# Strategy Appraisal Report

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|---|---|
| Authority Scheme Reference | HP07 |
| Defra / WAG LDW Number | CPW 1877 |
| Promoting Authority | Hartlepool Borough Council |
| Strategy Name | Seaton Carew Coastal Strategy Study |

**Recent damage sustained by the coastal defences in Seaton Carew and North Gare Breakwater (2003)**

| | |
|---|---|
| Date | 23rd November 2011 |
| Version | Version 5 |

StAR for *Seaton Carew Coastal Strategy*

| Version | Status | Signed off by: | Date signed | Date issued |
|---|---|---|---|---|
| Version 1 | Submission to NRG | JDP | 02/08/2010 | 02/08/2010 |
| Version 2 | Post NRG Comments | JDP | 14/12/2010 | 24/01/2010 |
| Version 3 | Revised Post NRG | JDP | 29/03/2011 | 29/03/2011 |
| Version 4 | Revised Post NRG | JDP | 06/09/2011 | 06/09/2011 |
| Version 5 | Revised Post NRG | JDP | 23/11/2011 | 23/11/2011 |
| | | | | |
| | | | | |

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## TABLES



## APPENDICES

**Attached to this document**



**Contained in Appendices Volume**

## To Commit Expenditure

**Promoting Authority:** **Hartlepool Borough Council**

**Project name:** **Seaton Carew Coastal Strategy**

**Approval Value:** **£** **29.105 million (Whole Life Cash Cost)**

**Sponsoring Director:** **David Jordan** **Director of Operations**

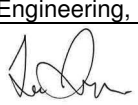
## Non Financial Scheme of Delegation

The Non Financial Scheme of Delegation states that for FCERM Strategies (or) Complex Change Projects, Regional Director or Director, Wales and Director of Operations approval is required.

## Approval Route

| | |
|---|---|
| Large Project Review Group | Ken Allison |
| Regional Director | David Dangerfield |
| Director of Operations | David Jordan |

## Approval History Sheet

| APPROVAL HISTORY SHEET (AHS) | | | |
|---|---|---|---|
| **1. Submission for review** *(to be completed by team)* | | | |
| **Project Title: Seaton Carew Coastal Strategy Study** | | **Project Code: CPW1877** | |
| **Project Manager: D Hancock** | | **Date of Submission: 23 November 2011** | |
| **Lead Authority: Hartlepool Borough Council** | | **Version No: Version 5** | |
| **Consultant Project Manager: Dr J Pos** | | **Consultant: URS Scott Wilson Ltd** | |
| *The following confirm that the documentation is ready for submission to PAB or LPRG. The Project Executive has ensured that relevant parties have been consulted in the production of this submission.* | | | |
| **Position** | **Name** | **Signature** | **Date** |
| Project Executive | Alastair Smith |  | 23/11/11 |
| | **Job Title:** | Assistant Director (Transportation and Engineering, Hartlepool Borough Council) | |
| Senior User/Project Sponsor<br>(or Area Flood & Coastal Risk Manager for Local Authority and Internal Drainage Board submissions) | Ian Hodge |  | |
| | **Job Title:** | Area Flood & Coastal Risk Manager | |
| NEAS Unit Manager (LPRG) or NEAS Regional Team Leader (PAB) – *Environment Agency projects only, delete as appropriate* | n/a | n/a | n/a |

| **2. Review by: Large Project Review Group (LPRG)** | | |
|---|---|---|
| **Date of Meeting(s):** | **Chairman:** | |
| **Recommended for approval:**<br>In the sum of £: | **Date:** | **Version No:** |

| **3. Environment Agency NFSoD approval** *Officers in accordance with the NFSoD: Specified Officer; Regional Director; Director of Operations* | | |
|---|---|---|
| **Version No:** | | **Date:** |
| Project Approval | **By:**<br>In the sum of: £ *(if different from above)* | **Date:** |

| **4. Defra or WAG approval** *(Delete as appropriate)* | |
|---|---|
| Submitted to Defra / WAG or Not Applicable (as appropriate) | **Date:** |
| Version No. (if different): | |
| Defra/ WAG Approval: or Not applicable (as appropriate) | **Date:** |
| Comments: | |

## NON FINANCIAL SCHEME OF DELEGATION (NFSoD) COVERSHEET FOR AFCRM COMPLEX CHANGE PROJECT / STRATEGIC PLAN

**1.**

| | | | | | |
|---|---|---|---|---|---|
| **Project name** | Seaton Carew Coastal Strategy Study | | | **Start date** | |
| | | | | **End date** | |
| **Business unit** | Hartlepool Borough Council | | **Programme** | | |
| **Project ref.** | HP07 | **Regional SoD ref.** | | **Head Office SoD ref.** | - |

