National
Qualifications
2021 ASSESSMENT RESOURCE

X826/76/11 Environmental Science
Paper 1 — Supplementary source booklet

Duration — 45 minutes

Supplementary sources of information

Source A is a sketch map showing the shingle banks and location of Settlement X.

Source B is an image showing forestry plantation on inland shingle banks, including gorse encroachment.

Source C is a table showing the SSSI designations in this area and reasons for their designation.

Source D is a list of particular risks to Scotland identified in the UK Climate Change Risk Assessment (2017).

Source E is a table showing the estimated costs of coastal engineering options at the estuary in 1996.

Source F is a graph showing the change in value of £100 between 1996 and 2020 when adjusted for inflation.

Source G is a table showing the advantages and disadvantages of coastal engineering approaches used to manage coastal erosion.

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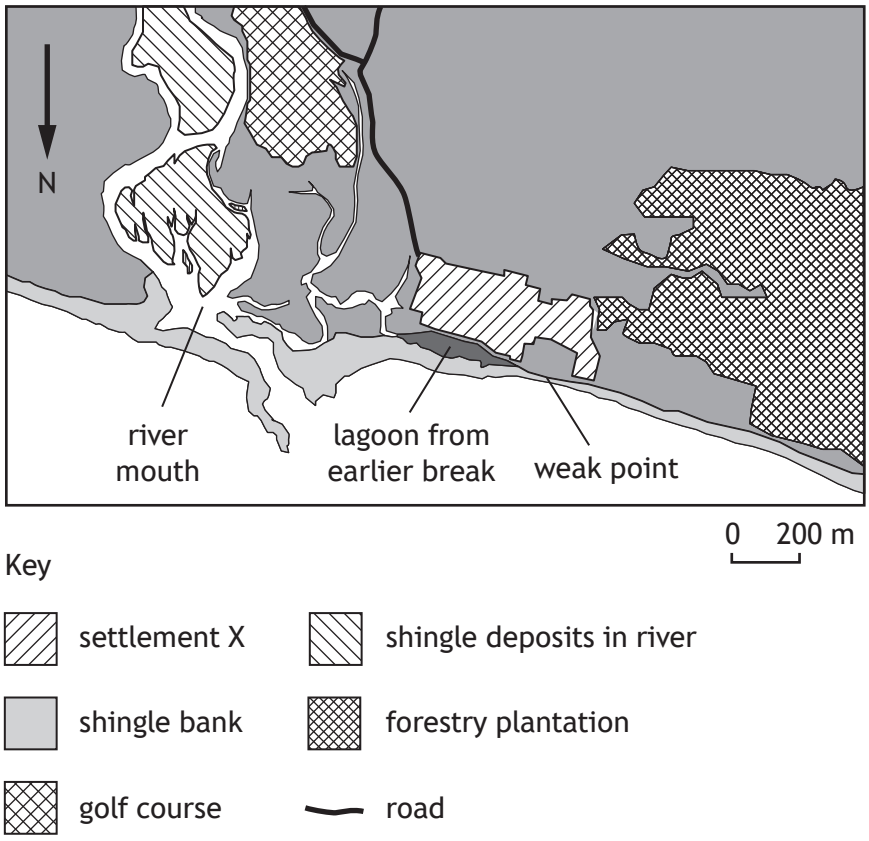
Source A Sketch map showing the shingle banks and location of Settlement X



Source B Image showing forestry plantation on inland shingle banks, including gorse encroachment

Source C SSSI designations in the area and reasons for their designation

Designation	Feature	Species
Estuary SSSI and river SSSI	• coastal geomorphology • river morphology • saltmarsh • shingle • wet woodland	• plant communities • Atlantic salmon, sea lamprey, freshwater pearl mussel, otter • butterflies — small blue, dingy skipper

