Stimulus Booklet: Suggested Answers to Student Activities

STUDENT ACTIVITIES ANSWERS

KN KNOW
UN UNDERSTAND
AP APPLY
AN ANALYSE
EV EVALUATE
CR CREATE

TWEED/GOLD COAST LOCATION AND ENVIRONMENT

1. Refer to Sources B and C to identify the following coastal features:

   ❱ Tweed River
   ❱ Duranbah Beach
   ❱ Letitia Spit and Letitia Beach
   ❱ Coolangatta beach
   ❱ Point Danger
   ❱ Snapper Rocks.
   This is an orientation activity

2. Refer to Source C

   a. Describe the location of the Tweed/Gold Coast region within Australia.
      This is a border region located in both northern NSW and southern Queensland and is where the Tweed River enters the sea in NSW.

   b. Explain how the NSW/Queensland border complicates the management of the Tweed Gold Coast coastal environment between Letitia Spit and Currumbin.
      Management involves two different state governments and local councils which need to cooperate. Actions in one council region or state could impact on the coastal environment of the other.

   c. How far inland from Kirra is the border between Queensland and NSW?
      4 km

   d. Measure the distance from the northern side of the Tweed River to:

      ❱ Point Danger
         1 km
      ❱ Tugun (measure along the coastline).
         25 km

   e. State the direction from the Tweed River mouth to:

      ❱ Currumbin
         NW
      ❱ Snapper Rocks.
         NNW

   f. State the direction of Coolangatta from Snapper Rocks.

      ❱ *West/WSW*

3. Refer to Source M: Topographic Map.

   a. State the natural features at the following area and grid references (GR):

      ❱ AR 5483
         Letitia Spit
      ❱ AR 5381
         Mangrove or wet swamp
      ❱ GR 542845
         Point Danger
      ❱ GR 540838
         Tweed River
      ❱ GR 530843
         Greenmount Beach
      ❱ GR547830.
         Letitia Beach

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b. State the human feature at the following grid references:

- GR 545840
  Breakwater/Training Wall
- GR 520841
  Musgrave Street
- GR 545836
  Sand Dredging

c. Determine the following directions:

- Greenmount beach from Snapper Rocks
  SW
- Letitia Beach from Kirra Beach
  SE
- the flow direction of the Tweed River between Northing 81 and Northing 83
  NNW (NW)
- the direction of flow of the Tweed River between Easting 54 and Easting 55
  East (ENE)
- the direction Kirra beach faces
  N / NNE
- the direction Duranbah Beach faces.
  ENE

d. Use the scale to:

- calculate the length of Letitia Beach shown on the map
  Approximately 2.5 km
- calculate the straight-line distance between Point Danger and Kirra Beach at Easting 52.
  2.25 km

e. Draw a precise map of the area shown on the topographic map. On your map:

- label all coastal landforms (sandy and rocky)
- add the Tweed River and Tweed River breakwaters
- shade the built up – urban area
- draw wave lines to show waves generated by a prevailing SE wind and resulting longshore drift on Letitia Spit
- draw wave lines to show wave refraction around Snapper Rocks
- add a title, scale and orientation (N) to your map.

Mapping responses will vary.

4. Refer to Sources G, H, J, and K.

a. What was the predominant wave direction at Tweed Heads in May 2018?
   SE

b. Draw a conclusion about the prevailing wind direction for the month of May. Justify your answer.
   SE as wind generates waves in the same direction

c. Identify the significant weather event that took place to the east of Australia in February 2019? Describe features of that weather event
   Tropical Cyclone Oma
   TC Oma was a Category 2 tropical cyclone located NE of Ballina in NSW on 19 Feb 2019. Oma moved in a SW direction towards the NSW/Qld coasts, increasing to a Category 3 late on 19 February. By the afternoon of 22 Feb Oma was downgraded to a Category 2 Cyclone with its effects felt over a wide area by 23 February.

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d. How did the weather event impact the prevailing wave direction and size during February?
Oma changed the prevailing wave direction at Tweed Heads to easterly and the waves were much bigger.

e. Compare wave sizes during May 2018 and February 2019.
In May 2018, the prevailing waves were south-easterly up to a height of 2 metres, although waves were more commonly 1–1.5 metres. In February 2019, the prevailing waves were easterly up to a height of over 4 metres although waves were more commonly between 1 and 2 metres.

f. What impact would the February weather event have on have on coastal processes operating on the Tweed Gold Coast beaches?
The larger waves during Cyclone Oma would be destructive waves which would cause beach erosion.

g. What is the connection between Cyclone Oma and the Kirra Point surf break?
Cyclones generate large waves that are enjoyed by professional surfers.

