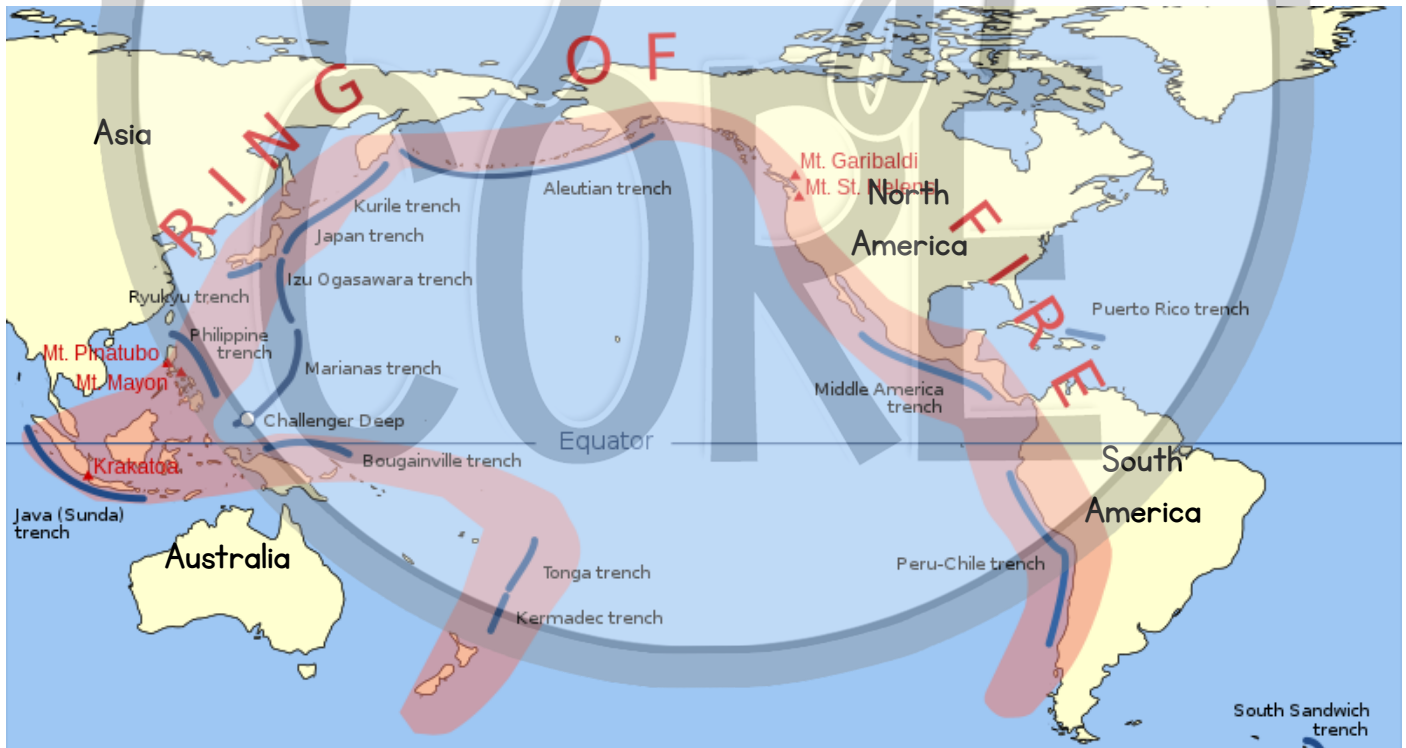
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Use the map to answer the following questions:



3. Which continent is Mt. St. Helens located in? _____

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5. Which continent has the most trenches? _____

Natural Hazard Design Solution

4th grade

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3. Hurricane Katrina Flooding (780L, 990L)
4. Stopping Lava Flows (770L, 980L)
5. Eldfell Volcano (780L, 990L)
6. Beast Quake (790L, 980L)
7. Earthquake-proof Buildings (790L, 980L)

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How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes six differentiated passages aligned to the following standard:

4-ESS3-2: Natural Hazard Design Solution

Generate and compare multiple solutions to reduce the impacts of natural earth processes on humans. (Cause and Effect)

Clarification Statement: Examples of solutions could include designing an earthquake-resistant building and improving the monitoring of volcanic activity.

Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.

Here are some suggestions for using these passages:

- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
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Manila Flood Plan

Manila is the capital of the Philippines. The Philippines is an island country in Southeast Asia in the Pacific Ocean. This city is on the island of Luzon along the shore of Manila Bay. It's at the mouth of the Pasig River. Manila is the Philippines' center for economy, politics, and social activity. Around 14 million people live in this city. Flooding makes this area a difficult place to live.

Floods take lives. They destroy buildings and affect the landscape of Manila. There have been many damaging floods in this area. Manila floods easily for many reasons. One reason is that the Philippines gets hit with about 20 **typhoons** per year. These typhoons have also gotten worse due to **climate change**. Typhoons are circular storms that begin over warm, tropical waters. They have high winds and heavy rain. The paths of these typhoons have become unpredictable as well. They now travel over parts of the Philippines that did not have as many typhoons in the past. This leaves people unprepared for the wild weather.



