

## C2 Scoping the environmental impacts of coastal defence, including beach nourishment

### Explanatory note

For projects which require Environmental Impact Assessment (EIA), a scoping exercise should be undertaken early in the planning stages of the project. This enables the project to be designed to avoid or minimise negative environmental impacts and provides an opportunity to incorporate positive environmental enhancements into the project. Early consultation with all interested parties, including the Environment Agency, is an essential part of scoping. Even if a project does not require EIA under EIA legislation, it may be advisable (and in some cases necessary) to undertake a scoping exercise in any case (e.g. to support applications for other relevant consents and authorisations needed to carry out the project).

This guidance note aims to promote a good practice approach to scoping as part of the EIA process which in some respects goes beyond the statutory EIA requirements. When scoping a project, developers, or their consultants, should satisfy themselves that they have addressed all the potential impacts and the concerns of all organisations and individuals with an interest in the project.

This guidance note provides information on the most likely potential environmental impacts of coastal defence projects. However, each project must be considered on a case-by-case basis as the detailed characteristics of the proposal and the site will determine the potential impacts.

This guidance is based on the main legal requirements on EIA stemming from the EC Directive and the UK Regulations. However, developers should seek independent legal advice to ensure that the proposed development is carried out in compliance with the requirements of this and any other relevant legislation relating to planning as well as to pollution control.

This guidance note must be read in conjunction with the *Scoping Handbook*, which provides general guidance on the EIA process and the scoping of projects.



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In addition, the following scoping guidance notes are relevant to *all* coastal protection projects:

- A1** Construction work
- A4** Vegetation management and conservation enhancements

The following scoping guidance notes *may* be relevant in certain circumstances:

- A3** Redevelopment and clean-up of contaminated land
- B3** Control of pest species, including disease vectors
- B4** Deliberate introduction of non-native and genetically modified species
- D1** Dredging of riverine and estuarine sediments

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# 1 Introduction

- 1.1 This guidance note, in conjunction with the *Scoping Handbook* and the notes listed on the previous page, seeks to help developers and other interested parties identify the potential impacts of coastal protection projects on the environment as a whole. It should be emphasised that the list of impacts is by no means exhaustive and that a full investigation into positive and negative impacts should be undertaken. Early consultation with the Environment Agency and other relevant organisations will enable the identification of environmental issues and constraints and the avoidance of sensitive areas, thus reducing the need for redesigning and mitigating avoidable impacts at a later stage.
- 1.2 Following this brief introduction, an overview of the legal requirements for EIA in relation to coastal defence works is provided. The potential environmental impacts of such projects are identified in Section 3. The text and summary table in this section will enable the reader to begin to identify the likely impacts arising from the particular proposal under consideration. The subsequent sections present the mitigation measures that may be relevant to coastal defence works, followed by key references and further reading.

## Background to development type

- 1.3 Coastal defence activities can require significant engineering operations, which may involve hard engineering solutions involving permanent coastal defence structures (e.g. sea walls) or soft engineering solutions (e.g. beach nourishment). Such projects provide protection to land and assets at risk from erosion or flooding by the sea. However, coastal defences can have damaging effects of their own in both the short and long term. Beach nourishment, for example, may require continual re-deposition of new beach material which can have negative impacts such as sedimentation elsewhere. A thorough scoping exercise and careful consideration of alternatives are, therefore, of prime importance.

## 2 Development control and EIA

### Development control

- 2.1 New coastal defence schemes are likely to require planning permission under the town and country planning regime, and as a result developers should contact their local planning authority to confirm whether or not their proposals require planning permission (or are subject to any other form of development control). They should also seek advice on the impact on their proposals of other planning-related legislation for example the Conservation (Natural Habitats & c.) Regulations 1994 (as amended), SI No. 94/2716.

### Environmental Impact Assessment

- 2.2 Coastal defence developments are subject to either Schedule 2 of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999 No. 293), or the Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 (SI 1999 No. 1783). The Regulations list applicable thresholds and criteria which apply to Schedule 1 and Schedule 2 developments. If the thresholds are not exceeded, then EIA is not required and so these thresholds and criteria are termed “exclusive criteria”. In cases where the thresholds are exceeded, Schedule 1 developments require an EIA (mandatory) but Schedule 2 developments only require an EIA if the development is likely to have significant effects on the environment by virtue of factors such as its nature, size or location. The exclusive criteria for Schedule 1 developments are taken from the EIA Directive, but those for Schedule 2 developments have been laid down in the UK Regulations, as provided for by the Directive. In addition to the specific criteria and thresholds set out in Schedule 2,

all developments listed in Schedule 2 may require an EIA if any part of the development is to be carried out in a sensitive area.

