

Coastal Erosion and Flooding Management

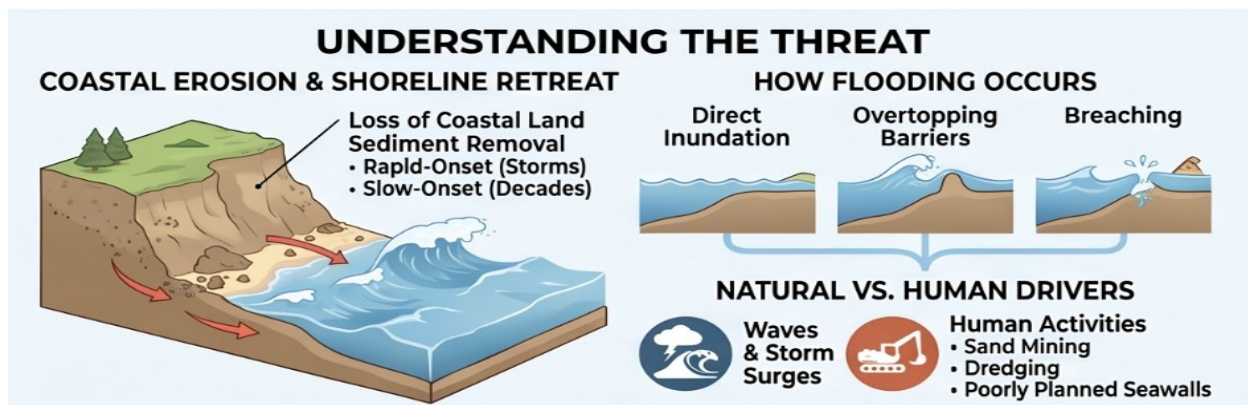
How shorelines change, why people are at risk, and what protection can be achieved

TWO CONNECTED HAZARDS

Erosion is the removal and transport of coastal material, causing a beach or cliff to retreat. Flooding is the temporary covering of normally dry land by seawater. A storm can cause both: waves erode beaches and cliffs, while surge and high tide raise water levels and allow waves to overtop low ground.

Why do coastlines erode?

Waves attack rock through hydraulic action (pressure in cracks) and abrasion (sediment striking the cliff). Weathering weakens rock above the shore; rainwater can saturate soft cliffs, triggering landslides. On beaches, longshore drift moves sediment along the coast. Erosion dominates when waves remove more material than rivers, currents and calmer waves replace. Storms, reduced sediment supply, sea-level rise and building too close to the shore can increase risk.



How does coastal flooding happen?

Low-lying coasts are exposed when high tide coincides with storm surge, powerful waves or heavy rain that cannot drain to the sea. Seawater may overtop a sea wall or cross a beach and dune ridge. Flooding can damage homes, roads and freshwater supplies; repeated erosion may also remove the natural beach or dune buffer that once reduced wave energy.

MANAGEMENT BEGINS WITH A CHOICE

Protect a valuable frontage in place; work with natural sediment and habitats; or make space for the shoreline to move. The best option depends on wave energy, geology, sediment movement, land use, cost, ecosystems and the people affected.

Hold the line engineered protection

Sea walls, rock armour and revetments absorb or reflect wave energy at the shoreline. Embankments and flood walls reduce overtopping; tidal gates or movable barriers can close during extreme water levels. Groynes interrupt longshore drift to retain beach sediment. These structures can quickly protect dense settlements, but are expensive to build and maintain. Reflected waves may scour the beach, while groynes may reduce the sediment reaching downdrift areas.

EROSION FOCUS

A wide beach or rock armour lowers the wave energy reaching a cliff or building.

FLOOD FOCUS

Raised barriers, dunes and space for stormwater reduce how far seawater travels inland.

IB GEOGRAPHY • MANAGEMENT CHOICES

Working With Coastal Change

Strategies beyond a fixed sea wall, including cliff line stabilisation and managed retreat

Build and maintain natural buffers

Beach nourishment adds sand or shingle to replace losses and widen the beach, so waves break and lose energy before reaching the backshore. Dune restoration uses fencing, boardwalks and native grasses to trap and bind sand. Saltmarshes and mangroves can slow waves and hold sediment in suitable sheltered settings. These approaches maintain habitats and amenity, but need space, a suitable sediment supply and monitoring; nourishment may have to be repeated after storms.

CLIFF LINE STABILISATION

A cliff may fail because waves undercut its base and because water weakens the slope above. Engineers may combine toe protection with drains that lower groundwater, regrading to a gentler angle, vegetation that holds surface material, or local rock bolts and mesh. The aim is to slow slope movement and protect assets at the cliff top; it does not make a dynamic cliff permanently stable.

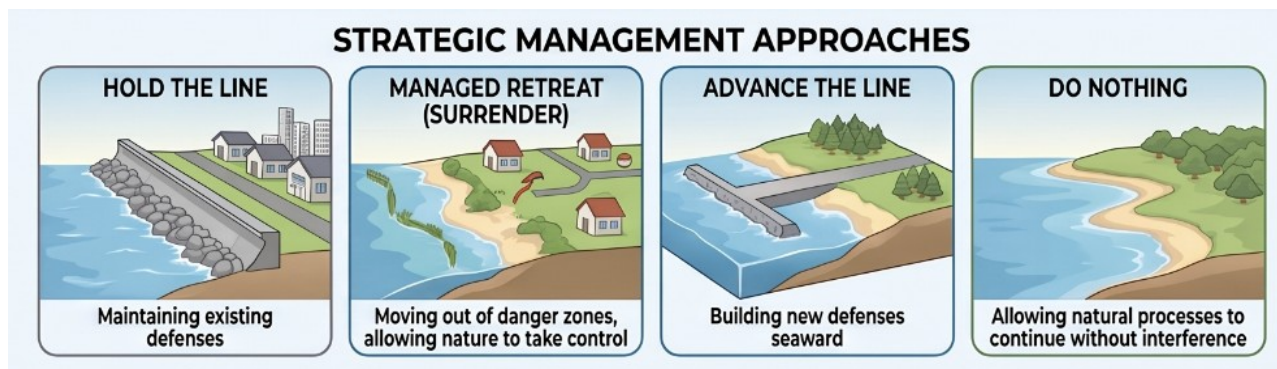
The method must match the cliff. Drainage and regrading can help soft, wet slopes, while bolts and mesh address local rockfall in fractured rock. Toe protection alone cannot prevent a groundwater-driven landslide. Stabilisation may be costly, alter natural scenery and reduce the sediment that eroding cliffs once supplied to nearby beaches.

Managed retreat and managed realignment

Managed retreat means planning a move away from land that cannot be safely or affordably defended over the long term. This may include restricting new building, buying or relocating homes and infrastructure, or moving a road inland. Managed realignment is a related shoreline policy: a defence may be set farther inland, allowing selected low land to flood and develop mudflat or salt marsh while a new line protects land behind it.

WHY CHOOSE RETREAT?

It can lower future exposure, create space for natural habitats and avoid repeated repairs to a defence that sea-level rise or erosion will outpace. It is socially difficult: households may lose homes, farmland, familiar places or livelihoods. Fair consultation, compensation and a clear timetable matter as much as the engineering.



Evaluate the whole coastline

No strategy eliminates risk. A sea wall may protect one town yet worsen sediment shortage farther along the coast; a restored dune may recover after a storm but still be breached; retreat may reduce long-term risk while imposing immediate costs on residents. Geographers compare short- and long-term effectiveness, cost, environmental effects and equity across the entire sediment cell, then adapt the plan as conditions change.