

# The True Cost of Coastal Erosion to the UK

*Our land and homes are not the only things set to be lost to the sea in the coming years*



Today, coastal erosion stands as the biggest threat to coastlines all around the world, including the UK.

For years, it has been described as a silent force, quietly reshaping the contours of the country. The four seas that surround the UK have, quite literally, been chipping away at our cliffs, terrains, and coasts. Land that was here as little as 50 years ago is gone and the painful reality is that more will follow, with [data showing sea levels are expected to rise by a further metre](#) over the next 100 years.

The news bulletins you have seen in recent history will tell the story of a homeowner whose house sits perilously close to the edge of a cliff, or of cliff faces crumbling into the sea, or of the land that has now been claimed by the water.

But the data and numbers paint a damning picture of the future. While we're going to explore this in far more detail, here are just some important facts to consider:

- 1.35 million properties are at potential risk from inundation by 2100

- 1,600km of major roads...
- 650km of railway line...
- 92 railway stations, and...
- 55 historic landfill sites

As the [Committee on Climate Change](#) have pointed out, the UK will almost certainly have to adapt to at least one metre of sea-level rise at some point in the future. Even a 0.5-metre rise in the sea levels is projected to make a further 20% of England's coastal defences vulnerable to failure.

The Government has committed a record £5.2 billion to help protect those locations most vulnerable to the threat of coastal erosion, topping up the £2.6 billion already spent.

However, it's just not going to be enough.

Commenting on the growing coastal erosion threat, Lee Sleight, Managing Director of [Aggregates Division](#) at [Aggregates Industries](#), said: "In the face of the relentless and escalating threat of coastal erosion, we stand at a critical juncture where the silent force of the seas is reshaping the very fabric of our nation.

"The disheartening reality is that land, present merely 50 years ago, has vanished, and the forecasted rise in sea levels by a metre over the next century paints a dire picture.

"While the government's commendable commitment of £5.2 billion aims to protect vulnerable locations, the enormity of the challenge demands more. As we confront this unprecedented crisis, our collective responsibility is not merely to adapt but to innovate, fortify, and safeguard the resilience of our coastlines for generations to come."

Now, we're going to delve into this more. We're going to explore this threat on a microscopic level, consider the geological and geomorphological factors, the human and economic impact, strategies for the future, and the current state of regulatory frameworks and give our take on whether there is a situation that can be managed.

In 2019, it was estimated that the [coastal erosion was going to cost the UK economy £12 billion](#). As a result of this research and this report, we put it far higher.

## Coastal Vulnerability Assessment: what are they and why are they important

Coastal Vulnerability Assessments (CVA) are essential for understanding and managing the risks associated with coastal erosion and sea-level rise, particularly in regions like the UK where diverse geological formations and historical erosion trends

present unique challenges. They incorporate a range of methodologies to assess the susceptibility of coastlines to various natural and human-induced factors, including:

- Geological
- Geomorphological
- Sociodemographic
- Economic

We explore all four of these factors in more detail as it is really important to understand the varying and complex challenges the UK are facing:

## 1. Geological factors

The geological makeup of a coastline is a primary factor in determining its susceptibility to erosion and other coastal processes:

- **Rock composition** - Coastlines composed of softer rocks, such as clay or sand, are more prone to erosion due to their lower resistance to wave action. In contrast, coastlines with harder rocks like granite are more resilient. The rate at which different rock types erode can significantly influence the shape and stability of the coastline over time.
- **Sediment type** - The type of sediment that makes up beaches and dunes is crucial in determining a coastline's response to external forces. Fine-grained sediments, like silt and clay, may be easily eroded and transported by waves, whereas coarser examples like sand and gravel can offer more resistance. The composition of beach sediments also affects the beach profile and its ability to buffer wave energy.
- **Stratification and structure** - The layering and structural features of coastal rocks, such as fault lines or the angle of bedding planes, can also influence erosion patterns. Areas with certain structural weaknesses may be more susceptible to processes like rock falls or landslides.

## 2. Geomorphological factors

The physical shape and features of the coastline play a significant role in how it interacts with marine processes.

- **Coastline slope and elevation** - The slope and elevation of a coastline affect how waves interact with the shore. Steep coastlines might experience more intense wave action at their base, leading to undercutting and cliff collapse. In contrast, gently sloping coastlines might have wider beaches that can dissipate wave energy more effectively.

- **Coastline width** - The width of the coastline, especially the beach area, is important in determining its capacity to absorb wave energy. Wider beaches can act as effective buffers against wave action, reducing the impact on inland areas.
- **Natural barriers** - Features like dunes, reefs, or vegetated areas can serve as natural barriers against coastal erosion. Dunes, for example, not only provide a physical barrier to wave action but also can trap and stabilise sediments. Other underwater structures can reduce wave energy before it reaches the shore.
- **Coastal landforms** - Various landforms such as headlands, bays, and estuaries each respond differently to coastal processes. Headlands might experience more erosion due to wave refraction, while bays might accumulate sediment, forming beaches.
- **Longshore drift and sediment transport** - The movement of sediment along the coast by waves and currents (longshore drift) plays a crucial role in shaping the coastline. Changes in this sediment transport can lead to erosion in some areas and accretion in others.