- 2.3 The former DETR has published guidance (referred to in the *Scoping Handbook*) which helps in the decision on whether, in respect of Schedule 2 projects, impacts are significant and whether EIA should be required. The guidance thus contains “indicative criteria”, although area sensitivity and project-specific issues must be taken into account and the decision is still discretionary. The following criteria apply:

- Exclusive criteria

Under Schedule 2, paragraph 10(m) of SI 1999 No.293, EIA may be required for coastal work to combat erosion and maritime works capable of altering the coast through construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works.

- Indicative criteria

Annex A of the *Department of the Environment, Transport and the Regions Circular 02/99, Environmental Impact Assessment*, states that “the impact of such works will depend largely on the nature of the particular site and the likely wider impacts on natural coastal processes outside of the site. EIA will be more likely where the area of the works would exceed one hectare.”

Furthermore, EIA may be required for any change to or extension of coastal defence works already authorised, where the change or

extension may have significant adverse effects on the environment. Responsibility for determining whether an EIA is required lies initially with the local planning authority.

- 2.4 Whether or not a formal EIA of proposed coastal defence activities is required, the Environment Agency and other statutory consultees and regulators may request environmental information concerning the proposal. An EIA may provide the most appropriate method for a developer to collate the necessary information.
- 2.5 The Food and Environmental protection Act 1985 Part II (FEPA) requires that a licence be obtained from DEFRA (the licensing authority) to deposit any article or substances in the sea or under the seabed. FEPA licence applications require external consultation which can be implemented through the EIA process.

### Other licences, consents and authorisations

- 2.6 Certain aspects of a coastal defence project, such as the construction of a coastal defence structure that may inhibit coastal drainage, may require prior permissions from the Environment Agency. These may include, for example, land drainage consents, abstraction licences, impounding licences, byelaw consents and discharge consents. The National Rivers Authority (predecessor of the Environment Agency) *Guide to the Understanding and Management of Saltmarshes* should be consulted as it contains a chapter on consents and licences. It is recommended that the developer seek independent legal advice and liaise with the Environment Agency during project design and subsequent stages to identify the consents, licences and authorisations that will be required.

## 3 Potentially significant environmental effects

- 3.1 The EIA Directive requires the EIA to “identify, describe and assess the direct and indirect effects of a project on the following factors: human beings, fauna and flora; soil, water, air, climate and the landscape; material assets and the cultural heritage; [and] the interaction between the factors.” Socio-economic issues, health and safety in the workplace, material assets and cultural heritage are all considered in EU *Guidance on Scoping* (ERM, 2001a) but are not impact categories for which the Environment Agency is the principal competent authority. Advice on these issues is presented in this guidance note without prejudice to the advice of the relevant competent authority, but the relevant competent authority should be consulted for each of these categories in all cases (further advice on the appropriate competent authority to contact is given in the *Scoping Handbook*).
- 3.2 An EIA of any proposed coastal defence project should determine the potential impacts on the environment of each aspect of the project, including location and management. Careful scoping facilitates this process. This section provides a non-exhaustive description of the environmental issues that might arise during the scoping of such a project. The *Scoping Handbook* provides guidance on how to conduct a scoping exercise.

- 3.3 Coastal defence activities have the potential to affect the environment in many ways. They can differ widely in terms of their mode of operation and location, and key issues are likely to vary from site to site. Impacts are likely to vary on both temporal and spatial scales, with impacts potentially occurring at locations well away from the works themselves. Of particular concern are the potential impacts on coastal geomorphology and this issue should be given special consideration; potential impacts are detailed below in the sections on water or on land as appropriate. However, it is recommended that expert advice on detailed technical issues be obtained.
- 3.4 Potential impacts are discussed here in broad terms only as their nature and intensity will depend on the physical characteristics of the project and the composition of any polluting materials. An EIA of proposed coastal defence projects should take these factors into account in assessing potential impacts on the environment.
- 3.5 The following paragraphs should be read in conjunction with Table C2. This details the activities involved in coastal defence activities and the impacts arising from them.

