The Alpine Fault and Our Active Faults

Geography 1.1 Demonstrate understanding of the spatial distribution of a phenomenon and its impacts on place

Ākonga Workbook : Internal Assessment 91932

Name: .....

Class: .....

Internal Assessment Due Date: .....

Natural Hazards Commission
Toka Tū Ake

AF8
ALPINE FAULT MAGNITUDE 8

Acknowledgements

This NCEA Geography Level 1 Resource, *The Alpine Fault and Our Active Faults* has been co-designed by the AF8 Programme and Illuminate Science with support from the Natural Hazards Commission, Eagle Technology and kaiako from across New Zealand.

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Version 2 – March 2026
This version was updated in March 2026 following feedback from kaiako.

AF8 [Alpine Fault magnitude 8] is a programme of scientific modelling, coordinated response planning, and community engagement, designed to build resilience to the next Alpine Fault earthquake. The AF8 Programme aims to share Alpine Fault hazard and impact science and preparedness information widely, through communication and engagement activities, to increase awareness, enable conversation and build societal preparedness to natural hazard events in Te Waipounamu our South Island.

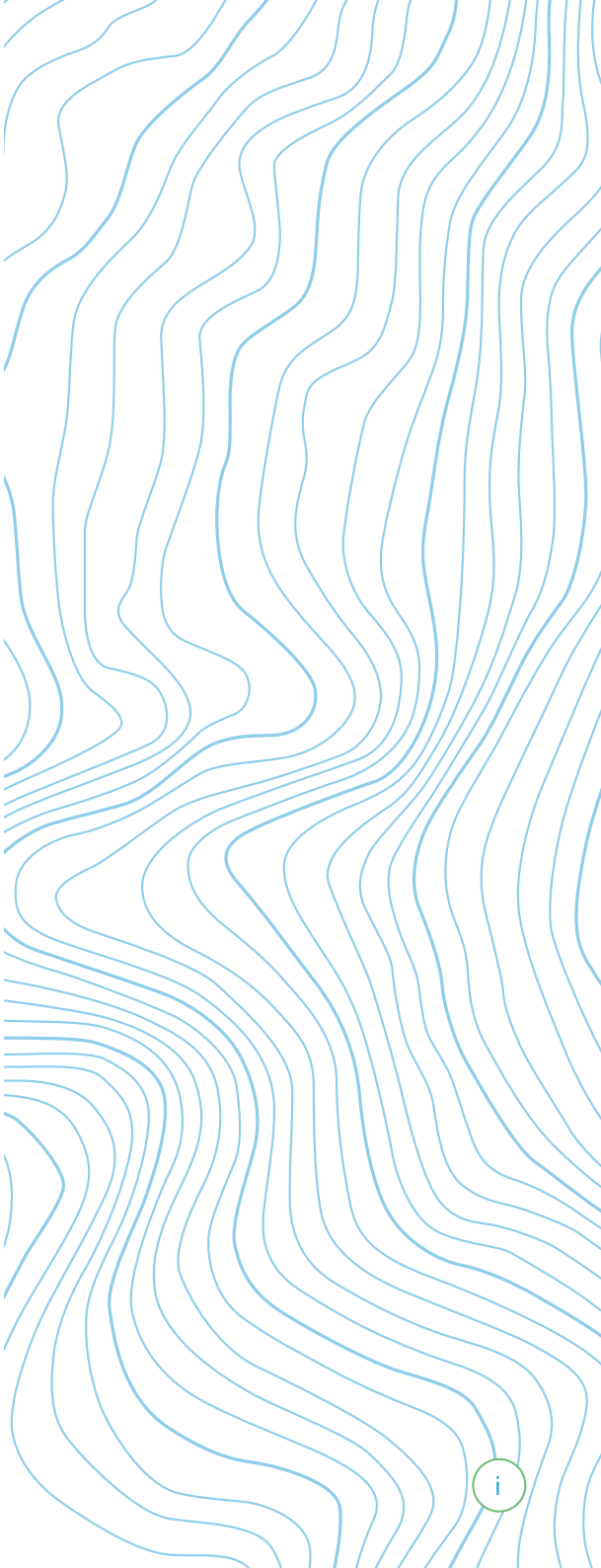
af8.org.nz **@AlpineFault8**

Produced by the AF8 Programme and kindly sponsored by Natural Hazards Commission Toka Tū Ake.

Natural Hazards Commission Toka Tū Ake

naturalhazards.govt.nz/be-prepared/

Contents



Introduction

We will be exploring **The Alpine Fault and Our Active Faults** as part of Internal Assessment 91932.

This workbook will take you through everything you need to complete this assessment.

There are six sections, and we recommend completing each section as you go through the StoryMap.

- → Section 1: Plate Boundary
- → Section 2: Earthquakes
- → Section 3: Risk
- → Section 4: Impacts
- → Section 5: Plan & Prepare

TOP TIP: We recommend using Google Chrome when accessing the StoryMap and creating your own.

You will also need a laptop or computer, access to the internet and the online StoryMap, this Workbook and your login to ArcGIS online.

Your teacher will set you up with a login and password for ArcGIS Online account:

URL: storymaps.arcgis.com

My ArcGIS username is: _____

Keep your password safe.

This is the account you will use to create your own StoryMap to complete this assessment.

Use the Ākonga StoryMap to complete Sections 1-5. This is information that may be useful for when you create your own StoryMap.

The Ākonga StoryMap can be found here: af8.org.nz/the-alpine-fault-and-our-active-faults

Assessment Outline

This internal assessment introduces you to the spatial distribution of earthquakes and their impacts on New Zealand.

