



National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TĀEA

Internal Assessment Resource

Geography Level 1

This resource supports assessment against:

Achievement Standard 91014

Apply spatial analysis, with direction, to solve a geographic problem

Resource title: Ruamoko Erupts!

3 credits

This resource:

- Clarifies the requirements of the standard
- Supports good assessment practice
- Should be subjected to the school's usual assessment quality assurance process
- Should be modified to make the context relevant to students in their school environment and ensure that submitted evidence is authentic

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Ministry of Education

To support internal assessment from 2013

Quality assurance status

These materials have been quality assured by NZQA.
NZQA Approved number A-A-11-2012-91014-01-4230

Authenticity of evidence

Teachers must manage authenticity for any assessment from a public source, because students may have access to the assessment schedule or student exemplar material.

Using this assessment resource without modification may mean that students' work is not authentic. The teacher may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform.

Internal Assessment Resource

Achievement Standard Geography 91014: Apply spatial analysis, with direction, to solve a geographic problem

Resource reference: Geography 1.8A v2

Resource title: Ruauumoko Erupts!

Credits: 3

Teacher guidelines

The following guidelines are supplied to enable teachers to carry out valid and consistent assessment using this internal assessment resource.

Teachers need to be very familiar with the outcome being assessed by Achievement Standard Geography 91014. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students against it.

Context/setting

This assessment activity requires students to apply spatial analysis, with direction, to solve a geographic problem. The context is a possible volcanic eruption in central Auckland.

Students will create spatial data and manipulate it to create several images or maps for inclusion in a layout about this event. Students should also write a detailed analysis of the location of specific effects of the eruption.

The questions in this assessment activity are intended to guide students through the material needed for their final report.

This activity is a simulation based on Exercise Ruauumoko, a national disaster exercise led by the Ministry of Civil Defence and Emergency Management between November 2007 and March 2008. The intention of this exercise was to test New Zealand's response to a major disaster caused by a volcanic eruption in central Auckland.

You can adapt this assessment activity to use with other civil defence scenarios or extreme natural hazards. If you choose to modify the activity, ensure that you modify the student instructions and assessment schedule accordingly.

Conditions

This assessment activity will take place over two weeks of class time.

Students will work individually to create spatial data, a layout, and a written analysis.

Resource requirements

For spatial data collection/creation and analysis, students will require the information provided in this assessment resource. Students can use this to create place marks and polygons and add layers to the view.

Students will require access to computers with Google Maps and Google Earth installed.

If student work is to be printed, a colour printer is advised for an effective result.

Students should be encouraged to access census data about local communities through the Statistics New Zealand website.

The following websites are useful sources of information:

- GeoNet Auckland Volcanic Field: www.geonet.org.nz/volcano/activity/auckland-volcanic-field/index.html
- Auckland Civil Defence and Emergency Management (CDEM): www.exerciseruaumoko.co.nz
- GeoNet Exercise Ruaumoko: www.geonet.org.nz/resources/volcano/ruaumoko/index.html
- KML Circle Generator: dev.bt23.org/keyhole/circlegen/
This site automatically generates circles for Google Earth. Coordinates need to be in decimal degrees.
- Statistics New Zealand – Quick Stats About a Place: www.stats.govt.nz/Census/2006CensusHomePage/QuickStats/AboutAPlace

Additional information

Schools in the Auckland Region have received a free CD-ROM, *Auckland's Volcanic Hazard*, linked to this assessment activity. This resource looks at the processes involved in and the effects of a volcanic eruption in the Auckland Region. For copies of the CD-ROM, contact Auckland Civil Defence and Emergency Management (CDEM).

Prior to this activity provide an explanation of what CDEM is and what it does. It is also necessary to teach the recognition of land-use patterns from aerial imagery.

This activity would work well as part of a topic examining extreme natural events, focusing on volcanic eruptions. Prior knowledge of these would be beneficial. If this activity is *not* linked to a study of extreme natural events, pre-teaching about the effects of a volcanic eruption is required; in particular the effects of volcanic ash on land and people.