### **Water environment**

- 3.6 Surface water hydrology can be affected during all phases of construction and maintenance of a coastal defence project. The construction of a hard engineering structure can result in compaction of soils and an increase in impermeable (or low permeability) surfaces. The subsequent increase in surface runoff may, in turn, increase the risk of flooding, compounded by the fact that the coastal defence structure may prevent direct drainage to the sea. Beach nourishment or dune construction can change the geomorphology and drainage characteristics of areas. The erodibility of the beach material used may change the nature of wave and tide movement, and there is the potential for changes to nearshore currents and flow hydrodynamics.
- 3.7 In some cases, the dredging operations will form part of a coastal defence project. Surface water quality could be affected by marine dredging activities and the disposal of sediments will be required after dewatering. In other cases, dredging will serve to supply beach nourishment material. Dewatering may again be required. Attention should be given to the likely pollution consequences of the drainage water from the dredged materials entering controlled waters, particularly where past contamination of sediments is likely. The salinity regime of watercourses and wetlands protected by coastal defences may change. Managed realignment schemes involving the inundation of, for example, arable land, can have a detrimental effect on water quality of the inundating water due to the release of chemicals already in the soil or surface water.
- 3.8 Coastal defence activities may have significant impacts on groundwater hydrology and quality. Such impacts may result from a direct connection being made between engineering foundations and the water table. In addition, the dewatering of dredging material can locally raise water tables and may affect the quality of the groundwater. Once constructed, a coastal defence structure may raise the water table if drainage of the land to the sea is impeded.
- 3.9 In order to protect vulnerable groundwater resources it is the policy of the Environment Agency to encourage new developments to locate in areas of low vulnerability to groundwater pollution. However, this policy does not imply an automatic prohibition on coastal defence projects within source protection zones.

## Land

- 3.10 Coastal defence projects will also have implications for the physical characteristics and land use of the site. By their nature, such projects have the potential to change the site significantly. Issues to consider include the effect on landscape character of the coastal defence structure itself, or of the beach landform/dune system. Impacts of schemes may occur at a distance from the scheme site. For example, a scheme to protect an eroding coast may reduce the supply of material which protects another stretch of coast by deposition. Care should be taken to ensure that contaminated recharge is not brought into a clean site, either for engineering purposes or for dewatering.

## Air and climatic factors

- 3.11 Coastal defence projects should not have large-scale effects on air quality climate, though the construction and maintenance of coastal defence structures can lead to short-term localised impacts related to emissions from vehicles.

## Ecology

- 3.12 The ecological impacts of coastal defence works can be dramatic, particularly on the marine environment, where there is the potential for dredging activities to significantly affect benthic communities and shellfish, and also fish populations through increasing turbidity and damaging feeding or spawning grounds. Such consequences require careful consideration as the long-term effects may be significant, particularly if sand stripping from the sea floor results in the exposure of underlying rock, changing the habitat. Submerged reefs and/or breakwaters can create new habitats and may lead to positive ecological impacts.
- 3.13 On land, the coastal defence structure should protect terrestrial communities and habitats, although construction activities will cause

local damage, and some forms of coastal defence will change habitats, for example, by stabilising eroding cliffs, or create new ones, such as dune construction. There can be potential to create habitats and enhance the biodiversity of an area. Coastal defences can require new control structures where watercourses are intercepted. The potential impacts of these on migratory animals, especially fish, need to be considered.

## Human environment

- 3.14 The potential impacts of a coastal defence development on the human environment may take a variety of forms. They are divided here into sections covering socio-economic and health issues; amenity, visual impact and nuisance issues; and culture, heritage and archaeology.
- 3.15 Construction may require a large engineering operation, often involving significant numbers of short-term employment opportunities, and the accommodation and catering needs of workers can benefit local economies. Maintenance of soft engineering solutions may also require significant staffing. The effects of schemes on commercial fisheries should be investigated both during and after the works, as should the potential effects on tourism. The protection of material assets in itself has socio-economic benefits.
- 3.16 The identification of which of these issues are significant or are perceived to be significant is an important function of public involvement during the scoping exercise. Understanding likely public concerns is a key issue and reference to experiences from other coastal defence projects and any public representations to the local planning authority should be made.
- 3.17 Other issues that commonly need to be addressed are the visual impact of the coastal defence structure, and noise associated with construction