TOP TIP: Mark your own work against the assessment schedule and check to see if you are missing any information before you submit your assessment.

What to do

You are going to create a StoryMap using ArcGIS to show your understanding of the spatial distribution of earthquakes across the South Island of New Zealand including:

- → What faults are
- → How earthquakes occur
- → Where they are located (spatial distribution)
- → Why they matter
- → How they impact communities
- → What we can do to plan and prepare

Use the following structure to produce your presentation. You must use relevant evidence, including geographic terminology, that develops the analysis throughout your presentation.

Begin with a description of the spatial distribution of earthquakes across New Zealand.

Next, use and include an annotated diagram, map, or another type of visual to explain the factors or processes contributing to the spatial distribution of earthquakes and their impacts.

Finish your presentation with an analysis of the spatial distribution of earthquakes by making judgments about the significance of earthquake impacts across the South Island of New Zealand.

Remember to use evidence and geographic terminology to develop your explanation.

How to present your learning

You will create a StoryMap using maps, images and text (within 750 to 800 words) to show what you learned through exploration.

Timeframe

Your kaiako will provide details of the duration, the checkpoints, and the submission date for the final assessment.

Assessment Schedule

This shows you how you will be assessed on your work to gain Achieved, Merit or Excellence credits.

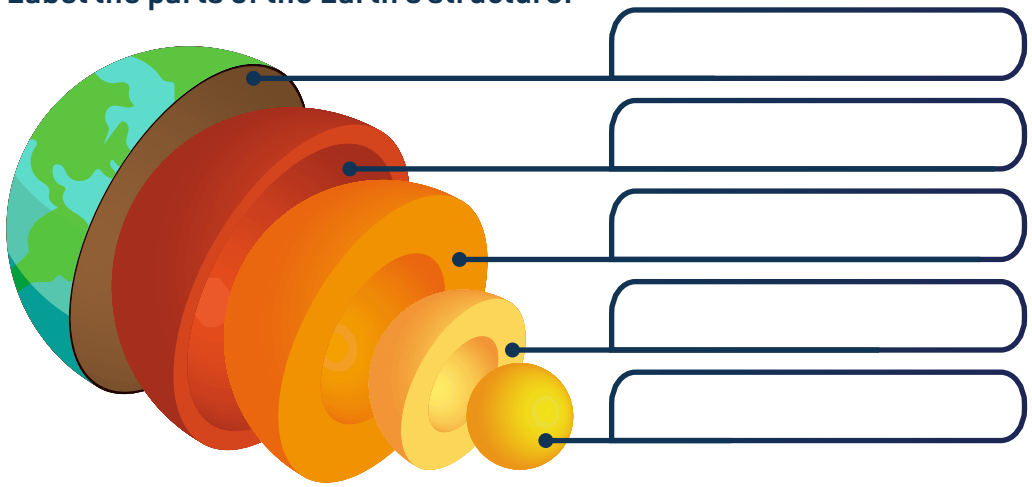
	Achievement	Achievement with Merit	Achievement with Excellence
Achievement Criteria	Demonstrate understanding of the spatial distribution of a phenomenon and its impacts on place	Explain the spatial distribution of a phenomenon and its impacts on place	Analyse the spatial distribution of a phenomenon and its impacts on place
Teacher judgements	The ākonga is able to: → describe the spatial distribution of earthquakes → describe factors or processes, or a combination of both, that contribute to the spatial distribution → describe the impacts of earthquakes on place → include relevant evidence and geographic terminology in the descriptions	The ākonga is able to: → explain factors or processes, or a combination of both, that contribute to the spatial distribution of the earthquakes → explain the impacts of earthquakes on place → use evidence and geographic terminology to support the explanation	The ākonga is able to: → examine factors or processes, or a combination of both, that contribute to the spatial distribution of the earthquakes → make judgements about the significance of earthquake impacts on place → use evidence and geographic terminology that develop the explanation
For example (description of possible student response to this activity)	The ākonga has: → described the spatial distribution of earthquakes in Aotearoa New Zealand. *For example, described that earthquakes occur in a specific pattern along the plate boundary* → described factors or processes, or a combination of both, that contribute to the spatial distribution of earthquakes in Aotearoa, New Zealand. This may include a description of tectonic plates and faults → described the impacts of the earthquake on the place. *For example, ākonga have described the impacts of the 1968 Inangahua, 2011 Christchurch and 2016 Kaikōura earthquakes* → included relevant evidence and geographic terminology in the descriptions. *For example, ākonga have supported descriptions with evidence from the 1968 Inangahua, 2011 Christchurch and 2016 Kaikōura earthquakes and a future Alpine Fault earthquake and used relevant geographic terminology, including "tectonic plates" and "faults"*	The ākonga has: → explained factors or processes, or a combination of both, that contribute to the spatial distribution of earthquakes in Aotearoa New Zealand. This may include giving reasons for why earthquakes occur in some places and not others. The student may also explain plate boundary movement and how this varies across New Zealand → explained the impacts of the earthquake on the place. *For example, ākonga have explained the impacts of the 1968 Inangahua, 2011 Christchurch and 2016 Kaikōura earthquakes. The response may include that landslides damaged roads and railways, limiting access and isolating communities.* → used evidence and geographic terminology to support the explanation. *For example, used evidence, such as an example along the Alpine Fault, with geographic terminology such as "tectonic plates" and "faults" "uplift" and "landslides", that back up the points being made.*	The ākonga has: → examined factors or processes, or a combination of both, that contribute to the spatial distribution of earthquakes in Aotearoa New Zealand. This may include giving reasons why this spatial distribution may change in future → made judgments about the significance of the impacts of the phenomenon on the place. *For example, ākonga have made judgments of impacts with reference to short and long-term impacts, and given examples from the 1968 Inangahua, 2011 Christchurch and 2016 Kaikōura earthquakes and what this may mean for a future Alpine Fault earthquake* → used evidence and geographic terminology to develop the explanation. *For example, used evidence, such as an example along the Alpine Fault, with geographic terminology such as "short term" and "long term" that support the points being made*

Overall level of achievement will be based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.