### 3. Sociodemographic factors

Sociodemographic factors also play a crucial role in assessing coastal vulnerability, as they directly relate to the human element in these environments.

- **Population density** - High population density in coastal areas often indicates a greater number of people potentially affected by coastal erosion and flooding. Densely populated coastal regions may face more significant challenges in evacuation, disaster management, and post-event recovery.
- **Land use** - The way land is used along the coast, whether for residential, commercial, industrial, or recreational purposes, affects how vulnerable these areas are to coastal hazards. For instance, industrial areas might contain hazardous materials that pose additional risks in the event of flooding, while recreational areas like beaches might need specific protection due to their economic and cultural value.
- **Infrastructure** - The presence and type of infrastructure near the coast, such as roads, bridges, hospitals, and schools, are vital considerations. The loss or damage of such infrastructure can have far-reaching impacts on community resilience, access to essential services, and overall recovery efforts after a coastal hazard event.

## 4. Economic factors

Economic factors are integral to CVAs as they quantify the potential financial impact of coastal erosion and sea-level rise. These factors include:

- **Economic value of coastal areas** - This encompasses the monetary worth of properties, businesses, and services located in coastal zones. These areas often house significant commercial and residential properties whose damage or loss can lead to substantial economic setbacks.
- **Tourism and recreation** - Many coastal areas are prime locations for tourism and recreation, contributing significantly to local and national economies. The degradation of these areas due to erosion or flooding can result in a decline in tourism, affecting livelihoods and business revenues.
- **Agriculture and fisheries** - In some regions, coastal zones are crucial for agriculture and fisheries. Erosion and salinization of agricultural land due to sea-level rise can impact food production and livelihoods. Around 550 hectares of higher-quality agricultural land is projected to be at risk from coastal erosion by 2100. Similarly, changes in coastal ecosystems can affect fish populations and, consequently, the fishing industry.
- **Potential financial loss** - This factor assesses the direct and indirect costs associated with coastal erosion and sea-level rise. Direct costs include the repair and replacement of damaged properties and infrastructure, while indirect costs might involve loss of income, a decrease in property values, and increased insurance premiums. The [number of residential properties at risk from coastal erosion in England](#) is estimated to increase from approximately 270 between 2010 and 2030 to between approximately 1,980 and 4,150 by 2110.
- **Cost of adaptation and mitigation** - Understanding the economic implications of implementing coastal defence measures, such as sea walls, groynes, or managed retreat, is also crucial. These costs need to be weighed against the potential damages avoided by such interventions.

### Historical erosion rates and trends

Now, we also must understand the historical changes in the UK's battle against coastal erosion. Understanding the past behaviour of a coastline is vital in predicting its future changes. Historical erosion rates provide insights into how quickly a coastline has been changing.

The Holderness Coast, for instance, has one of the highest erosion rates in Europe, losing an average of two metres annually (see case study below). This trend is

indicative of the broader historical patterns observed across the UK's coastline, where certain areas have witnessed significant land loss over the years.

The increasing frequency of storm events and rising sea levels, driven by climate change, are expected to further accelerate these erosion rates.

## Influence of climate change and sea-level rise

Climate change significantly impacts coastal erosion in the UK. [It is estimated that approximately 58% of coastal erosion](#), sea level rise, and storm surges can be attributed to climate change.

Predictions of sea-level rise, potentially reaching up to one metre by 2100, pose a significant threat to the UK's coastline. This rise in sea level is expected to exacerbate coastal erosion, increasing the frequency and severity of coastal flooding and leading to more pronounced changes in the coastal landscape.

## Case Study: The Holderness Coast

The Holderness Coast stretches 61 kilometres, from Flamborough Head in the north to Spurn Point in the south, along the north-east coastline of the UK. With an [average erosion rate of 2 metres per year](#), it is classified as Europe's fastest-eroding coastline. This rate of erosion has led to the loss of approximately 5 kilometres of land since Roman times, including 29 towns or villages.

The Holderness Coast illustrates the intricate interplay of geological factors, coastal defence strategies and the challenges faced in managing one of Europe's fastest-eroding coastlines. The varying approaches to coastal defence across different settlements along the coast demonstrate the need for a more balanced and comprehensive approach to coastal management.

### Geology and erosion

The geology of the Holderness Coast is divided into two main parts. The northern section, at Flamborough Head, is composed of chalk, a relatively harder sedimentary rock compared to the boulder clay that makes up the rest of the coastline further south. This difference in geological composition plays a significant role in the varying erosion rates along the coast.

### Fetch and longshore drift

One of the main factors affecting erosion at the Holderness Coast is wave energy, which is influenced by fetch - the distance over which the wind blows across the water. The longer the fetch, the more energy the waves carry when they hit the coast, contributing to higher rates of erosion.