activities and ongoing maintenance of defence schemes. Any restrictions to access that may arise as a result of the development should also be considered, as should the creation of nuisances such as mud on roads and dust during construction activities. The creation of submerged reefs or breakwaters can provide new habitats for weeds (including algae) and may affect beach amenity where deep weed mats form or where algal mats affect beach users. Schemes can provide additional coastal access opportunities or provide enhanced amenity facilities including car parks, boat launching facilities and bird watching hides. Increased visitor numbers after works could lead to negative impacts due to disturbance. Opportunities for enhancements should be considered as part of scheme development.

- 3.18 Impacts on architectural and archaeological heritage can occur, although protection of such features at risk from flooding or erosion may be a positive impact of a scheme. Care must be taken to identify any known archaeological or historical features and to take account of any impacts on these. The likelihood of there being any unrecorded sites and their potential for discovery should also be examined. A protocol for managing archaeological discoveries should be put in place.

### Table C2

- 3.19 The impact identification table highlights:
- sources of impact (development activities);
  - potential impacts;
  - receptors for these impacts.
- 3.20 It is recommended that the table is annotated and used during consultations with other interested parties. Reference should also be made to the prompt lists detailing impacts and sources of impacts in the *Scoping Handbook*.

Table C2 Summary of key potential impacts of coastal defence projects, including beach nourishment

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operational phase/ongoing site maintenance	Decommissioning
<b>WATER</b>	Surface water hydrology and channel morphology	<b>Dredging (where needed)</b> <ul style="list-style-type: none"> <li>• Short-term increases in turbidity</li> <li>• Re-suspension of contaminants</li> <li>• Potential pollution from dewatering of dredged material</li> <li>• Potential changes to local hydrodynamics and sediment transport mechanisms</li> </ul> <b>Engineering works</b> <ul style="list-style-type: none"> <li>• Increased sedimentation of watercourses</li> <li>• Potential of pollution from machinery</li> </ul>	<b>Coastal defence structure maintenance</b> <ul style="list-style-type: none"> <li>• Short-term increases in turbidity</li> <li>• Increased sedimentation of watercourses</li> <li>• Potential of pollution from machinery</li> </ul> <b>Effects of coastal defence structure</b> <ul style="list-style-type: none"> <li>• Reduced turbidity</li> <li>• Surface drainage impaired</li> <li>• Changes to currents, flows etc. leading to increased/decreased erosion</li> <li>• Potential changes to local hydrodynamics and sediment transport mechanisms</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Short-term increases in turbidity</li> <li>• Increased sedimentation of watercourses</li> <li>• Potential for pollution from machinery</li> <li>• Potential changes to local hydrodynamics and sediment transport mechanisms</li> </ul>
	Surface water quality	<b>Dredging (where needed)</b> <ul style="list-style-type: none"> <li>• Short-term pollution from suspended material</li> <li>• Disturbance of contaminated soil and subsequent pollution of watercourses</li> <li>• Short-term increase in BOD</li> </ul> <b>Engineering works</b> <ul style="list-style-type: none"> <li>• Pollution from spills or leaks of fuel, oil and construction materials</li> </ul>	<b>Coastal defence structure maintenance</b> <ul style="list-style-type: none"> <li>• Sediment-loading of watercourses</li> <li>• Potential for release of heavy metals from sea-bed materials pumped onto beach</li> <li>• Potential for pollution from dewatering or dredging</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Pollution from spills or leaks of fuel, oil and waste coastal defence structure materials</li> <li>• Changed salinity regime</li> </ul>
	Groundwater hydrology	<b>Engineering works</b> <ul style="list-style-type: none"> <li>• Changed recharge characteristics where foundation works cross the water table</li> </ul>	<b>Effects of coastal defence structure</b> <ul style="list-style-type: none"> <li>• Deep foundations may inhibit groundwater flow</li> <li>• Dewatering of seabed sediments might raise water table locally</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Removal of flow inhibition</li> <li>• More stable water table</li> </ul>