Section 1: Plate Boundary

The Earth's Structure

Label the parts of the Earth's structure:



DID YOU KNOW?

The Earth's crust plus the upper part of the mantle is also called the lithosphere, and tectonic plates are sometimes called lithospheric plates. Where two plates meet each other, stress builds up over time. This stress is eventually released in the form of an earthquake.

Always moving

Fill in the gaps:

Two tectonic plates can: _____ and move apart, _____ and collide (sometimes one plate sinks beneath the other), or _____, where the plates slide past each other.

Our Plate Boundary

Which of these plates is subducting near the East Coast of the North Island? *(Circle one)*

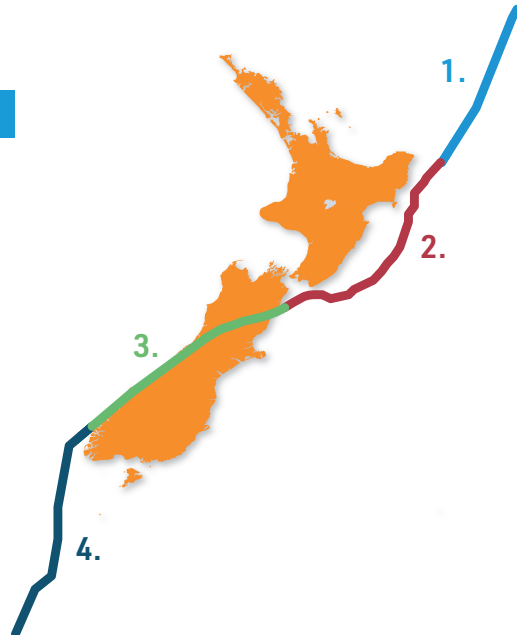
Australian Plate **Pacific Plate**

Which of these plates is subducting near the South-West Coast of the South Island? *(circle one)*

Australian Plate **Pacific Plate**

Where in New Zealand can you put your finger on the plate boundary?

_____



What are the common names for these sections of the plate boundary?

1. _____
2. _____
3. _____
4. _____

Draw the direction the plates are moving on the map

Answer Question 1 using about 25 words. Then describe how you could visualise your answer.

Plate boundary	Text	Visual e.g. photo, graphic, video or map.
Q1. What is a tectonic plate?		

Section 2: Earthquakes

Locating earthquakes

Where do most earthquakes occur?
(Tick the correct answer)

- ☐ In the atmosphere
- ☐ On faults
- ☐ In the oceans
- ☐ In the Earth's core

Why do we want to know where faults are located? *Explain in your own words:*

_____

_____

_____

_____

Where could you find information about an active fault near where you live?
(Tick the correct answer)

- ☐ The New Zealand Active Faults Database
- ☐ A weather forecast website
- ☐ A social media post
- ☐ A school timetable

Shaking it up

What happens when an earthquake occurs?
Explain this in your own words. Hint: Use the words stress and release in your answer.

_____

_____

_____

On average, how many earthquakes are recorded every year in Aotearoa New Zealand?
(Circle the correct answer)

1,500 5,000 15,000 20,000 35,000

What information does GeoNet record about each earthquake? *Tick all the correct answers.*

- ☐ Colour
- ☐ Location
- ☐ Depth
- ☐ Magnitude
- ☐ Wind speed

When thousands of earthquakes are mapped, what starts to appear? Unscramble these letters to find the answer:

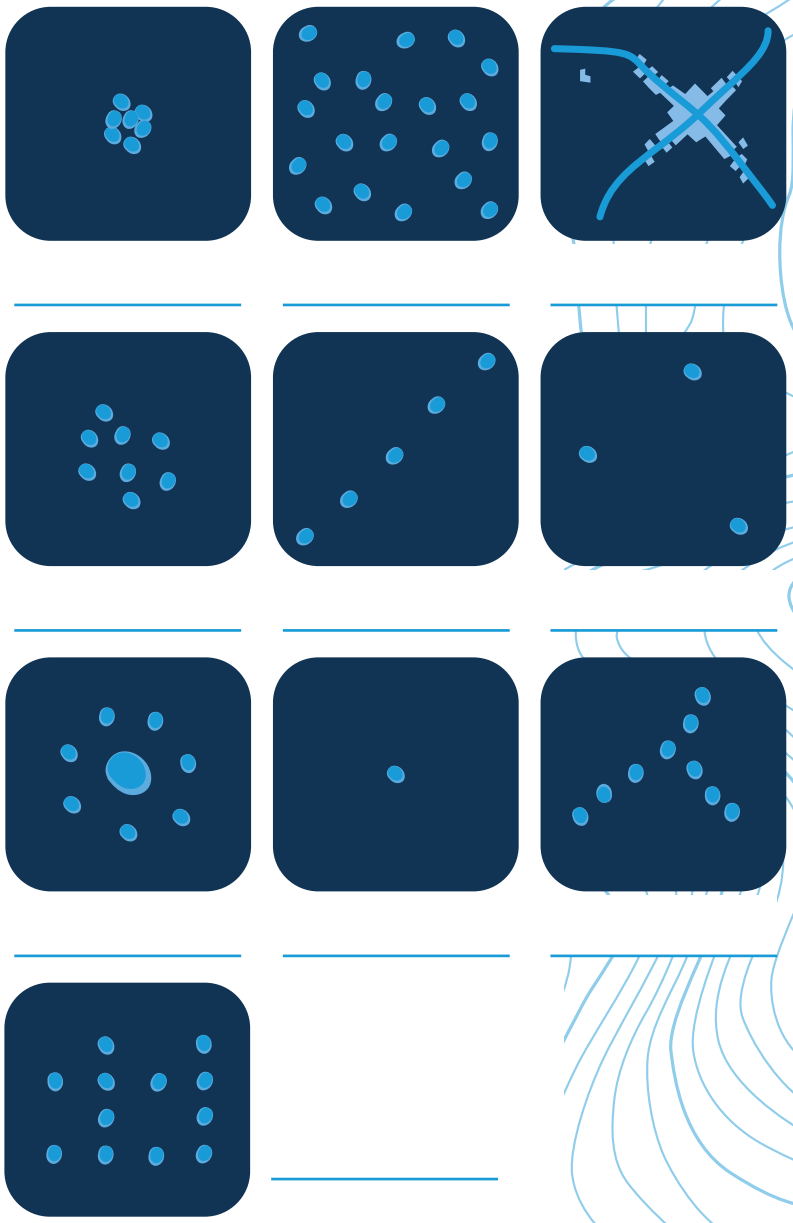
_____ _____

Spatial distribution

Match the word with the description of the pattern.

Linear	Features appear to originate from a point
Random	Features are likely to occur at any location
Peripheral	Features collect around a central point
Nucleated	Dense arrangement of features
Dispersed	Features appear in a line
Clustered	Features are in parallel lines
Sparse	Many of the same features are concentrated close together
Radial	Features are around the outside
Grid	Few features in the same area
Concentrated	Features are quite far away from each other

Label each pattern with the correct geography term



Answer Questions 2-7 using around 300 words. Then describe how you could visualise your answer.

Earthquakes	Text	Visual e.g. photo, graphic, video or map.
Q2. What is a fault?		
Q3. What is an earthquake?		

Earthquakes

	Text	Visual e.g. photo, graphic, video or map.
Q4. Explain how tectonic plates and faults cause earthquakes in Aotearoa New Zealand?		
Q5. What is the spatial distribution of earthquakes in Aotearoa New Zealand?		

Earthquakes

	Text	Visual e.g. photo, graphic, video or map.
Q6. What are the processes or factors that have caused this spatial distribution?		
Q7. What would cause the spatial distribution of earthquakes to change?		

Extra for earthquake experts!

Alpine Fault earthquakes

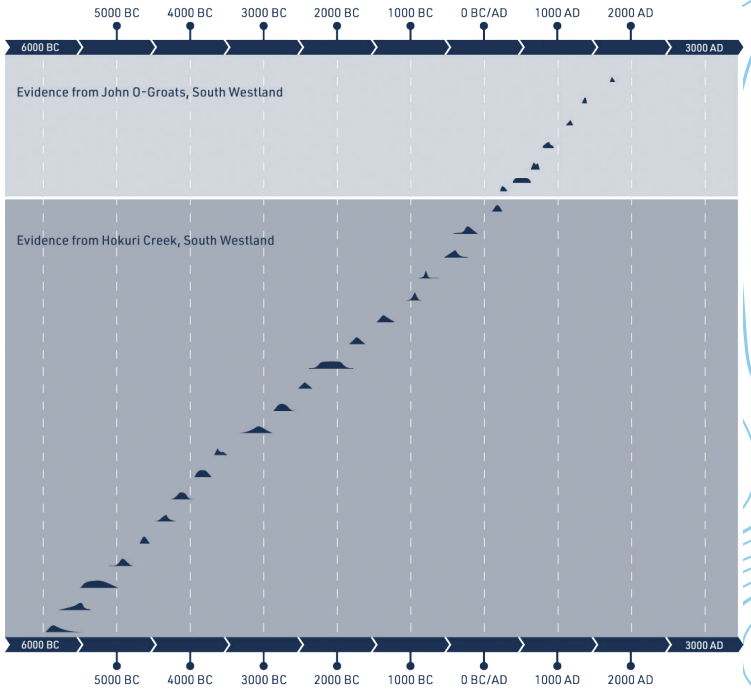
What is the name given to the period of time between earthquakes?

What is the average time period between earthquakes on the Alpine Fault? *(circle one)*

90 *yrs* **140** *yrs* **170** *yrs* **200** *yrs* **290** *yrs* **500** *yrs*

Roughly how long ago was the last 'Great Earthquake' on the Alpine Fault? *(circle one)*

90 *yrs* **140** *yrs* **170** *yrs* **200** *yrs* **290** *yrs* **300** *yrs*



Evidence of earthquakes

Sediment is studied to identify where earthquakes have occurred, and radiocarbon dating tells us exactly when they occurred.

What else do scientists look for to tell them what the environment was like at the time of these earthquakes?

What is the name given to the testing method that scientists use to work out how long ago an earthquake happened?

What do scientists look for in sediment layers when they want to test for dates and times of earthquakes?

DID YOU KNOW?

Did you know: the Kaikōura 7.8 magnitude earthquake lifted the seabed by up to 2 metres in places along a 20 kilometre stretch of the Kaikōura Coast, and in one place lifted the land by 5.5 metres!

Section 3: Risk

Earthquake Anatomy

What is the name of the point on the Earth's surface directly above where an earthquake starts?

_____

What is the name of the point inside the Earth where an earthquake begins?