## Defence strategies along the coast

Different settlements along the Holderness Coast have implemented various coastal defence strategies.

- **Bridlington** - As the largest settlement on the Holderness Coastline, Bridlington benefits from robust coastal defences, including a sea wall, promenade, and groynes. These structures effectively prevent erosion and safeguard the settlement. Additionally, Bridlington is protected by a 10-kilometre-long offshore sandbar, which provides natural protection from waves.
- **Hornsea** - Hornsea has chosen to 'hold the line' with groynes to trap sediment and a significant amount of infrastructure worth protecting. However, the end of these groynes marks an increase in erosion rates, impacting areas like caravan parks.
- **Mablethorpe** - This small settlement suffers from terminal groyne syndrome due to groynes stopping sediment movement south through longshore drift at Hornsea. Locals raised funds to install a rock groyne and rock armour, which provided temporary relief but led to increased erosion rates immediately afterwards.
- **Withernsea** - Withernsea has groynes coupled with rock armour and a sea wall. However, similar to Hornsea and Mablethorpe, the end of these defences leads to increased erosion rates.
- **Easington** - Easington, a small settlement in the far south of Holderness, has not been given any form of protection, leading to rapid land loss. In contrast, the nearby Easington Gas Terminal has been protected with rock armour.

The management strategies along the Holderness Coast have created a situation with clear winners and losers. While some areas like Bridlington and Hornsea are well-protected, others like Mablethorpe and Easington face increased erosion and land loss. The disparity in protection measures and the resulting impacts highlight the complex challenges in coastal management in the region.

## Further areas at-risk

### Holkham in Norfolk

In Holkham, located on the North Norfolk coast, erosion is a significant concern. The primary factors contributing to this erosion are the soft sandy composition of the beach and the dynamic tidal actions of the North Sea. [This erosion not only threatens the nesting sites of various bird species](#) but also impacts the local economy, which relies heavily on tourism drawn to the beach and nature reserve. The ongoing erosion

at Holkham represents a complex challenge, balancing the need for coastal protection with the preservation of natural habitats and the local economy.

### Tillingham Marshes in Essex

Part of the Essex estuarine system, this marshland is crucial for flood defence and supports a diverse range of wildlife. Its erosion is due to tidal actions and the inherent softness of the marshy land. This erosion poses a threat to the biodiversity of the area and weakens natural flood defences, increasing risks to inland regions. The erosion of Tillingham Marshes highlights the broader implications of coastal erosion on flood management and ecosystem health.

### Studland Bay in Dorset

Studland Bay, known for its sandy beaches and heathland, experiences erosion driven by natural wave action and human activities, leading to a reduction in beach area and impacting the local tourism industry. Additionally, the erosion of dunes in this area threatens the habitats of local wildlife, including rare bird species. The case of Studland Bay underscores the need for sustainable coastal management practices that balance environmental conservation with economic interests.

### Dungeness in Kent

The movement of shingle by waves and wind is the primary cause of erosion in this unique landscape. It not only impacts the rare plant species and bird habitats in the area but also poses risks to local infrastructure, including roads and properties. The erosion at Dungeness is a prime example of the challenges faced in managing unique coastal landscapes, requiring tailored approaches to protect both the natural environment and human interests.

## Case study: Minehead Emergency Sea Defence Project

The brief:

Aggregate Industries returned to one of Somerset's beaches to provide an emergency supply of 14,500 tonnes of [armourstone](#) to help boost its sea defences ahead of winter in a record six-week turnaround.

The challenge:

In response to the imminent threat posed by sea erosion to the sea wall near [Blue Anchor beach](#), an emergency project led by the [Environment Agency](#) was initiated to carry out vital repairs.

The goal was to safeguard the existing sea wall and protect up to 800 nearby properties from potential flooding. Building on the success of a previous £3.8 million scheme completed in September 2023, where Aggregate Industries supplied



armourstone for the protection of the B3191 road, the Environment Agency enlisted [Kier](#) as the main contractor. Once again, Aggregate Industries played a crucial role by supplying 13,500 tonnes of armourstone, sourced directly from the Glensanda super quarry in Scotland, and implementing an innovative water-based transportation approach to meet tight schedules and minimize environmental impact.

The result:

Nick Gilbert, Business Development Manager at Aggregate Industries, said:

“This was no mean feat, requiring us to effectively deliver on a job that would usually take a six-month lead time in just six weeks. However, through our dynamic experience in this area, along with our unique capabilities, such as having our own sea barge and a vast amount of ‘rock on stock’, we were able to pull it off.

Read the full case study [here](#).

## Analysing the Human and Economic Impact

Coastal erosion has far-reaching consequences, affecting not only the physical landscape but also the socio-economic fabric of coastal communities.

Beyond environmental degradation, it leads to hesitancy in investing in infrastructure, private residences and businesses in areas identified as vulnerable.

This lack of investment, in turn, triggers a cascade of negative outcomes: a reduction in amenity value, an increase in antisocial behaviour, a decline in property values and the gradual deterioration of community cohesion and morale.

