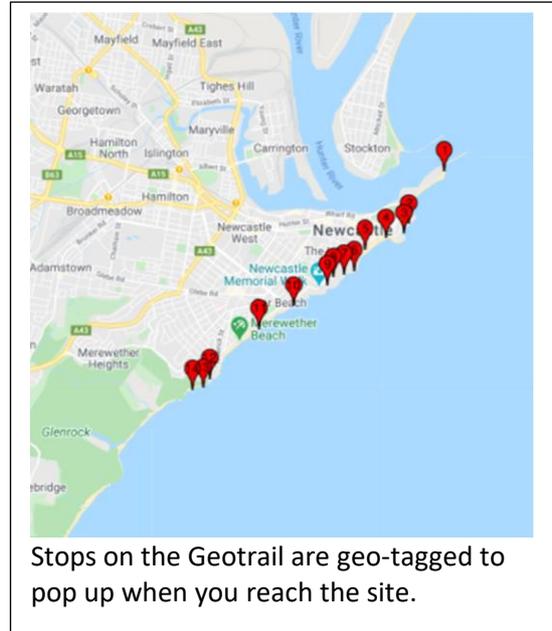




## Newcastle Coastal Geotrail

The Newcastle Coastal Geotrail is a 10 km walk along Bathers Way. Most of the path is level, but there are steps and slopes, as well as detours to rock platforms and beaches. Teachers may want to pick one or two activities in order to minimise the amount of walking required. Many key stops are located near carparks. Public buses service Nobbys Beach, Merewether Beach and areas in between.

The free NSW GeoTour app can be installed on mobile phones or tablets and does not require wifi to run. You can [download a brochure](#) about the Geotrail or get a free copy of the brochure from the Newcastle Visitor Information Centre at 430 Hunter Street or the Department of Regional NSW at 516 High Street, Maitland. [Find out more](#) about the trail from NSW Resources & Geoscience. The website also has a virtual geology fieldtrip (52 min).



## Safety

The Newcastle Coastal Geotrail is best visited at low tide. Check [Newcastle tide times](#) when planning an excursion. A pre-excursion visit to the site should be undertaken so that coordinators can complete a comprehensive risk assessment. Ensure adequate supervision, appropriate for the age of students.

Before going out to the rock platforms:

1. Check wave conditions – waves could sweep students off the rocks
2. Check tide times – rising and high tide is when waves change rapidly and may break unexpectedly
3. Check for strong winds – Winds over 15 knots can create hazardous waves, make tides higher than predicted and contribute to people losing their balance on rocks
4. Check the weather forecast – Take note of any weather conditions that may impact your trip
5. Check for marine warnings – the Bureau of Meteorology provides [warnings](#) to alert you to hazardous conditions.



**Stage 1 (Years 1 & 2) – Exploring the human and natural environment**

**Overview:**

Start at Nobbys Head and walk south to the Bogey Hole. Along the way, look for coal and chert (see below for details). Discover features of the human and natural environment.

**Stop 1 – Nobbys Head**

- Discuss lighthouse and role of lighthouses in navigation
- Bathers Way trail – paved for easier access and to protect the environment
- Natural features of the environment – plants, animals (especially birds)

**Stops 2 and 3 – Rock platform**

- How many different types of living things can students find? How do they classify them (bird, crab, etc)?
- Observe invertebrates such as snails and crabs. What features show that shells were made by animals?
- Find some pumice on the beach – are there animals or plants living on it? Does this rock really float?
- Compare water and land plants
- Look at wood fossils (Stop 3). How can you tell they were once living plants?

**Stop 6 – Bogey Hole and cliffs**

- Find coal seams in the cliff – how many black seams can students find? By this time, you may have a piece of coal to pass around. Discuss uses of coal as a resource and reason for growth of Newcastle
- Chert – discuss use and pass around a piece (if found). Students compare to coal – properties and uses
- Why would the commandant build a swimming pool here? Why has the city preserved this area and how has access been improved?

Syllabus outcome(s)	Geotrail Location	Activity
<i>History</i>		
HT1-2 Identifies and describes significant people, events, places and sites in the local community over time. The history of a significant person, building, site or part of the natural environment in the local community and what it reveals about the past <ul style="list-style-type: none"> <li>• <b>Brainstorm what aspects of the past can be seen in the local area</b></li> </ul>	Nobbys Head: Learn about the history of the area under General information → Aboriginal history  Stop 1 → Local history	Discuss Nobbys Head and the lighthouse. The lighthouse is an obvious important building. <ul style="list-style-type: none"> <li>• Why do we have lighthouses?</li> <li>• What does the lighthouse reveal about the past and present of Newcastle?</li> </ul> This lighthouse was the 3 <sup>rd</sup> built in NSW. People used to use coal fires for navigation in the region, but the

