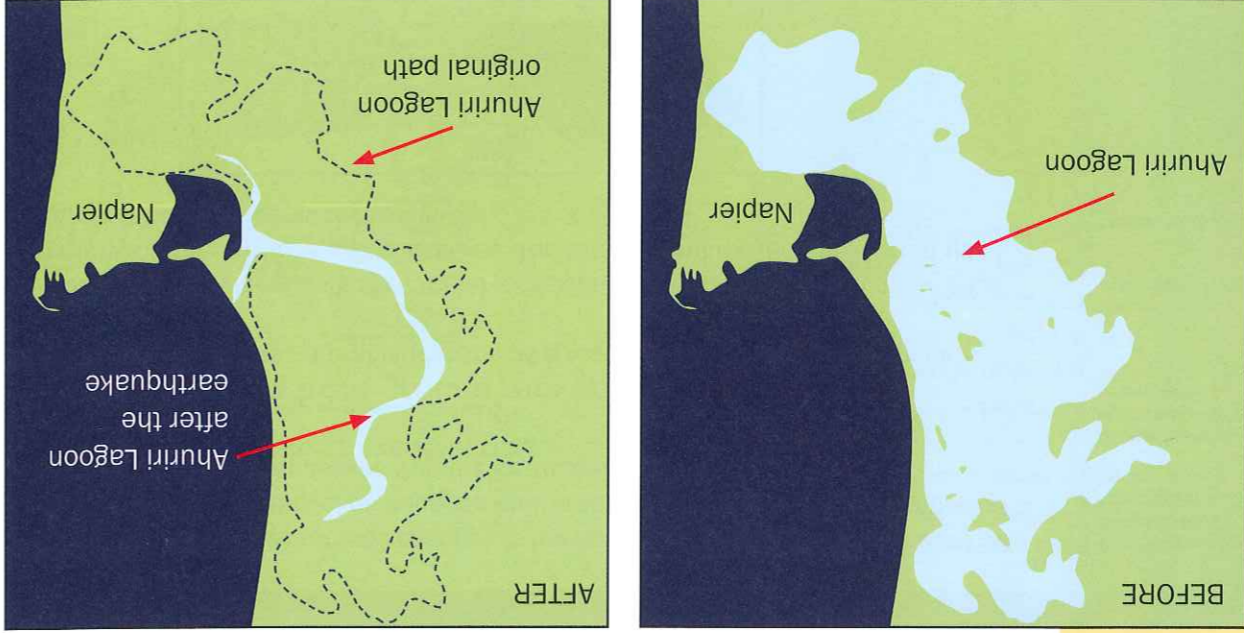
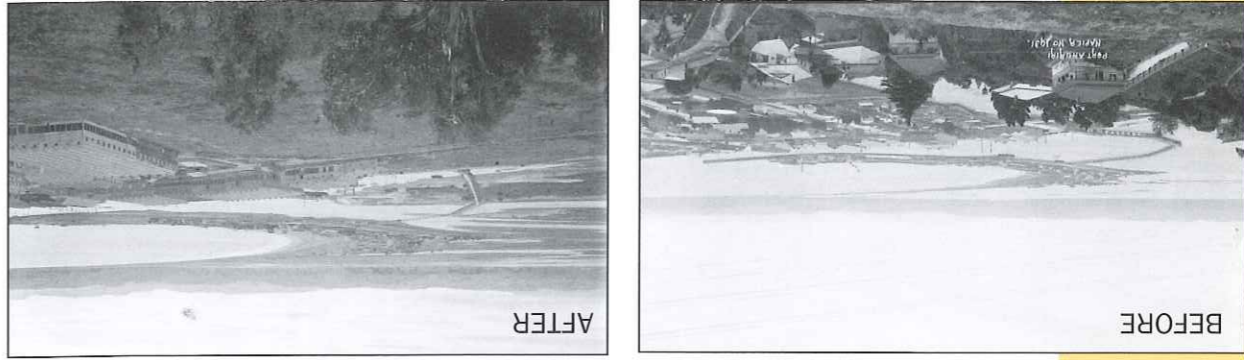


- Some earthquakes have both lateral and vertical movement. For example, an area of land in the 1855 Wairarapa earthquake was raised three metres on one side of the fault and shifted 12 metres sideways on the other side of the fault.
- Beach terraces are more significant. Terraces at Turakirae Head east of Wellington Harbour entrance were formed by earthquakes.
- Earthquakes can raise lagoons and harbours, which become dry land and useable for farming or building on. After the 1931 Hawkes Bay earthquake, the Napier airport was built on the uplifted Ahuriri Lagoon.