A flooded street in Manila, Philippines.

Another reason Manila floods so easily is due to **urbanization**. This means the area has lost its natural places such as forests. These natural places were able to absorb the rains. Homes, parking lots, and other city structures now cover the area. Roads act as funnels for rainwater. This allows rain to rush into places that don't have good drainage systems. Many of Manila's waterways are also full of solid waste, so their levels rise quickly. They also get blocked when storms dump rain on the area.

A third reason for flooding in Manila is that the city is sinking. Taking groundwater with wells has caused Manila to settle lower. The effects of **global warming** are making the sea levels rise, too. Manila is vulnerable to increased water from harsh typhoons dropping rain from above. The Pacific Ocean creeps farther onto land at the same time.

The Philippine government designed a plan to deal with flooding. The Metro Manila Flood Management Plan was approved in 2012. It has solutions for managing major flood events. First, the plan wants to reduce flooding from rivers.



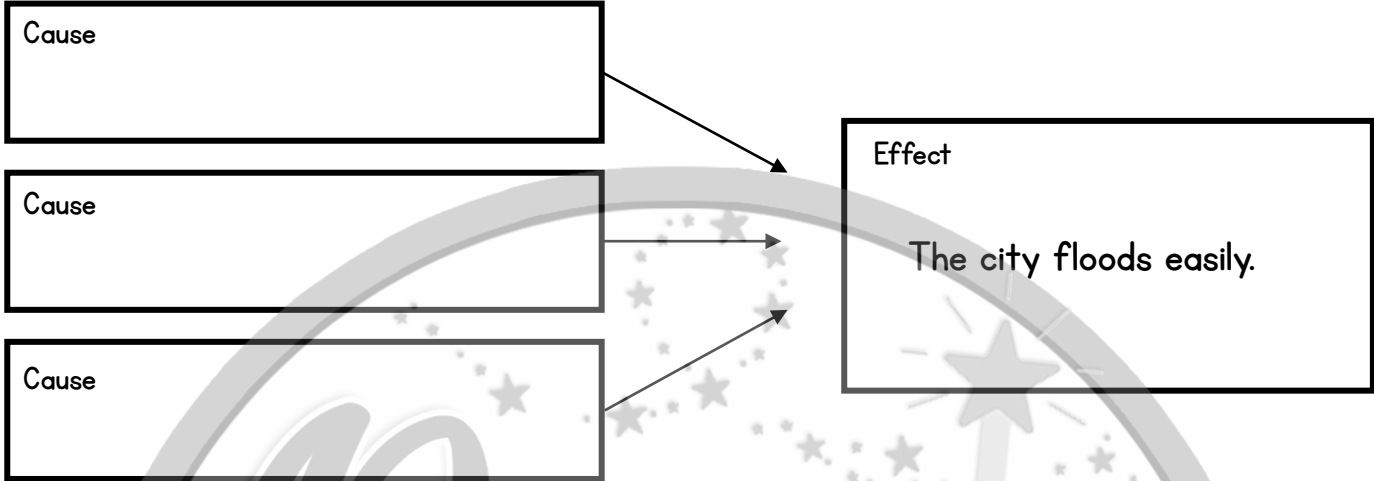
Example of the kind of dam that could be built in the upper Marikina River.

Building a dam in the upper Marikina River will help with this. Next, drainage in the city will be improved. This will allow water to be properly pumped out. Flood forecasting and early warning systems will be better developed. People will have warnings of flooding. The plan also calls for improvement in handling solid waste in the city. The waste won't end up in waterways. It won't act as a barrier to water flow.

The parts of this flood plan were created to solve the problems flooding causes in Manila. The World Bank received a grant to help pay for the plan. These projects were set to be completed by 2024. As of today, none of the pieces have been finished. Officials say lack of funds, disruption to traffic in the city, and poor management of the projects are to blame. Some people are trying to breathe new life into this plan to protect Manila from flooding.

Manila Flood Plan Questions

1. Use the chart below to show the causes of flooding in Manila.



2. How has urbanization contributed to flooding in Manila?

3. What plan has the Philippine government created to help with the floods?

4. Why has the plan not been completed even though it was set to finish in 2024?

Manila Flood Plan

Manila is the capital of the Philippines, an island country in Southeast Asia in the Pacific Ocean. This city is on the island of Luzon along the shore of Manila Bay. It's at the mouth of the Pasig River. Manila is the Philippines' center for economy, politics, and social activity. Around 14 million people live in this city, but flooding makes this area a difficult place to live.

Floods take lives, destroy buildings, and affect the landscape of Manila. There have been many damaging floods in this area. Manila floods easily for many reasons. One reason is that the Philippines gets hit with about 20 **typhoons** per year. These typhoons have also gotten worse due to **climate change**.



A flooded street in Manila, Philippines.