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<ul style="list-style-type: none"> <li>• Identify a significant person, building, site or part of the natural environment in the local community and discuss what they reveal about the past and why they are considered important</li> <li>• Investigate an aspect of local history</li> <li>• Develop a narrative on their chosen aspect of local history which focuses on the remains of the past</li> </ul>		<p>lighthouse can be seen from a greater distance. Learn more about the lighthouse from <a href="#">Visit NSW</a> or from <a href="#">Lighthouses of Australia</a>.</p> <p>Nobbys head was important to both Aboriginal and European peoples.</p> <p>Why would this area be important? Consider the natural features of the area.</p>
<p><i>Geography</i></p> <p>GE1-1 Describes features of places and the connections people have with places</p> <ul style="list-style-type: none"> <li>• Investigate features of places and how they can be cared for, for example:             <ul style="list-style-type: none"> <li>– Description of the natural and human features of places</li> <li>– Consideration of how a place can be cared for eg a park, farm, beach, bushland</li> </ul> </li> </ul>	<p>A) Nobbys Head: Learn about the history of the area under General information → Aboriginal history, or Stop 1 → Local history</p> <p>B) Stop 6 → 6C Convicts and the commandant</p>	<p>A) Nobbys head has both natural (rock) and human (lighthouse) features. What evidence can be seen of care for the area? (Consider the path and barriers to preserve fragile dune vegetation.)</p> <p>B) The Bogey Hole is a swimming pool built by convicts and now maintained by the city. What has been done to make this area safely accessible? Why was it a good place for the commandant’s wife to swim? (very private)</p>
<p>GE1-2 Identifies ways in which people interact with and care for places.</p> <ul style="list-style-type: none"> <li>• Investigate people’s connections and access to places, for example:             <ul style="list-style-type: none"> <li>– Discussion of why people visit other places</li> <li>– Examination of how technology has improved people’s access to places</li> </ul> </li> </ul>	<p>Bather’s Way (location of the Geotrail). See General information → Facilities for a list of amenities</p>	<ul style="list-style-type: none"> <li>• Why do people visit the coast and walk along Bather’s Way?</li> <li>• How has the city made it easier for people to access the area?</li> <li>• What facilities are available to visitors?</li> <li>• How does the Newcastle Coastal Geotrail make it possible for people to access the area without physically visiting it?</li> </ul> <p>Find out more about Bather’s Way from the <a href="#">City of Newcastle</a>.</p>



Science		
<p>ST1-4LW-S Describes observable features of living things and their environments What are the external features of living things?</p> <ul style="list-style-type: none"><li>• Describe the external features of a variety of living things</li><li>• Identify and group plants and animals using their external features, for example:<ul style="list-style-type: none"><li>– Native and introduced plants and animals</li><li>– Worms, insects, fish, reptiles, birds and mammals</li></ul></li></ul>	<p>Nobbys Head, Stop 3: The Cowrie Hole rock platform and beach</p>	<p>Students can observe plants on the sandy area around the lighthouse at Nobbys Head. Identify these as grasses, shrubs, etc. Compare to any algae washed up on the shore.</p> <ul style="list-style-type: none"><li>• What is similar and what is different?</li></ul> <p>Look for birds and invertebrates. At low tide, there will be many small invertebrates in the rock pools.</p> <ul style="list-style-type: none"><li>• What features do students use to identify them?</li><li>• What makes a shell different from a rock?</li><li>• How can we tell shells are from living things?</li></ul> <p>Wood fossils are easily seen – how are they similar to living trees or wood?</p>
<p>ST1-7MW-T Describes how the properties of materials determine their use How do the properties of materials determine their use?</p> <ul style="list-style-type: none"><li>• Identify a range of natural materials available locally or through trade used by Aboriginal and/or Torres Strait Islander Peoples for a specific cultural purpose</li></ul>	<p>Stop 6 → Coal for warmth and cooking Stop 13 → Fallen rocks for Aboriginal tools</p>	<p>When walking along the cliffs look for pieces of coal (black, lightweight, layered) and chert (hard, curved whitish) rocks*. Both were used by the Awabakel people. Coal was burned for warmth, cooking, opening shellfish and making coal tar. Chert breaks to form sharp edges and points – good for cutting tools and spear tips. *Photos at end of document</p>
<p>ST1-10ES-S Recognises observable changes occurring in the sky and on the land and identifies Earth's resources What are Earth's resources and how do we use and care for them?</p> <ul style="list-style-type: none"><li>• Identify and explore the use of a variety of Earth's resources including water and soil</li></ul>	<p>Stop 6 (6A, 6B) Coal</p>	<p>Cliffs along Bathers Way have layers of black that are clearly visible at Stop 6. These coal seams have been an important resource for people for thousands of years. Coal is fossilised plants. Europeans use coal for warmth, steelmaking and electricity production.</p>



## Stage 2 (Years 3 & 4) – The coastal environment past and present

### Overview:

Start at Nobbys Head and walk south to King Edward Park. Note human features that have remained largely unchanged for more than 100 years (lighthouse, Bogey Hole swimming pool). Observe different ecosystems on dunes and in rockpools. Discover evidence of natural processes that have changed the area in recent times (erosion and rock falls) and over the history of Earth.