### Ahuriri Lagoon Before and After the Earthquake of 1931



3.3

**Changes resulting from secondary threats**  
 Changes to the natural landscape may also result from factors indirectly related to the earthquake event.

- **Soil liquefaction** – Where loose or sandy soils become unstable and act like a liquid. The soils can appear to 'boil' up to the surface.
- **Landslides** – Earthquakes can cause landslides, mudslides and avalanches on steep or unstable hillsides. Landslides shift debris from slopes to valleys changing the landscape. This often happens in areas that have high rainfall.
- **Tsunami** – Earthquakes that cause the ocean floor to suddenly rise and fall can set off a tsunami. In deep water, the tsunami wave can be less than one metre but can travel around 800kph. When a tsunami wave hits shallow coastal water it slows down but increases in height. Tsunami waves don't usually crash onto shores. Instead they swamp large areas of land, causing widespread destruction. Water from tsunami waves can reach far inland. Tsunamis in New Zealand have reached less than 10m high.

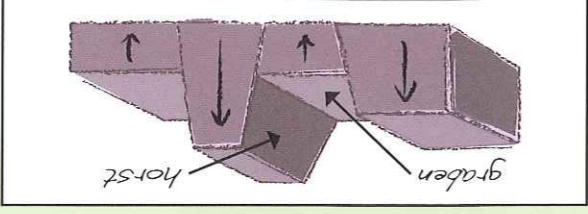
**Tsunami:** Large wave at sea, generated by an earthquake or a submarine landslide.

## Learning Activities

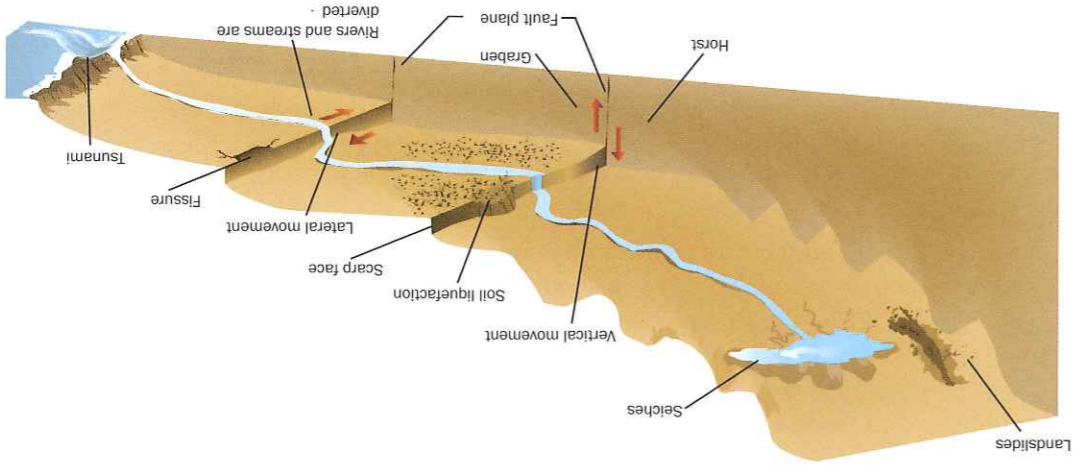
**Skill: Paragraph writing**  
 Using the GREED approach to paragraph writing, write a geographic paragraph to describe how earthquakes affect the land.

The GREED technique helps you to write well-organised paragraphs about geographic topics. GREED is an acronym so its letters have special meaning.

- GR** – Start with a generalisation:  
 The extent to which an earthquake changes the natural landscape depends on the size and duration and the type of movement caused by the earthquake.
- E** – Expand your generalisation with some further information:  
 Where an earthquake causes vertical movement to occur over thousands or millions of years, horsts and grabens will form.
- E** – Include specific examples to support your answer:  
 For example, the Southern Alps in the South Island are the result of millions of earthquakes and small vertical movements along the Alpine Fault. The Coromandel Ranges in the North Island is also an example of a horst and graben landscape feature...
- D** – Draw a diagram or sketch map to illustrate some of your points you have made in your paragraph.



Effects of Earthquakes on the Natural Environment



- **Seiches** – Earthquakes in a lake or enclosed harbour can cause tsunami waves that travel back and forth across the harbour like waves in a bathtub. Seiches could affect Wellington Harbour coasts.
- **New lakes** – Earthquakes can redirect streams causing new lakes and other waterways to form.
- **Rivers and streams diverted** – Rivers and streams often run alongside faults because fault movement creates lots of shattered rock which is easily eroded. But rivers and streams can be blocked by landslides caused by earthquakes. This often changes the waterways natural flow.

3.4