_____

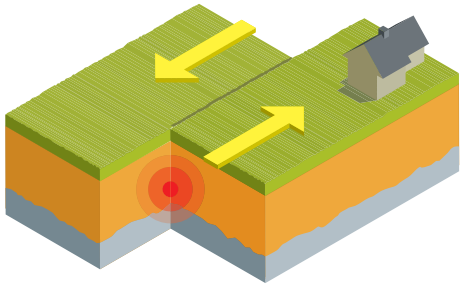
How do earthquakes move? *Explain in your own words*

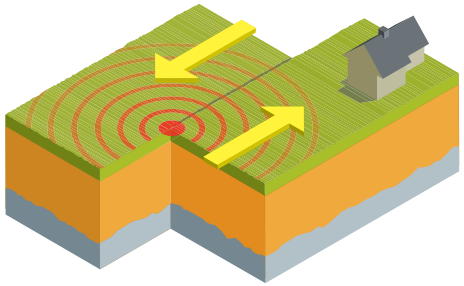
_____

_____

_____

_____





DID YOU KNOW?

On average, GeoNet record 50-80 earthquakes every day across Aotearoa New Zealand!

Thankfully you won't have felt them all due to a few different factors, that we'll explore here.

Measuring Magnitude

Magnitude measures the _____ released at the source of the earthquake. And helps us to understand the size of an earthquake.

The magnitude scale is logarithmic.

This means each level of magnitude up the scale releases _____ times more energy than the last.

How much more energy did the 7.1 Inangahua earthquake release compared to the 6.2 Christchurch earthquake?

_____

How much more energy did the 7.8 Kaikōura earthquake release compared to the 6.2 Christchurch earthquake?

_____

FILL IN THE BLANK

A magnitude **6** earthquake releases ☐ times more energy than a magnitude **5**

Shaking Intensity

Intensity measures the _____ of shaking produced by the earthquake at a certain location.

We measure earthquake intensity using the MMI Scale. What does MMI stand for?

M_____ M_____ I_____

The higher the number on the MMI Scale the _____ intense the shaking is in that location.

01	MMI 1 : Imperceptible
02	MMI 2 : Scarcely felt
03	MMI 3 : Weak
04	MMI 4 : Largely observed
05	MMI 5 : Strong
06	MMI 6 : Slightly damaging
07	MMI 7 : Damaging
08	MMI 8 : Heavily damaging
09	MMI 9 : Destructive
10	MMI 10 : Very destructive
11	MMI 11 : Devastating
12	MMI 12 : Completely devastating

DID YOU KNOW?

Did you know you can help GeoNet work out the intensity of an earthquake you feel?

Go to: felt.geonet.org.nz/ or download the app to your phone.

What are the four key factors that impact how we feel an earthquake? *(circle four)*

Answer Questions 8-11 using around 100 words. Then describe how you could visualise your answer.

Risk	Text	Visual e.g.. photo, graphic, video or map.
Q8. What magnitudes were the 1968 Inangahua, 2011 Christchurch, and 2016 Kaikōura earthquakes?		
Q9. What levels of shaking intensity (MMI) were felt in the 1968 Inangahua, 2011 Christchurch, and 2016 Kaikōura earthquakes?		
Q10. What is the likelihood of an Alpine Fault earthquake occurring in the next fifty years?		
Q11. What level of shaking intensity (MMI) would be experienced in an future Alpine Fault earthquake across the South Island?		

Section 4: Impacts

TOP TIP: Impacts can be positive or negative.

Answer Question 12 using 400 words.

Q12. How were communities impacted by the 1968 Inangahua, 2011 Christchurch, and 2016 Kaikōura earthquakes, and how may your community be affected by a future Alpine Fault earthquake?

Ngā taiao	Short Term	Long Term
a) Natural – our mountains, hills, rivers and land.		

Ngā taiao

b) **Built – our roads, railways, buildings and our power, water and phone infrastructure networks.**

Short Term	Long Term

Ngā taiao

c) Economic – our savings and investments

Short Term	Long Term

Ngā taiao

d) **Social – our families, friends and communities.**

Short Term	Long Term

Section 5: Plan & Prepare

Planning ahead

Name one action you could do before an earthquake occurs to prepare for these impacts?

1 _____

_____

_____

_____

1 _____

_____

_____

_____

1 _____

_____

_____

_____

1 _____

_____

_____

_____

1 _____

_____

_____

_____

1 _____

_____

_____

_____

DID YOU KNOW?

For more information on how to plan ahead, visit:

getready.govt.nz/en/prepared/household/make-a-plan/

STEP ONE: If you could only have 12 items in your emergency kit what would they be? Rank your top 1-12 items in the square shape

STEP TWO: In the circle shape, note any items you could put in your own grab bag with a "G" here.

- A list of emergency phone numbers and contacts
- A copy of your Household Emergency Plan
- Toothbrush, toothpaste and soap
- Tub for washing clothes and dishes
- Dish washing + laundry soap
- Prescription medicines for each family member
- Phone chargers and extra battery packs
- Warm + waterproof clothing, and sturdy shoes
- Non-perishable food (e.g. dried fruit, Marmite and peanut butter)
- Cash
- Books, games, puzzles or other fun things to do
- Sports equipment: bat and ball, rugby or soccer ball etc.
- Rubbish bags for waste
- Water for drinking, washing + cooking, (7 days worth)
- Play Station / Xbox
- Water purifying tablets
- Toilet paper + large rubbish bags for your emergency toilet
- A gas barbecue or camp stove to cook on
- Matches in a waterproof container
- Small flashlight or headlamp + extra batteries
- Tinned food and tin opener
- Hand-cranked or battery-powered radio, with extra batteries
- First aid kit
- Non-perishable lollies, snacks and sweet treats
- Pet and animal supplies: food, water, toys, bedding

DID YOU KNOW?