### Stop 1 – Nobbys Head

- Observe the lighthouse and use the app to find out more about its history. This has remained relatively unchanged for 100 years.
- Read about the volcanoes that erupted and produced Nobbys tuff (pronounced 'toof') or forests that produced the coal seams. Think about how the rocks can provide evidence of changes in the distant past.
- Identify plants and animals in the dunes. How are they interacting? Why is the vegetation particularly important? How is the vegetation protected?

### Stops 2 and 3 – Rock platform

- Compare vegetation on land and in the ocean. How is the role of vegetation similar in different environments?
- Observe animals and plants on the rock platform. What features could be used to group them? What features indicate that they are living?
- Look at wood fossils (Stop 3). How can you tell they were once living plants? What evidence do fossils provide for changes in the area over time?

### Stop 5 – Rocks telling the story of the past

- Look at the cliff and see what evidence there is from the past. Students should see coal (ancient forests), a dyke (ancient volcano) and faults.
- Observe faults and joints above South Beach. Relate these to rockfalls and erosion.

### Stop 6 – Bogey Hole and cliffs

- Listen to the recording and learn about the coal seams and convict history

### Stop 7 to 8 – *Themeda* Grassland community

- This grassland vegetation is recognised as an endangered ecological community. It is dominated by Kangaroo grass (*Themeda triandra*) but contains many other native plants. Look closely to appreciate the biodiversity and discuss reasons this type of vegetation may be endangered.





<p>natural resources to people eg provision of food, medicine, fuel, timbers, fibres, metals</p>		<p>diversity of plants and is an endangered ecological community.</p> <p>The <a href="#">Hunter Wetlands National Park</a> features a range of ecosystems including freshwater wetlands, mangroves and coastal rainforest ecosystems.</p>
<p><i>Science</i></p>		
<p>ST2-4LW-S Compares features and characteristics of living and non-living things</p> <p>How can we group living things?</p> <ul style="list-style-type: none"> <li>• Collect data and identify patterns to group living things according to their external features, and distinguish them from non-living things</li> <li>• How are environments and living things interdependent?</li> </ul> <p><b>Describe how living things depend on each other and the environment to survive</b></p>	<p>Stops 2 and 3: Rock platforms</p> <p>Stop 2 → Life at low tide</p> <p>Stop 3 → Fossil trees and growth rings</p> <p>Stop 3 → 3C Nooks and crannies</p>	<p>Students note features of organisms on the rock platform and use these to group living things. What features allow you to determine that a hard object is a shell of a living creature and not a rock? Should the fossilised wood at Stop 3 be considered a living organism?</p> <p>Students can observe features of the environment that help living things to survive, including rock weathering that provides shelter for small organisms.</p>
<p>ST2-10ES-S Investigates regular changes caused by interactions between the Earth and the Sun, and changes to the Earth's surface</p> <p>How do natural processes and human actions change the Earth's surface over time?</p> <ul style="list-style-type: none"> <li>• Investigate why the Earth's surface changes over time as a result of natural processes and human activity, for example:             <ul style="list-style-type: none"> <li>– characteristics of soils</li> <li>– identify evidence of natural changes in landforms, rocks or fossils</li> </ul> </li> </ul>	<p>A) Evidence for change</p> <ul style="list-style-type: none"> <li>• Geological overview (include subsections)</li> <li>• Stop 1 → Volcanoes around Newcastle, Nobbys Head, Nobbys Beach</li> <li>• Stop 3 → Fossil trees and growth rings</li> </ul>	<p>A) The Geotrail provides many opportunities to see evidence of changes in the area over time. Short term changes can be seen in the photos of Nobbys Head and Nobbys Beach from 100 years ago and today. Long term changes are seen in evidence such as fossils, coal seams, volcanic tuff, faults and folds. Explore the sections of the app that describe these changes and try to visualise the area in the distant past.</p>



- Identify that scientific knowledge helps people understand the effect of their actions, for example:
  - investigate how erosion is caused by human activity, eg walking on bush trails
  - investigate how erosion can be minimised, eg constructing boardwalks

- Stop 10 (include subsections)
- Stop 11 (include subsections)
- Stop 13 (include subsections)

B) Stop 5 →  
Respecting  
Yirannali

B) Coastal environments are always vulnerable to erosion by natural processes. At Stop 5, there are many joints visible in the rocks. These fractures show where future rocks may break off. What does this mean for the buildings on the cliff above? What features of the Bathers Way walk help to minimise erosion?