		Activities and potential impacts		
		Construction phase	Operational phase/ongoing site maintenance	Decommissioning
<b>WATER</b> <i>continued</i>		<b>Engineering works</b> <ul style="list-style-type: none"> <li>• Pollution from spills or leaks of fuel, oil and construction materials</li> </ul>	<b>Coastal defence structure maintenance</b> <ul style="list-style-type: none"> <li>• Contamination from spills or leaks of fuel and oil</li> <li>• Potential for heavy metal pollution from dewatering</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Pollution from spills or leaks of fuel, oil and construction materials</li> </ul>
	<b>LAND</b>	Landscape	<b>Excavations and engineering works</b> <ul style="list-style-type: none"> <li>• Possible creation of a new landform</li> <li>• Visual impact of works</li> </ul> <b>Dredging (where needed)</b> <ul style="list-style-type: none"> <li>• Temporary creation of dewatering mounds</li> </ul>	<b>Effects of coastal defence structure</b> <ul style="list-style-type: none"> <li>• Change in character of landscape</li> <li>• Visual impact of structures</li> </ul> <b>Dredging (where needed)</b> <ul style="list-style-type: none"> <li>• Temporary creation of dewatering mounds</li> </ul>
	Soils	<b>Use of vehicles and machinery</b> <ul style="list-style-type: none"> <li>• Compaction</li> <li>• Erosion</li> </ul> <b>Engineering works</b> <ul style="list-style-type: none"> <li>• Further erosion of exposed soil</li> <li>• Removal or alteration of soils on site</li> </ul>	<b>Coastal defence structure maintenance</b> <ul style="list-style-type: none"> <li>• Further erosion of exposed soil</li> <li>• Removal or alteration of soils on site</li> </ul> <b>Dredging (where needed)</b> <ul style="list-style-type: none"> <li>• Potential for loss of soils under dewatering mounds</li> <li>• Potential for pollution due to disposal of dredgings on land</li> </ul>	<b>Use of vehicles and machinery</b> <ul style="list-style-type: none"> <li>• Compaction</li> <li>• Erosion</li> </ul> <b>Removal of engineering works</b> <ul style="list-style-type: none"> <li>• Further erosion of exposed soil</li> <li>• Removal or alteration of soils on site</li> <li>• Removal of off-site topsoil for on-site replenishment</li> </ul>
	Geology	<b>Excavations and engineering works</b> <ul style="list-style-type: none"> <li>• Removal of rock by excavation works</li> <li>• Use of rock as coastal defence structure material having indirect effects on geology elsewhere</li> <li>• Recharge can help to preserve sites of geological interest</li> </ul>	<b>Excavations</b> <ul style="list-style-type: none"> <li>• Further removal of geological resource following maintenance work</li> <li>• Opportunities for studies of eroding sections reduced</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Natural processes restored</li> <li>• Potential for exposure and erosion of geological sites of interest</li> </ul>

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operational phase/ongoing site maintenance	Decommissioning
<b>AIR</b>	Local air quality	<b>Use of vehicles and machinery</b> <ul style="list-style-type: none"> <li>Emissions from construction site traffic</li> <li>Dust generation</li> </ul>	<b>Use of vehicles and machinery for maintenance/reconstruction</b> <ul style="list-style-type: none"> <li>Exhaust emissions</li> </ul>	<b>Use of vehicles and machinery</b> <ul style="list-style-type: none"> <li>Emissions from decommissioning site traffic</li> <li>Dust generation</li> </ul>
<b>FLORA AND FAUNA</b>	Aquatic ecology	<b>Excavations and engineering works</b> <ul style="list-style-type: none"> <li>Destruction of marine or littoral habitat</li> <li>Accidental harm to aquatic flora and fauna (from oil, fuel, cement or other substances entering water environment)</li> <li>Changed fauna and flora through salinity changes</li> <li>Interference with migration between sea and freshwater</li> <li>Creation of new habitats</li> <li>Increased turbidity smothering</li> <li>Release of chemicals</li> </ul> <b>Dredging (where needed)</b> <ul style="list-style-type: none"> <li>Direct impact on benthic fauna</li> <li>Indirect impact on benthic fauna due to changed currents or water quality</li> <li>Sand removal may reduce recolonisation potential if exposing rock</li> <li>Loss of shellfish</li> <li>Removal of breeding sites for shellfish, feeding and spawning sites for fish</li> <li>Creation of new habitat if rock exposed</li> </ul>	<b>Coastal defence structure maintenance</b> <ul style="list-style-type: none"> <li>Destruction of marine or littoral habitat</li> <li>Accidental harm to aquatic flora and fauna (from oil, fuel, cement or other substances entering water environment)</li> <li>Interference with migration between sea and freshwater</li> <li>Changed salinity regimes on brackish water habitats</li> <li>Increased turbidity smothering</li> <li>Release of chemicals</li> </ul> <b>Ongoing dredging (where needed)</b> <ul style="list-style-type: none"> <li>Direct impact on benthic fauna</li> <li>Indirect impact on benthic fauna and flora due to changed currents or water quality</li> <li>Sand removal may reduce recolonisation potential if exposing rock</li> <li>Loss of shellfish</li> <li>Removal of breeding sites for shellfish, feeding and spawning sites for fish</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>Destruction of marine or littoral habitat</li> <li>Accidental harm to aquatic flora and fauna (from oil, fuel, cement or other substances entering water environment)</li> <li>Potential recovery of shellfish or fish populations (where affected)</li> <li>Loss of protected freshwater habitats</li> <li>Development of saline and brackish water habitats</li> <li>Change of species present as habitat changes (may be negative or positive)</li> </ul>