Use this interactive game to work out what you should have in your own emergency grab bag:

www.ready.gov/kids/games/data/bak-english/index.html

Prepare your home, protect your whānau

Spot the difference! One of the homes to the left has been prepared to be safer in an earthquake, the other one hasn't.

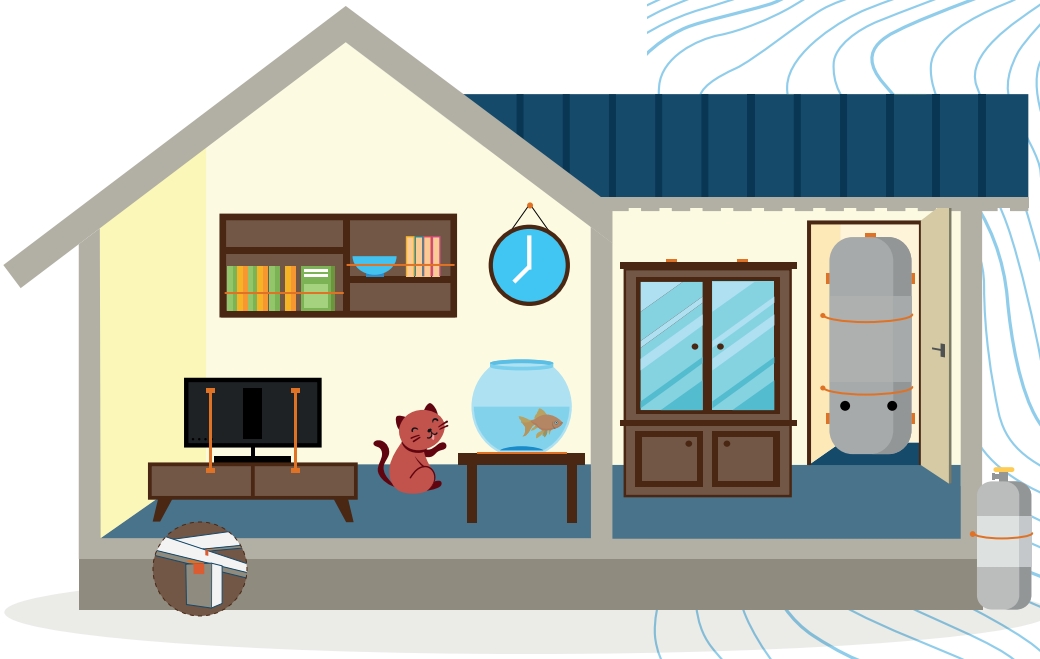
Can you spot the 13 differences? Circle them when you find them. Keep a special eye out for the 11 household items that have been fixed or fastened to stop them for causing damage in an earthquake.

Now list 3 things you or your whānau could secure in you own home BEFORE an earthquake to make sure they don't cause damage when things start shaking:

1. _____

2. _____

3. _____



DID YOU KNOW?

For more information on how to QuakeSafe your home to protect your whānau check out:

www.naturalhazards.govt.nz/our-publications/quake-safe-your-home/

Answer Question 14 using around 50 words. Then describe how you could visual your answer.

Plan & Prepare	Text	Visual e.g.. photo, graphic, video or map.
Q13. How could people organise themselves to prepare for the rupture of an Alpine Fault?		

Internal Assessment

Getting started with your StoryMap

Before you get started with this assessment activity, you should:

- learn how to login to and use ArcGIS Online.
- locate earthquakes on a map of Aotearoa New Zealand.
- comprehend that earthquakes occur along faults.
- understand the potential impacts of an earthquake.
- look at visuals of spatial distribution and practise using different ways of describing the pattern.
- practise applying geographic terms such as factors, processes, impact, and importance.

Your StoryMap

Now that you are an expert on **Active Faults and Our Alpine Fault**, it's your turn to create a StoryMap. Follow these instructions to begin.

TOP TIP: ArcGIS StoryMaps auto-saves your story (provided you have not yet published your changes).

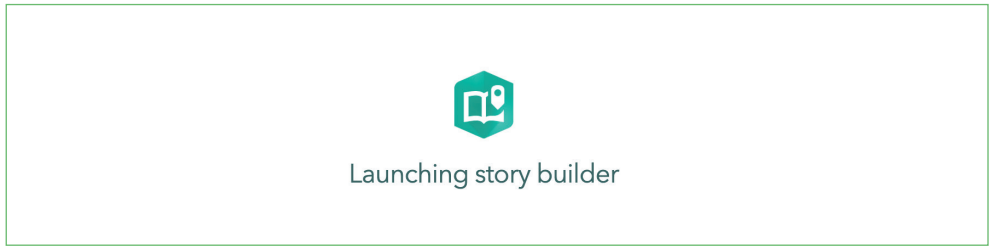
Login to ArcGIS online

To login go to storymaps.arcgis.com. This will open a page called Stories.

Create a StoryMap

Click on the **+New Story** button and then select **Start from scratch** from the drop-down menu.

You will see this screen appear.