Looking at the various dimensions of coastal erosion in the UK, from its impact on communities and economics to its effects on property, tourism, infrastructure and historic sites, it becomes evident that this is a challenge that demands immediate attention and action.

### Communities

Coastal erosion in the UK significantly impacts local communities, both economically and socially. The economic ramifications are substantial, as coastal erosion leads to property loss and damage, affecting industries ranging from shipping to tourism.

Britain's coastal communities face a range of challenges as a result of coastal erosion. This is on top of other unrelated challenges, with a study commissioned by the [Coastal Communities Alliance](#) and other groups revealing that household income in coastal areas is nearly £3,000 per year lower than in non-coastal communities, with a higher proportion of jobs below the living wage, higher rates of child poverty, poorer health outcomes and lower educational achievements.

In the extreme, coastal erosion necessitates the relocation of homes inland, a process that is not only complex and costly, but which has a detrimental effect on community wellbeing. Living in a property on the eroding coastline has a significant detrimental impact on residents' mental health due to the stress and uncertainty of the remaining lifespan of their property and the financial burden of losing their homes. In some cases, homeowners may face the financial burden of demolishing their homes while still paying mortgages.

In a report run by [Context](#), Hemsby-based resident, Kevin Jordan, spoke openly about the impact the coastal erosion crisis was having on his well-being.

He moved to Hemsby in his mid-50s, under the assurance that it would be at least 100 years before the sea swallowed his home. He said: "I thought, well, that will just about see me," the retiree, now 70, said.

However, when Jordan purchased his home, a tall sand dune blocked his view of the North Sea and the shoreline was about 91 metres (300 feet) away. Now, the cliff edge is roughly 21 metres (70 feet) from his front door and the sand dune has been washed away. The pace of that change has taken Hemsby residents by surprise. What experts told Jordan would take a century is close to happening in 14 years.

"I came here as a bit of escape, and with no financial worries," said Jordan. Now, the home he bought for £85,000 is "essentially worthless", he said, admitting he loses sleep worrying about the future.

The need for investment to assist these communities in adapting to coastal erosion is urgent, as leaving them to face crisis and despair is both unsustainable and unfair. However, local authorities face significant challenges in managing the impacts of an eroding coast. They lack clear strategies to support those with properties at risk and are constrained by limited funding, coastal adaptation is not yet a recognised policy option in government strategies.

## Economics

The economic impact of coastal erosion in the UK is significant and far-reaching, with substantial implications for both property and the broader economy.

Further exacerbating the situation, the Global Futures initiative, a partnership between WWF, the Global Trade Analysis Project and the Natural Capital Project, has found that coastal damages alone could drive a £12 billion loss to the UK economy.

That estimated loss is largely attributed to the degradation of natural coastal defences such as salt marshes and seagrass beds, of which the UK has already lost significant portions in the last century. The economic impact is equivalent to more than the UK Government's annual spending on police, fire services and law courts.

The findings of the Global Futures initiative underscore the urgent need for policies and investments focused on halting contributions to climate change, stopping deforestation and restoring natural coastal defences. The potential economic losses highlight the critical importance of addressing the climate and nature crisis, not only to protect the environment but also to safeguard the economic stability and well-being of communities across the UK.

## Property

The [Committee on Climate Change](#) has estimated that around 9,000 properties in England will be lost to coastal erosion by 2025, while in Scotland, more than 93,000 residential and commercial properties are at risk of coastal flooding and erosion.

A new map of England's coastline, developed by [One Home](#), suggests that by 2100, residential properties worth approximately £584 million will be lost to coastal erosion. This map, based on existing Environment Agency data and Shoreline Management Plans, highlights the areas where no new sea defences will be built, leading to inevitable property losses. The most affected areas include villages in North Norfolk, where over 400 properties, valued at over £100 million, are estimated to be lost.

Due to climate change, these numbers are expected to increase significantly, with some projections suggesting a potential tripling of properties at risk in the coming decades. Despite this, construction in high-risk areas persists. In 2005, around 117,000 buildings in England were at medium to high risk from coastal changes. By 2014, this number had increased to 129,000.

Let's look away from property for a moment and consider the number of people impacted by that 129,000 figure. The latest UK data shows that there are, on average, 2.4 people per household across the UK, meaning 309,600 alone face an immediate future living in a property that is located in a medium to high-risk area.

Returning to the village of Hemsby on the Norfolk coast, it has been facing the relentless threat of the sea for over a decade, with the situation worsening as coastal erosion intensifies. Recently, the pace of erosion has accelerated alarmingly, leading to the loss of numerous homes. [In March 2023 alone, three homes were lost to the sea.](#) Presently, 35 homes in Hemsby are in imminent danger due to coastal erosion, and projections indicate that this number could escalate to 90 in the foreseeable future.

Despite the evident risks, the housing market in Hemsby remains active, with estate agents selling properties with the assurance that buyers will have approximately 15 years before their homes are at risk of being claimed by the sea.