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operational phase/ongoing site maintenance	Decommissioning
<b>FLORA AND FAUNA</b> <i>continued</i>	Terrestrial ecology	<b>Beach nourishment</b> <ul style="list-style-type: none"> <li>• Temporary or permanent loss of terrestrial invertebrates</li> <li>• Loss of flora in the case of dune building</li> </ul> <b>Excavations &amp; engineering works</b> <ul style="list-style-type: none"> <li>• Temporary or permanent loss of vegetation across the site</li> <li>• Temporary or permanent loss of fauna across site</li> </ul>	<b>Coastal defence structure maintenance</b> <ul style="list-style-type: none"> <li>• Periodic disturbance to, or loss of, species (including rare and sensitive species)</li> <li>• Potential positive impact of protecting rare species/habitats at risk from inundation</li> </ul> <b>Effects of coastal defence structure</b> <ul style="list-style-type: none"> <li>• Protection of vegetation and fauna on the landward side</li> <li>• Development of dune systems resulting in high ecological value</li> <li>• Loss of often rare species associated with eroding habitats</li> <li>• Potential for vegetated shingle to develop on stabilised upper shore</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Loss of vegetation across the site</li> <li>• Loss of vegetation and fauna due to coastal erosion processes in the long term</li> <li>• Recovery of fauna and flora dependant on eroding habitats</li> </ul>
	Socio-economic <sup>1</sup>	<b>Engineering works and excavations</b> <ul style="list-style-type: none"> <li>• Disruption of services such as electricity, gas, water or telecommunications due to the presence of underground cables and pipes</li> <li>• Construction-related employment</li> <li>• Reduction in numbers of visitors</li> <li>• Effect on commercial fisheries</li> </ul>	<b>Defence in place</b> <ul style="list-style-type: none"> <li>• Long-term protection of material assets</li> <li>• Poor visual design may lead to long-term reductions in visitor numbers</li> <li>• Protection of agricultural land previously at risk</li> <li>• Potential for poor drainage and decrease in utility of agricultural land behind coastal defence structure</li> <li>• Effect on commercial fisheries</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Disruption of services such as electricity, gas, water or telecommunications due to the presence of underground cables and pipes</li> <li>• Construction-related employment</li> <li>• Reduction in numbers of visitors</li> <li>• Loss of material assets and agricultural land</li> <li>• Increase in visitor numbers</li> <li>• Effect on commercial fisheries</li> </ul>

<sup>1</sup> The Agency considers that key impacts to be identified and assessed are likely to include the following, but further advice and guidance should be sought from the relevant competent authority, as indicated in the *Scoping handbook*.