Google Earth

Guide students in becoming familiar with Google Earth and understanding how to create and manipulate data. To present their final layout, students will need to create screen captures of their data and paste these into a programme such as Microsoft Word.

Students will undertake the following tasks using Google Earth:

- flying to places
- turning layers on/off
- creating place marks using appropriate symbols, colours, and sizes
- creating polygons
- measuring distances
- tilting and zooming in/out in the view.

Guide students in setting up a folder in their own workspace in which to save the features they create. They will need to know how to save features into this workspace as well as in My Places in Google Earth.

You will need to decide how the Google Earth files and final presentations will be viewed for assessment. It is possible to assess all of this work on screen after students save their work to a central location. Student files can also be saved onto disk for the purposes of moderation.

A useful website with information about Google Earth is:

<http://www.geography.org.uk/cpdevents/onlinecpd/gis/gisorvisualisation/#top>

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Credits: 3

Achievement	Achievement with Merit	Achievement with Excellence
Apply spatial analysis, with direction, to solve a geographic problem.	Effectively apply spatial analysis, with direction, to solve a geographic problem.	Comprehensively apply spatial analysis, with direction, to solve a geographic problem.

Student instructions

Introduction

You have the job of producing a report for the Ministry of Civil Defence and Emergency Management (CDEM) about a volcanic event in Auckland.

Your task is to produce maps and images that show where the effects of the eruption are being felt and to write a report about the effects of the eruption on people, the economy, and the transport networks of New Zealand.

You will work individually to produce a layout on one side of an A3-sized piece of paper, and a written report.

This activity will take place over two weeks of class time.

You will be assessed on how well you are able apply spatial analysis to solve this geographic problem.

Task

Refer to Resources A and B for further guidance and essential information as you work through each activity.

Create, collect, and manipulate spatial data

Locate the Auckland Region

Use Google Earth to show the location of the Auckland Region in relation to the rest of New Zealand.

Take a screen capture and add this to your layout.

Show events taking place before the eruption

Use Google Earth to show details of events taking place before the eruption.

On your own paper/workspace, describe where the activity is concentrated. How much of the region is affected?

Create one or more images/maps that effectively and accurately show the areas affected by the volcanic activity.

Take screen captures and add these to your layout.

Show events taking place as the eruption begins

Use Google Earth to fly to the location of the eruption of the new vent and show:

- the initial shock wave
- areas covered by ash and coarse matter
- where lava bombs have landed.

Create one or more images/maps that effectively and accurately show the areas affected by the eruption and how they are affected.

Take screen captures and add these to your layout.

Show events taking place one month after the eruption

Draw an opaque polygon to show the lava flows from beside Onehunga Wharf towards Ambury Regional Park.

Draw an opaque polygon to show the area (10 kilometres by 2 kilometres) downwind of the volcano when the wind blows from the north-east.

Show events taking place six months after the eruption

Create one or more images/maps that effectively and accurately show the areas affected by the eruption and how they are affected between one and six months later.

Take screen captures and add these to your layout.

Produce a layout showing the effects of the volcanic eruption

Use the maps/images you have created to produce one A3-sized layout to show how and where the eruption has affected Auckland.

Add annotations to show where people, transport, and the economy are affected.

Analyse your data to provide a solution to the geographic problem

Provide a report for CDEM. State clearly which areas of Auckland are affected by the eruption. Include specific details in your answer, such as suburbs and streets.

Fully explain how they are affected, considering the effects on people, the economy, and transport networks.

Ensure that your report is valid, detailed, and based on the information in your layout.

Hand in your work

Ensure that you hand in:

- a cover sheet with your name and assessment details on it
- your layout
- your written report.

Resource A

Setting up Google Earth (not assessed)

Create a folder

In your workspace, create a folder where you can save your Google Earth data.