This situation mirrors the experience of Happisburgh, another Norfolk town grappling with similar risks. In Happisburgh, individuals who bought properties in 2001 were initially assured of secure tenure for 150 years. However, this estimate was

dramatically revised just six years later, with surveyors predicting only 25 years of safety.

The current residents of Happisburgh now believe that they have less than a decade before coastal erosion inevitably claims their properties. This pattern of rapidly changing forecasts and the increasing threat of coastal erosion highlight the urgent need for effective measures to address the displacement of people in these vulnerable coastal areas.

## Leisure and Tourism

Tourism, a vital industry for many coastal areas, suffers as tourists are less likely to return to areas experiencing continued beach erosion. Coastal erosion has already had an impact on key tourist attractions, such as the [Giant's Causeway](#) and Jurassic Coast, leading to the loss of land crucial for tourism-related activities.

Among these key attractions is golf, which is a major contributor to the visitor economy. Many of the UK's golf courses, renowned for their historical and cultural significance, are situated along the coastline. Notably, several prestigious courses used in the Open Championship are 'links' courses, found in delicate dune ecosystems.

A case in point is the ancient Montrose course, which has seen the North Sea encroach by [70 metres in the past 30 years](#), endangering significant portions of the course. Beyond isolated incidents, it's the cumulative impact of these climate-related changes that poses a substantial threat to golf, a sport with 977,000 participants in the UK and an economic contribution of approximately £4 billion.

## Infrastructure

A large amount of vital transport and utilities infrastructure is at risk of being lost to erosion over the next century. The British Geological Survey calculates that 1,600 kilometres of major roads, 650 kilometres of railway line, 92 railway stations and 55 historic landfill sites are at risk of coastal flooding or erosion by 2100.

Coastal erosion poses a significant threat to rail infrastructure in the UK. [The collapse of the railway line at Dawlish](#) in 2014 is a well-known example, but it's not the only vulnerable stretch. The coastal railway line from Carlisle to Barrow-in-Furness, one of Britain's most scenic routes, is also at high risk due to its proximity to the sea and cliffs, making it susceptible to the destructive power of the sea and rock falls.

A lot of the long-term problems associated with erosion are down to the fact that Victorian railway companies often built lines along the coast due to the flat terrain and cheap land. Other vulnerable stretches of coastal railway around Britain include the Cambrian Line in West Wales, the mainline along the North Wales coast from Chester to Holyhead, and the line from Folkestone to Dover.

The impact of climate change, including increased extreme weather events and rising sea levels, exacerbates the problem, making it a growing concern for the future of these key routes. Through a combination of hard engineering and, possibly, the rerouting of lines inland, it may be possible to preserve these vital transport links.

## Heritage sites

Coastal erosion in the UK presents a formidable challenge to the preservation of its historical sites. English Heritage, a prominent organisation dedicated to the conservation of historical sites, has raised alarms about the escalating threat of coastal erosion. They have identified six castles, including the iconic Tintagel Castle in Cornwall and Piel Castle in Cumbria, as being at significant risk due to their vulnerable locations and the fragile geological structures upon which they rest. This situation is exacerbated by predictions of sea levels rising by up to a metre before the end of the century.

The urgency of this situation is echoed in the [Celebrating Our Distinctive Heritage report from Historic England](#), which notes the disappearance of over 30 villages dating back to Roman times, illustrating the tangible loss of historical heritage to the sea.

In Scotland, the University of St Andrews' [Scotland's Coastal Heritage at Risk Project](#) is tackling similar challenges. This initiative builds upon previous Coastal Zone Assessment Surveys and actively involves local communities in monitoring and reporting changes, using modern tools like mobile apps and web-based forms for reporting and data collection.

The situation calls for a concerted effort to manage the risks to coastal heritage and communities, ensuring they are preserved for future generations. However, the challenge is not only in protecting these sites but also in adapting to the changing landscape, where some losses are inevitable, but much can still be saved and celebrated.

Rather than perceiving the unavoidable loss of some coastal and marine heritage as a defeat, it can be reframed as a unique chance to uncover aspects of history that would otherwise remain hidden. Coastal erosion has led to numerous significant archaeological findings. A notable instance is the discovery of Mesolithic communities in the Western Isles of Scotland, which was first archaeologically confirmed in 2001, thanks to the accidental exposure of deep deposits caused by coastal erosion.

## Case study: Rip Rap Rock Armour Used to Re-enforce River Bend in Cumbria

The brief:

Aggregate Industries [Rip Rap](#) rock armour, was selected to rebuild and re-enforce a bend in the river at Methop near Grange-over-Sand in Cumbria. In 2018 the

Environment Agency asked Aggregate Industries for a solution to stabilise a failing river embankment. The location of the embankment was a mile off a public highway, down a single-track farm access road.

The challenge:

Aggregate Industries proposed the use of 300-500mm Rip Rap rock armour due to its excellent durability and environmental benefits. The Environment Agency were happy with this solution and installed a mesh to the reinstated bend to deter wildlife from burrowing in and weakening it in the future. Aggregate Industries were then tasked with depositing the Rip Rap over the mesh.