**Stage 3 (Years 5 & 6) – Changes over time and observing life on the rock platform**

**Overview:**

Start at Nobbys Head and walk south to the Bogey Hole. At Nobbys Head, consider both the evidence of the colonial past (lighthouse) and of volcanic eruptions (Nobbys tuff and dyke). Proceed to the rock platform at low tide to observe adaptations of animals and plants and (on a hot day) to measure the temperature of different rock pools, relating this to their position relative to shore and/or depth. Continue south to the Bogey Hole and observe this convict-built pool. Along the way, stop to learn about changing sea level and changes for the Awakabal people during fluctuating sea levels.

**Stop 1 – Nobbys Head**

- Discuss the importance of Nobbys Head lighthouse as the area changed from convict settlement to coal producing region
- Observe evidence of volcanic eruptions that formed Nobbys tuff (older) and basalt dykes (younger)

**Stops 2 and 3 – Rock platform**

- Observe animals and plants of the rock platform. What features are adaptations to living on the rock platform? What features are probably NOT adaptations? Which organisms can survive on the exposed platform and which are only found in the pools?
- Experiment: measure the temperature of pools and their depth and distance from the high tide mark (usually a line of stranded seaweed). Does depth, distance or both relate to temperature?

Throughout the walk – where was the shore 20,000 years ago? Can you see that far? How has the change in climate and sea level affected where people can live in this area?

**Stop 6 – The Bogey Hole**

- What can we learn about convict life from this structure?
- What does this swimming pool indicate about everyday life? Have people dramatically changed their activities on the coast?

Syllabus outcome(s)	Geotrail Location	Activity
<p><i>History</i></p> <p>HT3-1 Describes and explains the significance of people, groups, places and events to the development of Australia</p> <ul style="list-style-type: none"> <li>• The nature of convict or colonial presence, including the factors that influenced patterns</li> </ul>	A) Nobbys Head: Stop 1 → Local history, Nobbys Head, Nobbys Beach	There is a great deal of Aboriginal and European history along the trail. The lighthouse (Stop 1) and Bogey Hole (Stop 6) were important structures from the 1800s that reflect the settlement of Newcastle. The photos



<p>of development, aspects of the daily life of inhabitants (including Aboriginal and Torres Strait Islander Peoples) and how the environment changed</p> <ul style="list-style-type: none"> <li>• <b>Outline settlement patterns in the nineteenth century and the factors which influenced them</b></li> <li>• <b>Discuss the impact of settlement on local Aboriginal peoples and the environment</b></li> <li>• <b>Discuss the diverse relationships between Aboriginal peoples and the British</b></li> <li>• <b>Investigate the everyday life of a variety of men and women in post-1800 colonial</b></li> </ul>	<p>B) Stop 6 → 6C Convicts and the commandant</p> <p>C) Stop 9 → Rocks as resources</p>	<p>of Nobbys Head and Nobbys Beach show changes from 1900 onward.</p> <p>Convict history is highlighted at Bogey Hole – built by convicts. Stop 9 – Rocks as resources tells how Newcastle started as a convict settlement and later transformed into a coal and steel-making area. Students should imagine how this would have shaped the lives of Awabakal people and the European inhabitants of the area.</p>
<i>Geography</i>		
<p>GE3-1 Describes the diverse features and characteristics of places and environments Environments shape places</p> <ul style="list-style-type: none"> <li>• Investigate how the natural environment influences people and places, for example:             <ul style="list-style-type: none"> <li>– <b>discussion of how climate influences the distribution of where people live</b></li> </ul> </li> </ul>	<p>Stop 9 → Aboriginal settlement – living through climate change</p>	<p>Read about the changes in sea level over time during Awabakal settlement of the area and how the changing climate influenced their lives.</p> <p>Students should consider where people will live in the area with continued sea level rise.</p>
<i>Science</i>		
<p>ST3-4LW-S Examines how the environment affects the growth, survival and adaptation of living things How do physical conditions affect the survival of living things?</p> <ul style="list-style-type: none"> <li>• Describe how changing physical conditions in the environment affect the growth and survival of living things, for example             <ul style="list-style-type: none"> <li>– temperature of water in aquatic environments</li> </ul> </li> </ul>	<p>Rock platform at low tide</p> <p>Stop 2 → Life at low tide</p> <p>Stop 3 (multiple subsections)</p>	<p>Explore life in pools on the rock platform.</p> <p><i>Observe changing water temperature in rock pools (hot day is best)</i></p> <p>There is the opportunity for students to measure the temperature of different pools and determine whether they are warmer near shore. On hot days, the pools near shore will be noticeably warmer. Volume affects temperature change, so students could investigate the relationship</p>