Set up Google Earth

Open Google Earth and create a new folder titled "Auckland Volcano".

Go to Tools > Options > Show Lat/Long. Check Degrees, Minutes and Seconds.

Go to Tools > Options and ensure that the terrain quality is set to Higher.

Save your work

Save the features you create into the folder in your workspace. Save your work in My Places in Google Earth before logging off.

Prepare a document for layout

Prepare an A3 document in a suitable computer application (for example, Microsoft Word, Pages, or InDesign) into which you will paste your maps/images.

Save this document in your workspace folder.

Creating, collecting, and manipulating spatial data

Locating the Auckland Region

Open Google Earth. Zoom in so that all of New Zealand is shown.

Under Layers, turn on Borders – 1st level Admin Regions.

Turn on Populated Places. The names Auckland, Wellington, and Christchurch will appear. Select Auckland.

Gathering information about events before the eruption

Using Google Earth, fly to Auckland and zoom in or out so that all of the urban area can be seen.

Use the Fly To box to locate St Heliers, One Tree Hill, and Onehunga. Create one place mark in each suburb to show where early earthquakes are located.

Create a place mark to show the location of the stronger earthquakes centred in an area between Mangere Bridge and Auckland International Airport.

Draw an opaque rectangular polygon to show where the ground has lifted in the area between Ambury Regional Park and Mangere Bridge (from the coast to 200 metres inland). Use the ruler to measure 200 metres.

Create a circular polygon to show the area where gas bubbles and discoloured water can be seen. This area is 400 metres in diameter and 200 metres offshore from Kiwi Esplanade. Use Google Maps to locate the street.

Zoom out so that the whole Auckland Region is visible.

Showing events taking place as the eruption begins

In the Fly To box on Google Earth, enter the location of the new vent as 36 56 01.93S, 174 46 32.04E.

Fly to this location. Create a place mark to show the location of the eruption.

Create an opaque polygon to show the initial shock wave from the eruption. To draw the circle, you could use KML Circle Generator: <http://dev.bt23.org/keyhole/circlegen/>. If you use this tool, change the latitude and longitude to decimal degrees.

Create an opaque polygon to show the 8 kilometre square area covered by ash.

Under Altitude, select Relative to the Ground and enter 8000 metres as the height. Extend the sides to the ground.

Create an opaque polygon or circle to show the area with a 3 kilometre radius from the vent where coarse matter has fallen.

Create an opaque polygon or circle to show the area up to 1.5 kilometres from the vent where lava bombs have landed.

From Layers, turn on:

- More > Parks
- Place Categories > Banks/ATMs, Fire, Hospitals, Schools
- Transportation > Airports, Rail.

Showing events taking place as the eruption begins

Measure the straight-line distance between the erupting volcano and Auckland International Airport.

- What types of buildings lose their windows due to the shock wave?
- What effects might this have?

Use Google Maps to identify the Port of Onehunga and the major roads: State Highway 1, State Highway 20, and Great South Road. The railway lines are shown on Google Earth.

- How will the eruption affect transport into and around Auckland?
- An ash cloud is falling to the north-east of the eruption centre. What are the main suburbs and land uses affected by the ash?
- People from the affected areas and other parts of central Auckland want to evacuate. What difficulties might they face?

Zoom out so that the whole Auckland Region is visible.

- Describe where the activity is concentrated.
- How much of the region is physically affected?

Record your answers on your own paper or in your workspace.

Producing a layout showing the effects of the volcanic eruption

Your layout should clearly and accurately show:

- the location of the Auckland Region in New Zealand
- the location of the earthquakes, ground uplift, gas bubbles, and discoloured water that occurred before the eruption
- the location of the volcano
- areas affected by ash, the shock wave, lava bombs, and lava flows.

Use proper mapping conventions in your layout.

Resource B

Coping with natural hazards

Auckland is located on an active volcanic field. We know that a volcanic eruption will occur in the future – but no one knows when. Based on eruptions in the past, geologists have given us information about what could happen in the next volcanic eruption in Auckland.