All transportation needed to be carefully coordinated. Aggregate Industries had to ensure that no two steel body tipper vehicles were on site at the same time delivering the Rip Rap material.

By the end of 2018, Aggregate Industries had delivered over 1,000 tonnes of material to the site. With occasional monitoring and maintenance, Rip Rap will last for generations.

Read the full case study [here](#).

## Erosion Mitigation and Adaptation Strategies

The UK's approach to managing coastal erosion involves a combination of mitigation and adaptation strategies. These strategies range from hard engineering solutions to softer, more sustainable approaches, each tailored to the specific needs of the affected areas.

### Hard engineering solutions

- **Beach nourishment** - Beach nourishment involves adding large quantities of sand or gravel to eroding beaches. This method replenishes beach material lost to erosion, acting as a buffer against wave action. While effective in the short term, it requires regular maintenance and replenishment, making it a costly option over time. The ongoing loss of beaches and coastal habitats due to sea level rise and sediment disruption highlights the importance of this method.
- **Seawalls, revetments, groynes and breakwaters** - These structures are designed to absorb or deflect wave energy, protecting the coastline behind them. Seawalls and revetments provide a barrier against wave action, while groynes and breakwaters interrupt wave patterns and reduce erosion. Each of these structures has its specific applications and considerations, including environmental impact and long-term maintenance requirements. The necessity for such structures is emphasised by the fact that nearly [9% of the best-quality](#)

[agricultural land in the UK is at high risk of coastal flooding.](#)

- **Relocation of buildings and infrastructure** - In areas where erosion poses a significant threat, the strategic relocation of buildings and infrastructure away from vulnerable areas is considered. This approach, often referred to as 'managed retreat,' is seen as a sustainable long-term solution to the challenges posed by an eroding coastline. It involves careful planning and community engagement to ensure minimal disruption and effective use of land resources. This strategy becomes increasingly relevant as projections indicate that the number of residential properties at risk from coastal erosion could increase to between 1,980 and 4,150 by 2110.

#### Soft engineering and natural solutions

- **Planting native vegetation and dune construction** - Stabilising the soil and sand through the planting of native vegetation and the construction of dunes provides a natural barrier against erosion. This approach not only helps in reducing erosion but also enhances the ecological value of the coastal area, supporting biodiversity and providing habitats for wildlife. The importance of this method is underscored by the threats to natural coastal habitats from coastal squeeze and sea level rise.
- **Breakwater islands** - Constructed offshore, breakwater islands reduce the intensity of wave action reaching the shore. These structures can be effective in protecting coastlines, especially in combination with other erosion control measures. They also create new habitats for marine life, contributing to the ecological diversity of the area. Their role is highlighted by the risks to major industry and infrastructure, with approximately 1,600 kilometres of major roads and 650 kilometres of railway at risk from coastal erosion and flooding.
- **Coastal monitoring and early warning systems** - Advanced monitoring systems are crucial for tracking erosion patterns and providing early warnings for at-risk areas. These systems enable proactive management and timely responses to erosion events, minimising damage and ensuring public safety. The significance of these systems is evident considering the steepening occurring at 61% of coastal locations in England and Wales.
- **Protection and restoration of wetlands** - Wetlands serve as natural buffers against coastal erosion. Their protection and restoration are key components of a holistic approach to coastal management, providing both ecological and erosion control benefits. Wetlands absorb wave energy, reduce the impact of storm surges, and support a wide range of biodiversity.

# Reviewing the Legal and Regulatory Framework

The United Kingdom has established a comprehensive legal and regulatory framework to manage and mitigate the impacts of coastal erosion. This framework is underpinned by various acts, policies and strategies that collectively aim to address the challenges posed by coastal erosion and related environmental concerns.

Effective land-use planning is essential for managing development along the coast. Regulations help ensure that new developments are not placed in high-risk areas and that existing structures are protected or relocated as necessary. This approach is vital for sustainable coastal development, reducing the risk of property damage and loss of life.

## The Coast Protection Act, 1949

[The Coast Protection Act 1949](#), stands as a pivotal piece of legislation in the UK, addressing coastal erosion and encroachment by the sea. This Act forms the backbone of the country's coastal management strategies. It includes the following key provisions:

- **Designation of coast protection authorities** - Councils of maritime districts are assigned as coast protection authorities, tasked with safeguarding land in their areas from coastal erosion. These authorities have the mandate to undertake necessary coast protection work.
- **Formation of coast protection boards**- In areas where it is essential for land protection, the Act allows for the creation of coast protection boards. Comprising representatives from various maritime districts and other relevant entities, these boards serve as coast protection authorities for their respective areas.
- **Empowerment for coastal protection work** - Coastal erosion risk management authorities are empowered to execute coast protection work as needed. This includes the authority to initiate projects both within their jurisdiction and in external areas for land protection.
- **Collaborative and integrated approach** - A collaborative approach is encouraged, involving representatives from local councils, harbour authorities and other relevant organisations in coast protection boards, ensuring a comprehensive approach to coastal protection.
- **Regulatory framework for protection work** - The Act establishes a regulatory framework for conducting coast protection work, ensuring controlled and effective management of such activities. It also details the procedures for



setting up and operating coast protection boards.