<ul style="list-style-type: none"><li>• Test predictions by gathering data and use evidence to develop explanations of events and phenomena</li></ul> <p>How do the structural and behavioural features of living things support survival?</p> <ul style="list-style-type: none"><li>• Describe adaptations as existing structures or behaviours that enable living things to survive in their environment</li><li>• Describe the structural and/or behavioural features of some native Australian animals and plants and why they are considered to be adaptations</li></ul>		<p>between pool depth and temperature. Shallow pools heat more quickly. This investigation is an excellent stimulus for discussion of fair testing.</p> <p><i>Adaptations in the tidal zone</i></p> <p>Students should observe animals and plants in the rockpool area. Are there more in the pools that remain water-filled or on the exposed platform? Which organisms can survive out of water? Do they have apparent structures that might help them survive?</p> <p>Key concept – adaptations are not general features of an organism, but ones that give it an advantage in a specific situation. For example, a shell is normal for molluscs (snails, clams, limpets). Being able to close that shell and survive on the exposed rock platform is an adaptation found in some molluscs.</p>
<p>ST3-10ES-S Explains regular events in the solar system and geological events on the Earth's surface</p> <p>How do sudden geological changes and extreme weather events affect the Earth's surface?</p> <ul style="list-style-type: none"><li>• Investigate the effects of sudden geological changes and extreme weather events on the Earth's surface, for example:<ul style="list-style-type: none"><li>– earthquakes, volcanic eruptions, tsunamis</li><li>– cyclones, storms, drought and floods</li></ul></li></ul>	<p>Stop 1 – Erupting volcanoes and Volcanoes around Newcastle</p> <p>Stop 2 – Hot magma from deep Earth and Dyke from the deep</p> <p>Stop 5 → Molten rock injected into Earth's crust</p>	<p>We do not think of Australia as a place full of volcanoes, but there is ample evidence of volcanic activity at Nobbys Head. How has volcanic ash affected the present landscape? Consider what the environment would have been like during the volcanic eruptions.</p> <p>Dykes provide evidence of more recent volcanic action (Stops 2 and 5). We can tell the dykes are younger because they cut across the older tuff layers.</p>



**Stage 4 (Years 7 & 8) – Geography; Earth Science; Biology**

*Geography*

Outline:

The Geotrail documents the history of the coastal landscape and how it has been changed over geological time by volcanic eruptions, changes in sea level and tectonic forces. Subsequent weathering and erosion have shaped the topographic features we see today.

*Earth Science*

Outline:

The Newcastle coastline offers the opportunity to observe the three major rock types and relate them to the history of the area. Students can view fossils and rock layers – both of which help us to reconstruct the past of the planet and the area. Visible coal seams provide a stimulus for investigating the past and present importance of coal as a resource.

*Biology*

Outline:

Visit the rock platforms at Stops 2 and 3. Find and classify organisms. Observe adaptations for life in the tidal zone. Create food chains and webs to represent the ecosystem. Predict ways in which human actions could affect the food chains and webs.

Syllabus outcome(s)	Geotrail Location	Activity
<p><i>Geography</i></p> <p>GE4-2 Describes processes and influences that form and transform places and environments Landscapes and landforms</p> <ul style="list-style-type: none"> <li>Investigate different landscapes and the geomorphic processes that create distinctive landforms, for example:           <ul style="list-style-type: none"> <li><b>identification of a variety of landscapes and landforms</b></li> <li><b>explanation of geomorphic processes that create landforms eg weathering, erosion, deposition, tectonic activity</b></li> <li><b>examination of ONE landscape and its distinctive landforms</b></li> </ul> </li> </ul>	<p>See both stops and subsections for:</p> <ul style="list-style-type: none"> <li>Geological overview</li> <li>Stop 1 – Erupting volcanoes</li> <li>Stop 2 – Hot magma from deep Earth</li> <li>Stop 5 – Splitting from Zealandia</li> <li>Stop 10 – Layers of time</li> <li>Stop 11 – The changing seascape</li> <li>Stop 13 – Rocks and sediments under stress</li> </ul>	<p>The Geotrail provides details of the history of the area and processes in its formation including volcanic activity, tectonics, sea level variation, weathering and erosion.</p> <p>By the end of the excursion students should develop an understanding of the events and forces that have shaped the Newcastle coastline, as well as the evidence seen in the rock.</p>