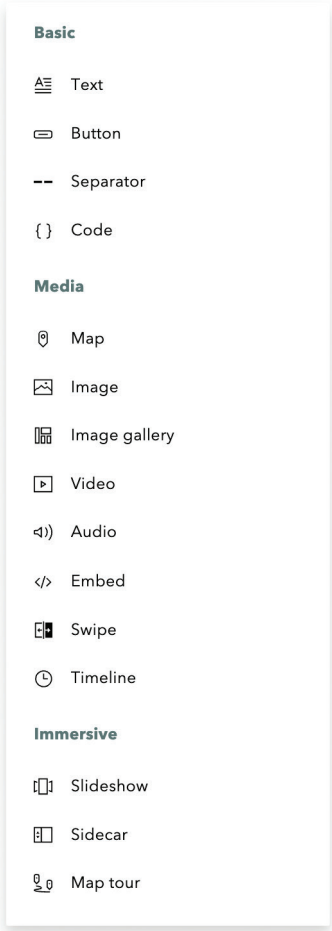


And then your StoryMap's Title Page will appear.

Click on **Title your story** and create your title. Click below the title to add a subtitle (it's optional), and then write your name in the byline. Click on **Add cover image or video** to add a cover image to your title page. Then your title page is done.

Next click the little plus sign below the title, and you'll see a menu of options.

This menu provides you with different types of features that you can use to create your StoryMap. Have a go at adding different section to explore how you might display your information for your assessment.



Plan your Content

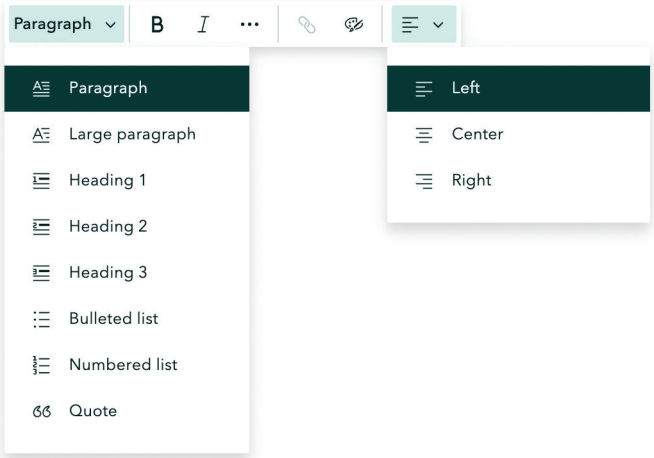
Use the **Heading** feature to break up your content into sections. This will help your organise your information.

Use the answers to your questions at the end of each section to draft your key information and then consider the type of immersive function you will use to display your information.

TOP TIP: Remember to explain why something occur and go back to the Assessment Schedule to make sure you have everything you need covered off in your StoryMap.

Add Text

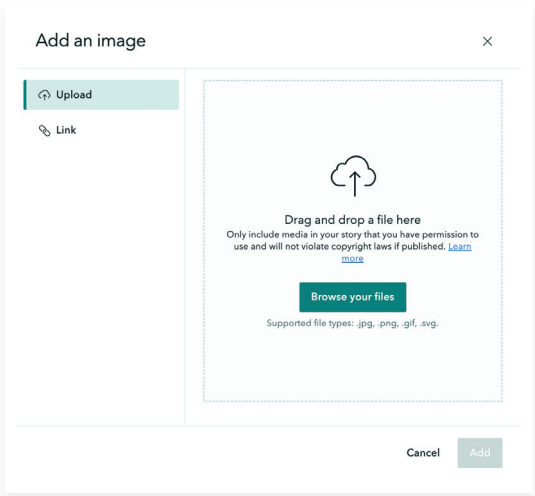
When you choose **Text**, you'll see a flashing cursor, below which is a little menu of text formatting options. If you want to add standard text, just start typing.



Add an Image

Add an Image from the menu. Navigate to your folders to find an image you'd like to include and add it to your story.

Make sure to create a caption for each you use and credit the source of the image or where you found the information.



Make a map

Select **Map** from the menu, and then click **Shared with Me** to look for the maps shared within the ArcGIS Group your teacher has created.

Layout

Think about how you will present your information. There are a few different options:

→ **Sidecar** is a scrolling, slide-based section with three different options.

1. The **floating panel** layout is ideal for short captions or descriptions, where users scroll down through the content.
2. The **docked panel** layout is ideal for longer content
3. The **slideshow** layout is ideal for short captions or descriptions, where users click manually across the content.

TOP TIP: Once you've added text, images and other media, you can drag and drop items to move them around within your StoryMap.

Design

Click **Design** in the top menu to turn the **Navigation** and **Credits** on.

- → Enable navigation so that your headings become bookmarks that appear as a navigation bar.
- → Enable credits so that you can provide links to your sources.

You can also chose different **Cover** layouts and **Themes**.

TOP TIP: You can Undo/Redo anything by clicking the arrows in the header (provided you have not yet published your changes).

Preview and Publish

Click **Preview** to see how your StoryMap will look like when it is published. The Preview button is also in the top menu next to **Publish**.