The Ministry of Civil Defence and Emergency Management (CDEM) works to make New Zealand communities resilient to hazards and disasters. It needs to know where and what the effects of the next volcanic eruption might be. It also needs a report that shows people the type and extent of effects of a volcanic eruption in central Auckland.

Counting down the hours

Earthquakes are occurring in St Heliers, One Tree Hill, and Onehunga as magma moves up into the lower part of the Earth's crust. People cannot yet feel these earthquakes.

Stronger earthquakes are occurring.

The magma is moving upwards at 4–5 kilometres per day. An eruption is likely to happen in 24–28 hours.

Stronger earthquakes continue to be felt. Some are felt throughout the Auckland Region. The strongest is 4.5 magnitude on the Richter scale, possibly resulting in damage to properties. These earthquakes are centred in an area between Mangere Bridge and Auckland International Airport.

The ground lifts by 4 centimetres in the area between Ambury Regional Park and Mangere Bridge, from the coast to 200 metres inland.

Earthquakes are almost continual in Mangere Bridge, Onehunga South, and Hillsborough.

Gas bubbles and discoloured water can be seen 200 metres offshore from Kiwi Esplanade, covering an area of about 400 metres in diameter.

Between Ambury Regional Park and Mangere Bridge the ground continues to lift at a rate of many centimetres per hour.

The new vent emerges

The new volcanic vent is located at 36°56'01.93"S. 174°46'32.04"E (about 770 metres north of Kiwi Esplanade and 630 metres west of Onehunga Wharf).

Ash and steam erupt 8 kilometres up into the air. This causes a shock wave that blows out windows within a 2 kilometre radius of the vent.

The ash cloud rises about 8 kilometres high. It drifts with the south-west wind and deposits fine ash on the ground, on houses, and on roads, covering an area 10 kilometres long and 3 kilometres wide.

The ash fall is 50 centimetres thick on the ground within 2 kilometres of the vent and 0.5 centimetres thick beyond that.

Heavy falls of coarse scoria and ash erupt. These cover a circular area with a 3 kilometre radius from the vent.

Large 1 metre-sized lava bombs are thrown 300 metres into the air. They fall in an

area up to 1.5 kilometres from the vent.

The eruption forms a cone 700 metres wide and 50 metres high.

Key facts

The Penrose area has 5000 businesses and employs 45,000 people. This is 14% of Auckland City's total number of jobs. Only 700 people live in Penrose.

About 5500 people live in Mangere Bridge. There are many businesses in the area.

About 18,000 people live in Onehunga. There are 1000 businesses and 7000 jobs in Onehunga.

One hundred international and 300 domestic flights arrive and depart from Auckland Airport every day. About 34,000 passengers go through the airport every day. The airport generates \$19 billion a year for the New Zealand economy. Twelve thousand people are employed in and around the airport.

One month on

Lava flows from the volcano fill the Manukau Harbour in the area beside Onehunga Wharf. The wharf burns. The lava reaches and fills the area towards Ambury Regional Park.

The wind changes to the north-east. Ash eruptions continue. An area 10 kilometres long and 2 kilometres wide is covered in ash downwind from the volcano.

The volcano continues to grow to 125 metres high and blocks the harbour.

Six months on

After 35 days, the eruption stops. The cone is now 125 metres high.

Large deposits of ash cover the ground up to 10 kilometres from the volcano. The ash is 1–10 centimetres deep. The lava remains hot for months.

Assessment schedule: Geography 91014 Ruamoko Erupts!

Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
<p>The student applies spatial analysis, with direction, to solve a geographic problem.</p> <p>The student successfully and accurately creates some (about half) of the polygons and place marks, adds some layers, and saves these features in the view.</p> <p>The student completes some of the required maps/images to a good standard to show the required information, or includes all the required maps/images but several are lacking information.</p> <p>The student describes the effects of the eruption, refers to maps/images, and gives comments that are valid but lack detail.</p> <p><i>For example (partial extract):</i> <i>Maps/Images</i> <i>See Appendix A (following).</i> <i>Description of effects</i> <i>“The eruption will affect people, transport, and the economy. In parts of Auckland there will be up to 50 centimetres of ash on the ground. Fig. [number] shows the areas covered by ash. Some factories may have to shut as ash damages their machines. This could happen in Penrose.</i> <i>“Transport will be affected. Lava flows block the port, and the airport may close because of the ash cloud 8 kilometres high. Main roads such as SH20 could shut because of the lava bombs. The area where these fall is shown on Fig. [number].”</i></p>	<p>The student effectively applies spatial analysis, with direction, to solve a geographic problem.</p> <p>The student successfully and accurately creates, adds, and saves most of the polygons, place marks, and layers in the view.</p> <p>The student completes all of the required maps/images and shows them on the layout. The maps/images show the information accurately.</p> <p>The student uses most of the appropriate mapping conventions. See Appendix A for an example.</p> <p>The student explains the effects of the eruption on people, transport, and the economy.</p> <p>The student refers to maps/images in their responses.</p> <p><i>For example (partial extract):</i> <i>Maps/Images</i> <i>See Appendix A (following).</i> <i>Description of effects</i> <i>“The volcanic eruption will affect people, transport, and the economy. Fig. [number] shows the areas covered by ash from the volcano. It affects Mt Wellington, Onehunga, and Penrose. The ash covers the ground up to 50 centimetres deep.</i> <i>“Lots of people work in Penrose, and many of these people work in factories. The ash will cause the factories to shut as it damages machinery. If this happens, employees may lose money and factory owners will as well.</i> <i>“Transport will be affected. The Port of Onehunga</i></p>	<p>The student comprehensively applies spatial analysis, with direction, to solve a geographic problem.</p> <p>The student successfully and accurately creates, adds, and saves most of the polygons, place marks, and layers in the view.</p> <p>The student completes all of the required maps/images and shows them on the layout. The maps/images show the information accurately.</p> <p>The student uses most of the appropriate mapping conventions. See Appendix A for an example.</p> <p>The student fully explains the effects of the eruption on people, transport, and the economy.</p> <p>The student refers to maps/images to provide locational information and specific place names, providing detailed evidence in their responses.</p> <p><i>For example (partial extract):</i> <i>Maps/Images</i> <i>See Appendix A (following).</i> <i>Description of effects</i> <i>“The volcanic eruption will create significant impacts on people, transport, and the economy in the Auckland Region.</i> <i>“Although the actual eruption is not that large, it affects a much bigger area. As shown in Fig. [number], the ash from the volcano affects areas north-east and south-west due to prevailing winds. Suburbs such as Penrose, Onehunga, and Mt Wellington are coated with ash between 0.5 and</i></p>

	<p><i>will shut as it is blocked by lava, as shown on Fig. [number]. The airport will also shut as planes cannot fly through or very close to volcanic ash. It is only 6.5 kilometres from the airport to the ash cloud. Main roads such as SH1 may be shut due to being covered in ash.”</i></p>	<p><i>50 centimetres deep.</i></p> <p><i>“Although only 700 people live in Penrose, about 45,000 people work there. Ash is corrosive, and this area has a lot of factories judging from the shapes of the buildings on Google Earth. A lot of machinery will have to stop operating. This may affect people’s incomes as they will not be able to work. Factory owners will lose money.</i></p> <p><i>“Transport will be severely affected. The airport and Port of Onehunga are affected. Planes will not be able to fly due to danger from ash shutting their engines down. The volcanic ash cloud is only 6.5 kilometres from the airport. SH1 and SH20 may be closed.</i></p> <p><i>“As shown in Fig. [number], SH20 is the zone where lava bombs and scoria will fall. This will endanger motorists.”</i></p>
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Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.

Appendix A: Ruaumoko Erupts