Earth Science		
<p>ES1 Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales</p> <ul style="list-style-type: none"><li>• Relate the formation of a range of landforms to physical and chemical weathering, erosion and deposition</li><li>• Outline the origins of and relationships between sedimentary, igneous and metamorphic rocks.</li><li>• Classify a variety of common rocks and minerals according to their observable properties.</li><li>• Describe the conditions under which fossils form</li><li>• Outline how geological history can be interpreted in a sequence of horizontal sedimentary layers, in which the oldest are at the base and youngest at the top</li></ul> <p>Additional content</p> <ul style="list-style-type: none"><li>• Describe some methods used by scientists to determine the relative age of rock layers</li></ul>	<p>See stops and subsections for:</p> <ul style="list-style-type: none"><li>• Stop 1 – Erupting volcanoes</li><li>• Stop 2 – Hot magma from deep Earth</li><li>• Stop 3B – Fossil trees and growth rings</li><li>• Stop 4 – Rocks from faraway places</li><li>• Stop 10 – Layers of time</li><li>• Stop 12 – Fallen rocks and fossils</li></ul>	<p>All three major rock types can be observed in the area. Coal and sandstone are sedimentary rocks. Basalt dykes are igneous rocks. Gneiss ballast rocks are metamorphic. Students should use their knowledge of the rock cycle to decide whether Nobbys Tuff should be classified as igneous or sedimentary. This rock was formed by layers of volcanic ash. What visual differences have they noticed between the three rock types? Do these differences help to classify the tuff?</p> <p>Fossilised wood is easily observed at the Cowrie Hole (Stop 3) near the beach. Students can learn about the way it fossilised.</p> <p>Fossils are important for matching layers of the same age worldwide. <i>Glossopteris</i> leaves (Stop 12) are evidence of Gondwana and were a significant find on Scott's ill-fated Antarctica expedition.</p> <p>Stop 10 explains how cliffs preserve the history of the area and past environments.</p>
<p>ES3 Scientific knowledge influences the choices people make in regard to the use and management of the Earth's resources.</p> <ul style="list-style-type: none"><li>• Classify a range of the Earth's resources as renewable or non-renewable</li><li>• Outline features of some non-renewable resources, including metal ores and fossil fuels</li><li>• Discuss different viewpoints people may use to weight</li></ul>	<p>Coal seams are seen throughout the trail. Learn more at:</p> <ul style="list-style-type: none"><li>• Geological overview → Ancient landscapes and environments (formation)</li><li>• Stop 6A – Coal for warmth and cooking</li></ul>	<p>Coal has been used in the Newcastle area for thousands of years, beginning with Awabakal people. The coal seams are responsible for the growth of modern Newcastle and the former BHP Steelworks. Coal mining remains a major economic force in the region.</p> <p>Students should look at the coal seams and consider their use. How has the role of coal varied over</p>



<p>criteria in making decisions about the use of a major non-renewable resource found in Australia</p> <p>Additional content</p> <ul style="list-style-type: none"> <li>• Debate the economic and environmental impacts of mining and resource exploration</li> </ul>	<ul style="list-style-type: none"> <li>• Stop 6B – Ribbons of coal</li> </ul> <p>Stop 9 → Rocks as resources</p>	<p>time? What are the environmental impacts of mining and burning coal?</p>
<p><i>Biology</i></p>		
<p>LW1 There are differences within and between groups of organisms; classification helps organize this diversity</p> <ul style="list-style-type: none"> <li>• Explain how the features of some Australian plants and animals are adaptations for survival and reproduction in their environment</li> </ul>	<p>Rock platform at low tide</p> <p>Stop 2 → Life at low tide</p> <p>Stop 3 (multiple subsections)</p>	<p>Students should be able to classify organisms on the rock platform into major groups. Within these groups, identify features that are adaptations. Adaptations are not general features of an organism, but ones that give it an advantage in a specific situation. For example, a shell is normal for molluscs (snails, clams, limpets). Being able to close that shell and survive on the exposed rock platform is an adaptation found in some molluscs.</p>
<p>LW5 Science and technology contribute to finding solutions to conserving and managing sustainable ecosystems.</p> <p>Students:</p> <ul style="list-style-type: none"> <li>• Construct and interpret food chains and food webs, including examples from Australian ecosystems</li> <li>• Describe interactions between organisms in food chains and food webs, including producers, consumers and decomposers</li> <li>• Predict how human activities can affect interactions in food chains and food webs, including examples from Australian land or marine ecosystems</li> </ul>	<p>Rock platform at low tide</p> <p>Stop 2 → Life at low tide</p> <p>Stop 3 (multiple subsections)</p>	<p>Arrange creatures observed on the rock platform into food chains and webs. Students may infer the presence of some organisms not observed such as birds that are mentioned in the Geotrail app.</p> <p>Based on the food chains and webs, predict the effect of human activities such as gathering shellfish to eat or dumping pollutants that might kill one type of organism. How does this affect the entire ecosystem?</p>



### Stage 5 (Years 9 & 10) – Tectonics (Earth Science)

#### Overview:

Students examine evidence for tectonic activity and see how this has influenced landforms. Evidence of past volcanic activity and earthquakes is used to explore the effect on Earth's spheres.