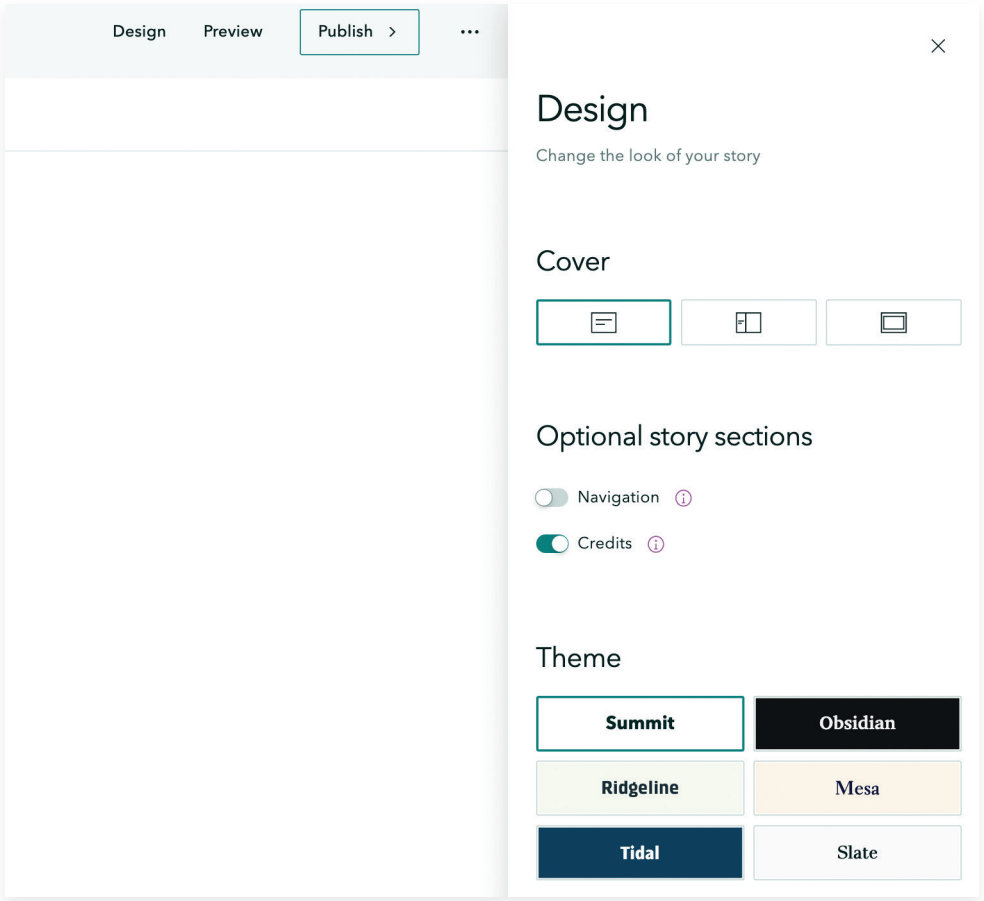
When you are happy with your StoryMap, and have finished proofreading it you can click **Publish**. When you publish your StoryMap you have the option to make it visible to:

- → Only you via **Private**
- → Others from you school via **My Organisation**
- → Public via **Everyone**.

You can also share your story to ArcGIS groups that you are a member of by using the search box.

You can carry on editing once you have published. Any edits you make will show as **Unpublished Changes**.

These changes will not show until your click **Publish** again.



Good luck!

Glossary

Aftershock – An earthquake that happens after the main earthquake (mainshock) on the same fault or nearby faults. Aftershocks occur because stress has changed in the Earth's crust after the first earthquake and pressure is still being released.

Describe – To state the features of.

Earthquake/fault rupture – The sudden movement of rock along a fault when built-up stress is released. The rupture starts at one point on the fault and spreads along it, like a tear moving through the Earth's crust.

Epicentre – The point on the Earth's surface directly above the hypocentre where an earthquake begins. It is used to describe the surface location of an earthquake.

Explain – To give reasons for something and show how or why it happens.

Examine – To make known the cause or detail of something.

Fault – A crack or weakness in the Earth's crust where stress builds up as tectonic plates move. When this stress is released, an earthquake occurs. Faults vary in size, depth, and how active they are, and many are found along tectonic plate boundaries.

Focus / hypocentre – The point inside the Earth where an earthquake rupture starts and energy is first released.

Foreshock – A smaller earthquake that happens before the mainshock in the same area, as stress begins to be released along a fault.

Impacts – The effects an earthquake has on a place, including changes to the natural taiao, built taiao, economic taiao, and social taiao.

Intensity – A measure of how strongly the ground shakes at a specific place during an earthquake. In New Zealand, intensity is described using the Modified Mercalli Intensity (MMI) scale, which depends on distance from the epicentre, ground conditions, and earthquake magnitude.

Magnitude – A measure of the total amount of energy released by an earthquake, calculated from seismometer recordings. Each earthquake has one magnitude value, and larger magnitudes mean more energy has been released.

Mainshock – The largest earthquake in an earthquake sequence. It is usually followed by aftershocks and may be preceded by foreshocks.

Phenomenon – Types of geographic features, objects, or events that can be mapped. They can exist at a local, regional, national, or global scale.

Probability – A way of describing how likely an earthquake is to happen within a certain time period, based on evidence from past earthquakes and fault activity.

Processes – A series of actions or steps that cause change over time, such as tectonic plate movement and the build-up and release of stress along faults.

Rupture length – The distance along a fault over which movement occurs during an earthquake.

Seismic wave – Energy that travels outward from the hypocentre through the Earth when an earthquake occurs. These waves move through rock and cause the shaking felt at the surface.

Seismometer – A scientific instrument that measures ground movement caused by earthquakes and sends this information to scientists for mapping and analysis.

Spatial – Relating to where something is located and how it is arranged across space, such as the pattern of earthquakes across New Zealand.

Taiao – All conditions of the environment, including the physical surroundings, the climate, and living things. The taiao exists at different scales and all parts of it are connected. Ngā taiao refers to more than one environment.

Tectonic plate – A large piece of the Earth's crust and upper mantle that moves slowly over the mantle below it. New Zealand lies on the boundary between the Australian Plate and the Pacific Plate.

Tectonic plate boundary – The place where two tectonic plates meet. Plate boundaries can be convergent (moving together), divergent (moving apart), or transform (sliding past each other). New Zealand's plate boundary includes both convergent and transform movement.

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