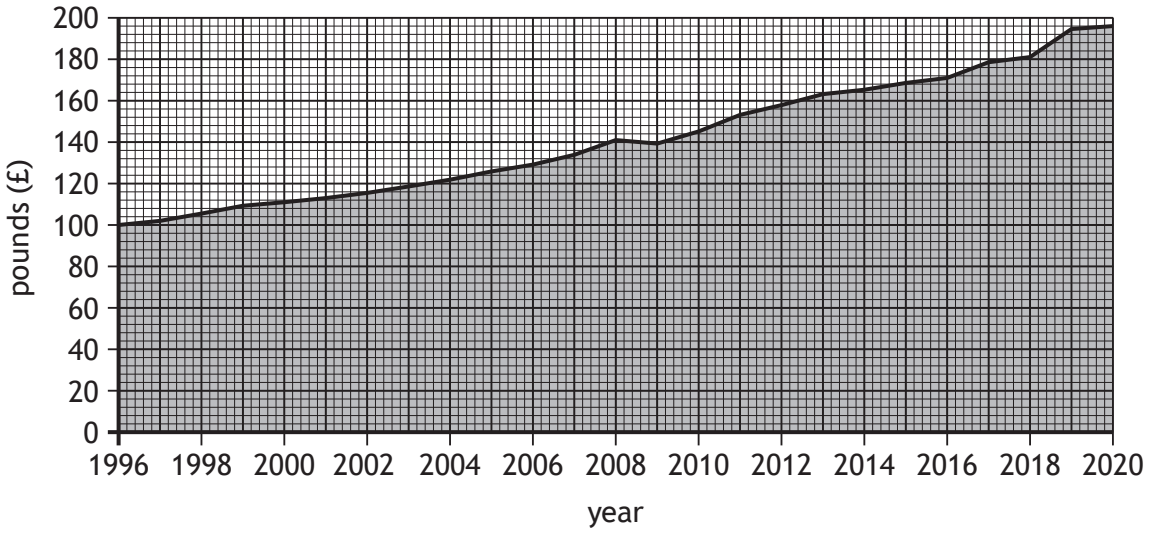
Source D Particular risks to Scotland identified in the UK Climate Change Risk Assessment (2017)

- Species and habitats, from the changing climate
- Soils and natural carbon stores
- People, communities, and buildings, from flooding
- Coastal areas, from sea level rise combined with extreme weather events
- Marine species, from ocean changes
- Health and wellbeing

Source E Estimated costs of coastal engineering options at the estuary in 1996

Offshore breakwater	Rock armour	Rock groynes	Beach nourishment (over 50 years)	Emergency work (over 50 years)
£1·85 million	£6·84 million	£1·94 million	£3·59 million	£776,554

Source F Change in value of £100 between 1996 and 2020 when adjusted for inflation



Source G Advantages and disadvantages of coastal engineering approaches used to manage coastal erosion

	Approach	Advantages	Disadvantages
Hard engineering	Breakwater — placed 200 m offshore, near weak point	• one-off construction • minimal maintenance once in place • will trap shingle coming downriver • will break the waves and absorb their energy • habitat potential for marine species eg lobsters, mussels	• requires seabed survey and modelling • lengthy planning and construction processes • below-water construction, with disturbance of sea bed • may act as barrier to anadromous species
	Rock armour — large boulders placed in front of shorefront shingle banks	• easy to maintain • will break the waves and absorb their energy	• financial and environmental impacts of transporting rock • visual impact if imported rocks differ from local geology
	Rock groynes — mesh cages containing rocks, placed at right angles to the coast	• will trap shingle carried along the shore by coastal currents	• minimum height of 6·5 m needed, plus extensive below ground engineering • visual impact • reduces localised erosion but enhances it further along coast • disruption of coastal processes and disturbance of species could threaten SSSI status
Soft engineering	Beach nourishment — local shingle deposits are moved back into place, or replacement of lost shingle	• not visually intrusive if the same materials are used • allows natural geomorphological processes to continue	• impacts of transporting shingle • disturbance of shingle and species could impact SSSI status • requires constant monitoring and maintenance
	Managed retreat — allowing waves to break through shingle and flood the land behind	• encourages development of saltmarsh behind the shingle bank, which breaks waves and absorbs their energy	• only used if land behind is of low value • potential loss of Settlement X • seawater incursion could affect groundwater quality
	Emergency work only		• would require planning to provide short-notice to Settlement X residents. • could not be scheduled to protect anadromous species or nesting birds

[END OF SUPPLEMENTARY SOURCE BOOKLET]