Syllabus outcome(s)	Geotrail Location	Activity
<p>ES2 The theory of plate tectonics explains global patterns of geological activity and continental movement.</p> <ul style="list-style-type: none"><li>Outline how the theory of plate tectonics explains earthquakes, volcanic activity and formation of new landforms</li></ul>	<p>See both stops and subsections for:</p> <ul style="list-style-type: none"><li>Geological overview</li><li>Stop 1 – Erupting volcanoes</li><li>Stop 2 – Hot magma from deep Earth</li><li>Stop 5 – Splitting from Zealandia</li><li>Stop 10 – Layers of time</li><li>Stop 11 – The changing seascape</li><li>Stop 13 – Rocks and sediments under stress</li></ul>	<p>Use information in the Geotrail to create a timeline of tectonic activity in what is now Newcastle. Note how the tectonic setting changed over time and the evidence left in the rock for these changes.</p> <p>Based on knowledge of the past, what type of tectonic events are likely to happen in the area today? Why?</p>
<p>ES3 People use scientific knowledge to evaluate claims, explanations or predictions in relation to interactions involving the atmosphere, biosphere, hydrosphere and lithosphere.</p> <ul style="list-style-type: none"><li>Describe some impacts of natural events, including cyclones, volcanic eruptions or earthquakes, on the Earth's spheres</li></ul>	<p>See both stops and subsections for:</p> <ul style="list-style-type: none"><li>Geological overview</li><li>Stop 1 – Erupting volcanoes</li><li>Stop 2 – Hot magma from deep Earth</li><li>Stop 5 – Splitting from Zealandia</li><li>Stop 10 – Layers of time</li><li>Stop 11 – The changing seascape</li><li>Stop 13 – Rocks and sediments under stress</li></ul>	<p>What impact did volcanic eruptions that formed Nobbys Tuff have on Earth's spheres? Compare this to the effect of the volcanic activity that produced dykes. Explain why the volcanic events would have been associated with earthquakes and what effects the earthquakes would have on the spheres.</p>



## Stage 6 Earth & Environmental Science – Integrated excursion for Years 11 and 12

### Overview:

The Geotrail explains the geological history of the area (including volcanic eruptions), the origin of rocks observed along the way and the importance of coal in development of the Newcastle region. An excursion can cover most aspects of the course including volcanic activity, stratigraphy, tectonics and resources.

Syllabus outcome(s)	Geotrail Location	Activity
<i>Module 1: EES11-8 Describes the key features of the Earth's systems, including the geosphere, atmosphere, hydrosphere and biosphere and how they are interrelated</i>		
What are the components of rocks and soils? <ul style="list-style-type: none"><li>Explain the formation of rocks as characteristic assemblages of mineral crystals or grains that are formed through igneous, sedimentary and metamorphic processes, as part of the Rock Cycle</li></ul>	See stops and subsections for: <ul style="list-style-type: none"><li>Stop 1 – Erupting volcanoes</li><li>Stop 2 – Hot magma from deep Earth</li><li>Stop 4 – Rocks from faraway places</li></ul>	All three major rock types can be observed in the area. Coal and sandstone are sedimentary rocks. Basalt dykes are igneous rocks. Gneiss ballast rocks are metamorphic. Students should use their knowledge of the rock cycle to decide whether Nobbys tuff should be classified as igneous or sedimentary. This rock was formed by layers of volcanic ash, some of which have been washed into the area and deposited.
How is the age of geological materials determined? <ul style="list-style-type: none"><li>Describe relative and absolute dating of the geosphere</li></ul>	<ul style="list-style-type: none"><li>Stop 1 – Erupting volcanoes</li><li>Stop 10 – Layers of time</li><li>Stop 12 – Fallen rocks and fossils</li></ul>	Nobbys Head offers the chance to interpret a stratigraphic column. There are clear sedimentary layers and a basalt dyke.  Students should recognise that the basalt must be younger than the layers that it cuts across, just as a road must be there in order for you to cross it. Both the tuff and the basalt can be dated using radiometric dating. The coal seams are fossiliferous, so could be dated using correlation.  Stop 10 has a detailed description of the layers in the cliff and the environments in which they were deposited.



How are non-renewable geological resources discovered and extracted?

- Investigate traditional Aboriginal quarrying and mining methods
- Locate and relate a range of non-renewable resources to their location, for example:
  - minerals
  - fossil fuels
  - ores of economic significance
- Analyse the economic importance of Australia’s non-renewable resources

A) Aboriginal quarrying

- Stop 6 → Coal for warmth and cooking

- Stop 13 → Fallen rocks for Aboriginal tools

B) Coal

- Geological overview → Ancient landscapes and environments (formation)
- Stop 6A – Coal for warmth and cooking
- Stop 6B – Ribbons of coal
- Stop 9 → Rocks as resources

A) When walking along the cliffs look for pieces of coal (black, lightweight, layered) and chert (hard, curved whitish) rocks. Both were used by the Awabakal people. Coal was burned for warmth, cooking, opening shellfish and making coal tar. Chert breaks to form sharp edges and points – good for cutting tools and spear tips. In this erosive landscape, these resources could simply be gathered from rockfalls or pried out of a cliff face.

B) The trail discusses the coal deposits of the Newcastle region and their geological origins. Understanding the depositional environments helps students to understand the location.

Coal royalties are a significant source of income for NSW and coal mining was vital for the development of Newcastle. A visit to the Newcastle Museum’s [Fire and Earth](#) exhibit would complement a discussion of resources.