Potential receptors of impact		Activities and potential impacts		
		Construction phase	Operational phase/ongoing site maintenance	Decommissioning
HUMAN ENVIRONMENT <i>continued</i>	Health and safety <sup>1</sup>	<b>Engineering works and excavations</b> <ul style="list-style-type: none"> <li>• Risk of injury on construction site</li> </ul>	<b>Defence in place</b> <ul style="list-style-type: none"> <li>• Reduced risk of flood damage and injury resulting from flooding</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Risk of injury on construction site</li> <li>• Increased risk of flood damage and injury resulting from flooding</li> </ul>
	Amenity	<b>Engineering works and excavations</b> <ul style="list-style-type: none"> <li>• Disruption to beach and pleasure craft users</li> <li>• Visual disturbance of stockpiled materials</li> </ul>	<b>Defence in place</b> <ul style="list-style-type: none"> <li>• Possible alteration of rights of way or reduction in access</li> <li>• Restriction of recreation opportunities</li> <li>• Potential additional facilities provided</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Disruption to beach and pleasure craft users</li> <li>• Visual disturbance of stockpiled coastal defence structure waste</li> <li>• Potential for increase in recreation opportunities</li> <li>• Potential loss of facilities</li> </ul>
	Nuisance	<b>Dredging (where needed)</b> <ul style="list-style-type: none"> <li>• Possible increase in level of wind-blown sand from spreading of dredged material</li> </ul> <b>Engineering works and excavations</b> <ul style="list-style-type: none"> <li>• Increased traffic</li> <li>• Noise from construction traffic and operations</li> <li>• Mud on roads</li> </ul>	<b>Use of vehicles and machinery</b> <ul style="list-style-type: none"> <li>• Noise</li> <li>• Mud on roads</li> <li>• Where amenity is improved, greater visitor numbers may increase disturbance</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Increased traffic</li> <li>• Noise from deconstruction traffic and activity</li> <li>• Mud on roads</li> </ul>
	Architectural and archaeological heritage <sup>1</sup>	<b>Engineering works and excavations</b> <ul style="list-style-type: none"> <li>• Damage to known or unknown features of archaeological or cultural importance</li> </ul>	<b>Coastal defence structure maintenance or extension</b> <ul style="list-style-type: none"> <li>• Further damage to archaeological features</li> </ul>	<b>Removal of structures</b> <ul style="list-style-type: none"> <li>• Loss of archaeological features to coastal erosion processes</li> </ul>

<sup>1</sup> The Agency considers that key impacts to be identified and assessed are likely to include the following, but further advice and guidance should be sought from the relevant competent authority, as indicated in the *Scoping handbook*.



## 4 Mitigation measures

- 4.1 Following the scoping exercise and the identification of potential environmental effects, mitigation measures should be proposed to avoid or reduce potential negative impacts to air, water, land, ecology and humans, or to introduce positive aspects to the development. In some circumstances, the introduction of positive measures will be a licence requirement: for example, suitable beach replenishment materials should be obtained from a source not impacting on fish spawning grounds. Guidance has been provided by the Environment Agency to assist developers on a range of relevant subjects in the form of Pollution Prevention Guidelines (see the *Scoping Handbook*). See Section 5 for other relevant sources.
- 4.2 A primary consideration in impact mitigation should be the siting of coastal defence works, although in many cases the site will have been predetermined by the need to protect specific assets. The development site should be selected to avoid, if possible, damage to important ecological sites and high quality landscapes whilst still achieving the aim of protecting identified areas of land. In order to protect property and lives it may be necessary to impact on designated nature conservation sites. Where this is a potential issue full consultation with English Nature or the Countryside Council for Wales will be necessary.

### Mitigating the impacts of construction activities

- 4.3 Construction activities have the potential to affect all environmental receptors. However, the following list summarises the mitigation measures most relevant to coastal defence developments:

- phasing of construction work to minimise disturbance to wildlife at sensitive times of year, such as during the breeding season, when young are being raised or when migrant species are present;
- use of techniques to minimise compaction of soil or sediment, such as restricting access during wet conditions, and using protective boarding and low ground pressure machinery. If necessary, soil or sediment should be carefully removed and stored for subsequent reinstatement;
- use of dust control strategies;
- storage of fuel, equipment and construction materials so as to minimise the risk of soil or sediment contamination or water pollution (see Environment Agency, 2000a);
- setting the route and timing of construction traffic so as to avoid residential areas or other sensitive human receptors (e.g. schools, hospitals, nursing homes);
- access roads should avoid riparian zones and should be built using appropriate construction materials;
- use fencing to delineate working areas or to protect particularly sensitive species or habitats;
- to mitigate the effects of coastal squeeze, opportunities for habitat creation should be sought elsewhere;
- liaison will be needed with particular interest groups, for example, fishermen via fisheries liaison officers.