- **Adaptability in application** - Flexibility is a key feature of the Act, allowing authorities to tailor their strategies and actions to the specific needs of their coastal areas.

### Significance of the Act

It provides the legal underpinning for local authorities and other bodies to effectively manage and mitigate risks associated with coastal erosion and sea encroachment. The Act's focus on collaborative and integrated management is essential in tackling the complexities of coastal environments.

## The Flood and Coastal Erosion Risk Management Strategy

Developed and maintained by the Environment Agency, the [National Flood and Coastal Erosion Risk Management \(FCERM\) Strategy for England](#) outlines the vision and actions required to prepare for and adapt to flooding and coastal change up to the year 2100.

The strategy emphasises the need for sustainable management of flood and coastal erosion risks, promoting actions that align with environmental enhancement and long-term resilience.

### 1. Importance of robust policies

The FCERM Strategy highlights the critical role of robust policies in mitigating the impact of coastal erosion. It underscores the necessity for risk management authorities to consider the strategy in their activities, ensuring a coordinated and effective response to coastal erosion challenges. The strategy's adoption reflects the government's commitment to proactive and adaptive management of coastal erosion, recognising the dynamic nature of coastal environments and the need for flexible, forward-looking approaches.

### 2. Emphasis on collaborative and integrated approaches

The strategy also places significant emphasis on collaborative and integrated approaches, involving local communities, stakeholders, and various levels of government. This collaborative framework is essential for addressing the complex and multifaceted nature of coastal erosion, ensuring that solutions are locally relevant, environmentally sustainable, and economically viable.

### 3. Future directions and adaptation measures

Looking ahead, the FCERM Strategy sets out a roadmap which outlines a series of practical actions and objectives to be achieved by 2026, contributing to the long-term

vision of creating a nation resilient to flooding and coastal change by 2100. Its key elements include:

- **Protection and preparation** - The roadmap focuses on better protecting and preparing communities from flooding and coastal change, supporting the delivery of the Flood and Coastal Erosion Risk Management Investment Programme.
- **Innovative projects** - It aims to pioneer innovative methods to boost flood and coastal resilience, making a significant difference in local communities.
- **Training and support** - The roadmap provides training, tools, and support to public authority practitioners to develop skills and capabilities for climate adaptation.
- **Information and evidence** - It ensures policymakers and practitioners have the necessary information about current and future risks from various types of flooding and coastal erosion to make well-targeted investments.
- **Wider priorities** - The strategy identifies ways in which flood and coastal investments can contribute to broader priorities like local nature recovery, carbon reductions, and integrated water solutions for flood and drought resilience.

#### 4. Ambitions and objectives

##### Climate-resilient places

The roadmap aims to work with partners to bolster resilience to flooding and coastal change, both now and in the face of climate change.

##### Resilient growth and infrastructure

It focuses on making the right investment and planning decisions to secure sustainable growth and infrastructure resilience to flooding and coastal change.

##### A nation ready to respond and adapt

The strategy ensures local people understand the risks posed by flooding and coastal change and are prepared to manage the impacts and take action.

##### Implementation and future directions

- The roadmap supports the implementation of the £5.2 billion Flood and Coastal Erosion Risk Management Investment Programme, which aims to protect

properties over the next six years.

- It incorporates the government's £200 million [Flood and Coastal Resilience Innovation Fund](#), funding three key programmes: the Flood and Coastal Resilience Innovation Programme, the Adaptive Pathways Programme, and the Coastal Transition Accelerators Programme.
- The strategy aligns with various government policies and initiatives, including the 25-Year Environment Plan and the Environmental Land Management Scheme.

## Coastal Change Management Areas

Coastal Change Management Areas (CCMAs) are identified as a crucial tool for coastal planning. They are integral to ensuring sustainable development and infrastructure planning in coastal areas, taking into account the long-term impacts of coastal processes and climate change.

### Purpose and implementation

#### Risk reduction

Local planning authorities are advised to reduce risk from coastal change by avoiding inappropriate development in vulnerable areas and not exacerbating the impacts of physical coastal changes.

#### Identification of CCMAs

Areas likely to be affected by physical coastal changes should be identified as CCMAs. In these areas, authorities should:

- Specify appropriate development types and circumstances
- Make provisions for relocating development and infrastructure away from CCMAs.

#### Establishment criteria

CCMAs are established in areas where the interplay between coastal change and development or infrastructure needs resolution. They are also considered for facilitating the rollback and relocation of land uses.

#### Shoreline change consideration

A CCMA should be defined where significant shoreline changes are expected over the next 100 years, considering climate change. They are not necessary in areas where

the [Shoreline Management Plan](#) (SMP) policy is to hold or advance the line, provided there is evidence of how this will be secured.