Typhoons are circular storms that begin over warm, tropical waters. They have high winds and heavy rain. The paths of these typhoons have become unpredictable as well. They now travel over parts of the Philippines that did not have as many typhoons in the past. This leaves people unprepared for the wild weather.

Another reason Manila floods so easily is due to **urbanization**. This means the area has lost its natural places such as forests that once could absorb the rains. Homes, parking lots, and other city structures now cover the area. Roads serve as funnels for rainwater, allowing it to rush into places that don't have good drainage systems. Many of Manila's waterways are also full of solid waste so their levels rise quickly. They also get blocked when storms dump rain on the area.

A third reason for flooding in Manila is that the city is sinking. Taking groundwater with wells has caused Manila to settle lower. The effects of **global warming** are making the sea levels rise, too. Manila is vulnerable to increased water from harsh typhoons dropping rain from above. At the same time, the Pacific Ocean creeps farther onto land as time passes.

The Philippine government designed a plan to deal with the flooding of Manila. The Metro Manila Flood Management Plan was approved in 2012. It has solutions for managing major flood events. First, the plan seeks to reduce flooding from rivers by building a dam in the upper Marikina River. Next, drainage in the city will be improved so water is properly pumped out. Flood forecasting and early warning systems will be better developed so people can have warnings of flooding. The plan also calls for improvement in handling solid waste in the city, so it doesn't end up in waterways and act as a barrier to water flow.

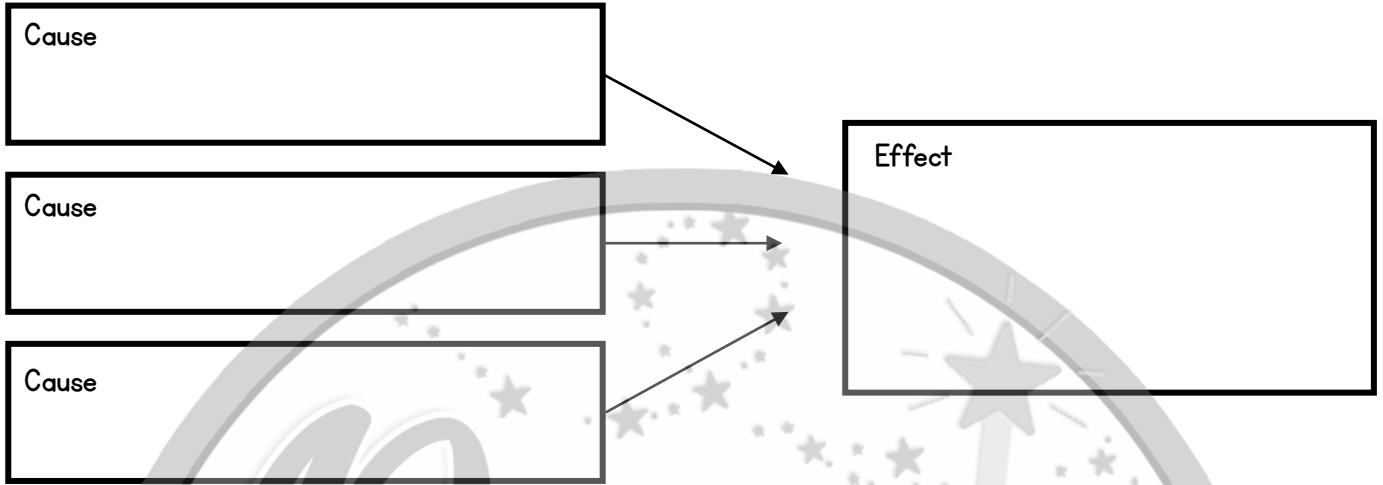


Example of the kind of dam that could be built in the upper Marikina River.

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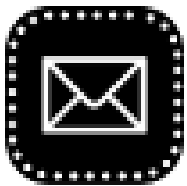
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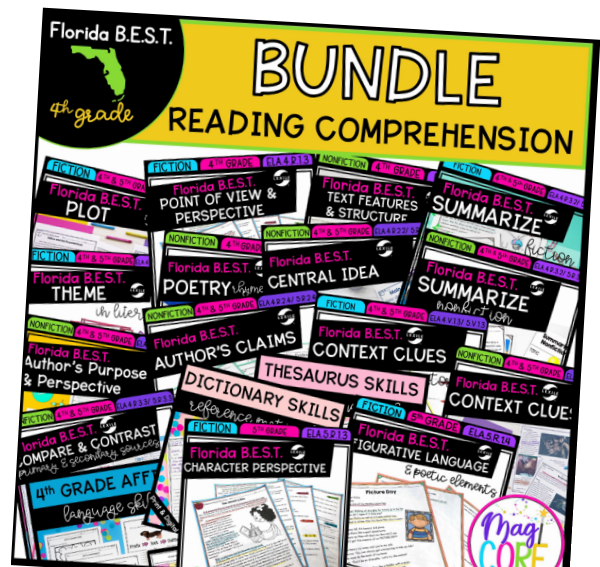


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