**Module 2: EES11-9** Describes the evidence for the theory of plate tectonics and the energy and geological changes that occur at plate boundaries

What are the geological and topographic features that have resulted from plate tectonics at each plate boundary type?

- Model types of plate boundaries showing the dominant topographic and geological features, including:
  - divergent boundaries: rift valley, mid-ocean ridge, normal and transform faults
  - convergent boundaries: mountain range, trench, reverse faults and folds

See both stops and subsections for:

- Geological overview
- Stop 5 – Splitting from Zealandia
- Stop 13 – Rocks and sediments under stress

Features of both divergent and convergent plate interactions are visible.

Divergent: normal faults are visible at Stops 5 and 13

Convergent: See information about folding of Nobbys Tuff at Stop 13 à Folding. The tuff itself is the product of volcanic action associated with convergent boundary volcanoes



**Module 3: EES11-10** Describes the factors that influence how energy is transferred and transformed in the Earth's systems

How do energy transfers and transformations alter the lithosphere?

- Describe the role of heat and its interactions with the lithosphere in creating different types of volcanic eruptions and magma compositions, including but not limited to:
  - thermal plumes resulting in effusive mafic eruptions
  - partial melting of subducted oceanic plates resulting in explosive felsic eruptions
  - interactions of magma and overlying ice resulting in ash clouds

See sections and subsections for:

- Stop 1 – Erupting volcanoes
- Stop 2 – Hot magma from deep Earth

Two different types of volcanic eruptions and magma composition are visible at Nobbys Head and along the trail. The tuff was formed from volcanic ash from an explosive volcano and the basalt dyke is from an effusive magma.

**Module 5: EES12-12** Describes and evaluates the models that show the structure and development of the Earth over its history

What is the role of fossils in expanding what is known of geological time and past life on Earth?

- **Investigate** and model processes of fossil formation by examining a variety of methods in rock, including:
  - mould formations
  - cast formations
  - trace fossils
- Discuss the significance of index fossils in generating a geological timescale
- Extrapolate how the principles of uniformitarianism and superposition as well as fossils and absolute dating can be used to date events of geological significance

- Stop 3B – Fossil trees and growth rings
- Stop 10 – Layers of time
- Stop 12 – Fallen rocks and fossils

Fossilised wood is easily observed at the Cowrie Hole (Stop 3) near the beach. Students can learn about the way it fossilised.

Fossils are important for matching layers of the same age worldwide. *Glossopteris* leaves (Stop 12) are evidence of Gondwana and were a significant find on Scott's ill-fated Antarctica expedition.

Stop 10 explains how cliffs preserve the history of the area and past environments. Uniformitarianism is the underlying assumption of this column, as we use our knowledge of current deposition to interpret events in the geological past.



**Module 6: EES12-13** Describes and evaluates the causes of the earth's hazards and the ways in which they affect, and are affected by, the Earth's systems

How and why do geological disasters occur?

- Using data, predict the zones along which earthquakes and both effusive and explosive volcanic eruptions are likely to occur and relate these to plate boundaries
- Using secondary sources, investigate and explain the hazards associated with earthquakes, including ground motion and tsunamis
- Using secondary sources, investigate and explain the hazards associated with volcanoes, for example:
  - ash eruptions and lava flows
  - lahars and poisonous gas emissions
- Account for the types of magma in each of the above types of volcanoes, and analyse how this affects the explosivity of their eruptions

See sections and subsections for:

- Geological overview
- Stop 1 – Erupting volcanoes
- Stop 2 – Hot magma from deep Earth
- Stop 5 – Splitting from Zealandia
- Stop 13 – Rocks and sediments under stress

The tectonic environment of the region has changed from convergent to divergent to stable over the course of time seen in the deposits along the Geotrail.

Evidence of past hazards is visible in the tuff layer (ashfall), basalt dykes, faults and joints (earthquake). Students may wish to investigate the Newcastle earthquake using information at the Newcastle Museum and available online.

Students should relate the different volcanic deposits (tuff, basalt) to different types of volcanoes and different hazards.

**Module 8: EES12-15** Describes and assesses renewable and non-renewable Earth resources and how their extraction, use, consumption and disposal affect the Earth's systems

How are Australia's natural resources extracted, used and managed?

- Prepare a case study of an important Australian renewable or non-renewable resource, including but not limited to:
  - how the resource is found, extracted and/or managed
  - how the resource is used
  - whether the resource can be extracted and/or used sustainably
  - the past, present and future use and importance of the resource

- Geological overview → Ancient landscapes and environments (formation)
- Stop 6A – Coal for warmth and cooking
- Stop 6B – Ribbons of coal
- Stop 9 → Rocks as resources

The visible coal seams and information about the historical importance of coal offer a good stimulus for the case study of a resource.



**Rocks to look for**

**Coal**



**Chert (used for tools)**



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