TWEED SAND BYPASSING

1. Refer to Source D.

   a. Name the two permanent outlets for sand pumped via the Tweed Sand Bypassing (TSB) network.
   Point Danger, Snapper Rocks

   b. Identify and suggest reasons for the temporary transfer pipelines.
   To transfer sand from the permanent pipelines to the desired destination when required.

   c. Calculate the total distance of the entire TSB network (water and sand pipelines)
   4km

   d. Develop two optional 'travel journeys' for a grain of sand travelling northwards along Letitia spit towards the jetty. The sand must travel through TSB pipelines and the final destination will be North Kirra Beach. Natural processes should be referred to in your story. (This is a repeat of a question in Part 4 of this resource).
   There are many options for this activity, e.g. sand transported by longshore drift before being sucked into the jetty pipelines. The sand will then be transferred by pipeline and released at Snapper Rocks where it will join the longshore current moving northwards. The sand grain will avoid being trapped by Kirra Groyne and constructive waves will wash the sand onto Kirra Beach – cross beach transfer.

   e. Add the TSB pipeline locations to your precise map from the Activity 3.
   Mapping activity

   f. Use the scale to calculate the area covered by the map.
   3.75 km²

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2. Refer to Sources E and F.

a. What is the coastal management strategy shown in Source F?
Dredging

b. What geographical process has necessitated the use of this management strategy?
Deposition of sand

c. Provide evidence from the photograph and map that dredging has taken place at the Tweed River entrance.
Deeper water in the entrance is indicated by the darker colour in the photograph. On the map, the deepest water is at the river mouth near to the northern breakwater.

d. What direction was the photographer facing when taking the photo in Source F?
NW

e. Where is an accumulation of sand shown on the map? What should happen to this sand?
North of the TSB jetty and east of the southern breakwater. Sand will need to be dredged once it accumulates in the Tweed River entrance.

f. Define the terms bathymetry and dredging in your own words.
Example: Bathymetry is the depth of the ocean floor.
Example: Dredging is the man-made removal of sand from the sea floor/ river bed by machine.

g. Name stakeholders who would benefit most from changes to Tweed River bathymetry.
Professional and amateur fishermen, sailors.

3. Use Sources I and L:

Photographs are an important monitoring tool for TSB.

a. What is ARGUS?
ARGUS is a series of cameras on tall buildings taking photos every minute of the day

b. What other types of photographs are used for coastal monitoring? How are different images obtained?
Ground level taken from beaches and CoastSnap stations.
Oblique level taken from helicopters very 4 months.
Vertical aerial taken from aeroplanes every 6 months

c. Identify the instrument used to provide wave data for the TSB smart phone app.
Wave Buoy/Wave River Buoy/Live Wave Buoy

d. Suggest the source of weather data shown on the app.
Bureau of Meteorology (BOM) Coastalwatch

e. Describe the wave and weather conditions for the day shown in this image.
Waves 0.78 metres high coming from the ESE every 12 seconds (wave period) Weather – Temp 27 °C, Wind NE @ 7 knots, Partly Cloudy

f. Name stakeholders who would find the TSB smart phone app useful.
Surfers, tourists, local beach users

g. Name other instruments used for coastal monitoring by TSB.
Wave rider buoy (wave height, period, direction); Sonar (ocean depth)

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STAKEHOLDERS

1. Refer to Sources A and H.

   Surfboard riders are considered a stakeholder in the management of the Tweed/Gold Coast coastal environment. The area is also a World Surfing Reserve.

   a. Identify the coastal locations in Sources A and H.
   Letitia Spit (A), Kirra Point (H)

   b. What direction was the photographer facing when taking the each of these photos?
   SE (A), NE (H)

   c. Explain why surfers are considered important stakeholders in coastal environments.
   Surfers come to the coast to find good waves and the management strategies implemented can impact on these conditions. Surfing brings income and tourists to the coast and they are an important part of the economy.

   d. Complete the table below by identifying other stakeholders and justifying their stakeholder status.

STAKEHOLDER	REASON FOR STAKEHOLDER STATUS
Surfboard riders	Rely on good wave conditions
Surfers/swimmers	Beach and surf conditions
Businesses, e.g. retailers, restaurants, hotels	Economic survival linked to spending by locals and tourists attracted to beaches and surf
Local residents	Recreational use of beaches
Tourists	Attracted to the coast by beach lifestyle… good beaches and recreation opportunities are essential
Local council	Environmental decision making and management
State government	Legal regulations, planning

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2. Refer to Source O.

a. Rank the activities from most to least importance to the local economy.
Commercial fishing; diving; recreational boating and fishing; charter fishing; whale watching.

b. Graph the estimated annual values of activities associated with TSB as a pie graph. *Hints*

i. *Calculate each activity value as a % of the total value. Convert % to degrees 1 % = 3.6 degrees.*

ii. *Draw segments from largest to smallest in a clockwise direction from North*

Pie graph using the following calculations

c. Create a heading for your graph that clearly identifies the nature of the listed activities.
Estimated value of marine activities at the Tweed River entrance 2019.

3. Refer to Source P.

a. Identify two differences in the activities of domestic and international overnight tourists to the Gold Coast.
Visits to national/state parks ranked 5th most important activity for international tourists compared to 10th for domestic tourists. Domestic tourists ranked exercise, gym and swimming as a top-10 activity, but international tourists did not.

b. Calculate the difference in the % of international and domestic tourists who identified visits to national parks/state parks as an activity they would undertake on the Gold Coast.
60.1% (International) − 9.4% (Domestic) = 50.7%

c. Suggest reasons for these differences.
Domestic tourists may be weekender travellers keen to maintain their exercise regime compared to travellers after different experiences. Domestic travellers may already have visited national and state parks on previous visits.

ACTIVITY	VALUE	%	DEGREES
Commercial fishing	$4,830,000	77%	277
Diving	$580,250	9.3%	34
Recreational boating and fishing	$457,528	7.2%	26
Charter fishing	$316,333	5.1%	18
Whale watching	$84,850	1.4%	5
Total	**$6,268,961**	**100%**	**360**