### Mitigating the impacts of the operational phase

- 4.4 Maintenance operations are likely to be the main source of impacts associated with the operational phase of hard engineering structures. With softer engineering structures, activities such as dredging can have very damaging impacts on each occasion, and the long-term effects of such schemes should be carefully investigated. An overall consideration for the proposed development is that its design and operation are in accordance with all other relevant legislation. Developers should seek independent legal advice to ensure that all legal requirements relating to the proposed development are identified and complied with.
- 4.5 The measures have been arranged according to their primary receptor, however it should be noted that many of the following mitigation measures are interrelated. For example, correct handling and storage of chemicals, plus bunding to contain spills, would serve to reduce the impacts of such an incident on soils, surface and groundwaters, and ecology.

### Protecting the water environment

- 4.6 In order to minimise potential impacts on the water environment during the design and operation of a coastal defence scheme, it must be ensured that:
- an appropriate water management system is used, including, for example, efficient land drainage and the use of constructed ponds for receiving site runoff to reduce the impact of runoff on nearby watercourses;
  - sustainable drainage systems (SuDS) are used where appropriate to alleviate flooding, improve water quality and ensure recharge of groundwater base flows;

- hazardous or potentially polluting materials such as fuel, oil or wastes are sited on an impervious base away from water, properly bunded, and kept locked when unattended;
- steps are taken to ensure that dewatering dredgings cannot pollute groundwater resources (by locating them appropriately, or collecting the effluent for disposal);
- an emergency plan is formulated and tested through exercises to ensure that procedures to prevent or mitigate impacts due to accidents or spillages are in place and operate effectively (some developments may require such plans to be formulated and the Environment Agency should be consulted to identify where this is the case);
- a water level management plan is developed and implemented for wetlands protected by sea defence schemes if appropriate;
- dredged material destined for disposal should undergo chemical analysis to ensure that the material is suitable for sea disposal (this will be a license requirement).

### Protecting the land environment

- 4.7 Much of the aim of coastal defence works is protection of the terrestrial habitat. With that in mind, impacts should be mitigated where possible by:
- appropriate design to reduce visual impacts;
  - effective management of dewatering activities to reduce impacts on soils;
  - analysis of dredging materials where they are destined for disposal to land to ensure they are not contaminated;
  - locating access roads in areas of low habitat value;

- designing a vegetation and monitoring scheme to address the impacts created adjacent to the landward side of the new coastal defence structure;
- using drip trays under stationary machinery to prevent oil and grease contaminating soil and groundwater.

### Protecting the air environment

- 4.8 Developers should consider the aspects of the development that are likely to lead to emissions to air. Such aspects can include vehicle emissions and dust associated with coastal defence construction and scheme maintenance. Suitable mitigation measures may include the use of water sprays to reduce dust.

### Protecting ecology

- 4.9 Measures designed to prevent or reduce impacts to water or land will also help prevent adverse impacts on ecology. The following list identifies further measures to reduce or avoid impacts to terrestrial and aquatic species and their habitats:
- existing habitat features should be incorporated into site design and protected from change;
  - works should be undertaken outside important breeding or migration seasons;
  - further habitats should be created to compensate for habitat loss occurring through coastal squeeze and to improve the landscape and ecological potential of the area;
  - carry out dredging according to pre-designed patterns which allow habitat recovery.

### Protecting the human environment

- 4.10 Some of the measures noted above can also reduce possible impacts on humans, notably the risk assessment and emergency planning measures. Further mitigation measures more specific to the human environment are listed below:
- management operations should aim to minimise disturbance to adjacent residential and recreational uses;
  - where access restrictions resulting from the coastal defence project arise, arrangements for alternative access should be made with the provision of bridges or stiles where appropriate and feasible;
  - safety concerns should be addressed by such measures as implementing strict health and safety procedures for construction workers, and the installation of adequate fencing and other site security to prevent trespass and vandalism;
  - sites of archaeological or cultural interest should be preserved in situ where possible. As relocation is rarely possible, thorough archaeological investigations should be carried out where damage is unavoidable;
  - carry out beach nourishment activities outside tourist season where possible;
  - landscape new dunes (or other soft engineering solutions) in keeping with existing geomorphology;
  - re-vegetate dunes as soon as their formation or reconstruction has been completed;
  - liaison with affected parties (for example, fishermen, local residents, etc).

## 5 References and further reading

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