### Role of SMPs

SMPs, which assess risks associated with coastal processes, should be the primary evidence source in defining CCMAAs and informing land allocation within them.

## Conclusion

There's no questioning the fact that coastal erosion represents a significant environmental challenge. The UK's varied geological formations, coupled with historical erosion trends, make this threat both a unique and a pressing one.

The implications of coastal erosion are far-reaching, affecting geological stability, sociodemographic dynamics, economic stability, property values, leisure and tourism industries, infrastructure and heritage sites.

### Key points

- The varying geological makeup of the UK, including rock composition and sediment type, is a major influence on the rate and pattern of coastal erosion, directly impacting the stability and shape of the coastline.
- Population densities in coastal areas amplify the human impact of coastal erosion, affecting community resilience and necessitating effective disaster management strategies.
- The economic value of coastal areas, including their role in tourism, agriculture and fisheries, is at risk. The potential financial loss due to coastal erosion and sea-level rise is substantial, with a predicted increase in residential properties being in danger.
- Historical trends, such as the rapid erosion of the Holderness Coast, highlight the need to address coastal degradation without delay. Climate change exacerbates these trends, increasing the frequency and severity of coastal erosion and flooding.
- Coastal erosion leads to hesitancy in investing in vulnerable areas, affecting local economies, property values and community morale.

### A call to action

There is an urgent need for robust, adaptive policies that consider the long-term impacts of coastal erosion. Investment in sustainable coastal defence measures and support for affected communities is crucial.

Policymakers must prioritise the integration of coastal erosion risks into land-use planning and infrastructure development.

Local communities should be actively involved in coastal management strategies via awareness programmes and community-led initiatives that can foster resilience and adaptive capacity.

Industries, particularly those reliant on coastal resources, must adopt sustainable practices and contribute to coastal defence and restoration efforts. The tourism and estate agency sectors should particularly heed the risks and opportunities presented by coastal changes.

## The importance of sustainable solutions

Sustainable solutions are vital in combating coastal erosion. These include both hard engineering methods, like seawalls and groynes, and soft engineering approaches, such as beach nourishment and dune restoration. Emphasis should be on solutions that balance environmental conservation with economic and social needs.

## Future challenges and opportunities

The future of coastal management in the UK is laden with challenges. But the future also presents opportunities. The increasing threat of climate change necessitates innovative, flexible and integrated approaches to coastal management. Opportunities lie in advancing coastal science, developing new technologies for erosion control and fostering collaborative efforts between government, communities and industry.

In conclusion, the UK is at a critical point in its approach to coastal erosion. Immediate and concerted action, guided by sustainable principles and inclusive policies, is essential to safeguard coastlines, communities and economies. The challenge of coastal erosion, while daunting, also presents an opportunity to demonstrate global leadership in coastal management and environmental stewardship.

## How else Aggregate Industries can help

Here at [Aggregate Industries](#), we have an array of [Sea and Flood Defence](#) aggregate solutions that are well-suited to cater to the evolving requirements in a world where rising sea levels are an increasing concern.

In this section, we'll examine four primary products that are already making a significant impact around the UK:

### Sustainable Drainage Systems (SuDS)

SuDS, or [Sustainable Drainage Systems](#), presents an innovative and eco-conscious approach to managing surface water runoff in urban and rural areas. Departing from conventional systems that swiftly channel water away, SuDS prioritise sustainability by

replicating natural processes to reduce flooding, enhance water quality, and foster biodiversity. These systems incorporate various techniques like permeable surfaces, green roofs, swales, detention basins, and infiltration devices, allowing rainwater absorption or slowdown. SuDS not only mitigate flooding risks but also act as natural filters, removing pollutants and improving water quality before reaching water bodies, thereby demonstrating a commitment to sustainable, environmentally friendly drainage solutions.

## Hydromedia

[Hydromedia](#) is an advanced porous concrete solution designed to address urban water management challenges and promote sustainable development. Composed of a specialised mix of aggregates, cement, and water-permeable additives, Hydromedia facilitates rapid water drainage, reducing surface runoff and minimising the risk of flooding. Its porous nature allows rainwater to infiltrate the surface, replenishing groundwater and preventing the strain on traditional drainage systems. Beyond its functionality, Hydromedia also contributes to improved water quality by filtering out impurities as water permeates through the concrete.

## SuperDrain Asphalt

[SuperDrain Asphalt](#) stands as an innovative and sustainable solution which addresses crucial issues in water management and urban resilience. This specialised asphalt product is engineered with advanced permeability features, allowing it to efficiently manage surface water runoff in urban areas. Unlike traditional asphalt surfaces, SuperDrain facilitates rapid water infiltration, reducing the risk of flooding and minimising strain on conventional drainage systems. Its unique composition promotes groundwater recharge and helps maintain water quality by filtering impurities as water passes through the asphalt.

You can find out more about Aggregate Industries; solutions by [visiting here](#).

//ENDS//