**2.**

| **Role** | **Name** | **Post Title** |
|---|---|---|
| **Project Sponsor** | David Jordan | Director of Operations |
| **Project Executive** | Alastair Smith | Assistant Director (Transportation and Engineering, Hartlepool Borough Council) |
| **Project Manager** | Dennis Hancock | Principal Engineer, Hartlepool Borough Council |

**3.**

| **Outline Risk Assessment (ORA) Category** | **Low** | ☐ | **Medium** | ☐ | **High** | ☐ |
|---|---|---|---|---|---|---|

**4.**

| **NFSoD value** | **£k** |
|---|---|
| **Whole Life Costs (WLC) of Complex Change Project / Strategic Plan** | £29,105 |

**5.**

| **Required level of Environmental Impact Assessment (EIA)** | **N/A** | **Low** | **Medium** | **High** |
|---|---|---|---|---|
| | ☒ | ☐ | ☐ | ☐ |

**6.**

| **NFSoD approver name** | **Post title** | **Signature** | **Date** |
|---|---|---|---|
| | | | |
| David Dangerfield | **North East Regional Director** | | |
| David Jordan | **Director of Operations** | | |
| **NFSoD consultee name** | **Post title** | **Signature** | **Date** |
| Ken Allison | LPRG Chair | | |
| Ian Hodge | Area Flood & Coastal Risk Manager | | |
| Alastair Smith | Assistant Director (Transportation and Engineering), Hartlepool BC | | 23 Nov 2011 |

# 1 Executive Summary

## 1.1 Introduction and Background

1.1.1 This StAR details the development and business case to manage coastal erosion risk over the next 100 years for Seaton Carew.

1.1.2 The requirement to develop a coastal strategy for the Seaton Carew frontage was identified in the Action Plan within the second generation Shoreline Management Plan (SMP2).

1.1.3 The study area is defined as the coastline between Newburn Bridge to the north and the Tees Estuary to the south and comprises Management Areas MA12.2, MA 13.1, MA13.2, MA13.3 and MA13.4 as defined in the SMP 2 (Figure 1).

1.1.4 The Tees Estuary forms part of the southern boundary of the strategy. Directly surrounding the Tees Estuary is a terrestrial landscape of very low-lying, flat farmland combined with urban areas, a nuclear power station, substantial industrial development and some notable designated natural habitats.

## 1.2 Definition of the Problem

1.2.1 The northern part of the Strategy area, the Seaton Carew Town frontage (MA12.2 and MA13.1), is protected by linear defences consisting of vertical walls, and in places fronted by rock revetments. These defences protect the town from erosion (with 486 households, commercial properties – hotels and shops - within the 100 year erosion envelope) and are currently managed by Hartlepool Borough Council (HBC) with general maintenance. There is currently no strategy to upgrade or replace these defences to account for their degradation or the increased pressures of sea level rise and climate change. Current and estimated future water levels are not sufficient to cause tidal inundation; therefore the frontage requires protection from erosion and the risks of overtopping.

1.2.2 The vertical walls in MA13.1A have been subject to undermining and overtopping damage. The poor condition of this defence is demonstrated by events in 2006 and 2007 which resulted in two breaches and the loss of the access steps (Appendix D - Plate 5 to Plate 10). One breach resulted in a serious accident involving a member of the public (Appendix C – Figure 2). Temporary emergency works were carried out to prevent this area from deteriorating. The works comprised placement of 2-4 tonne rock armour along a length of approximately 400m (Appendix D – Plates 3 and 4). However, the emergency works do not extend the full length of the undermining structure. The residual life of these defences is approximately 5 years due to the undermining foundations which leave the walls vulnerable to catastrophic failure.

1.2.3 Along MA13.1B to E the existing wall which is showing signs of significant deterioration is not able to withstand significant wave attack, and is at risk from undermining due to reduced beach levels during storms. Regeneration of the land behind the defences along this section is a key aim for HBC and concern exists that the existing condition of the defences will significantly hinder this objective.

1.2.4 The south of the Strategy (MA13.2 to MA13.4) area is artificially held by two strategically important control structures; the North Gare Breakwater and the Seaton Channel Training Wall. Both structures are in a poor state of repair and are at the end

of their structural lives. These structures control the morphology of the southern area of the strategy; the North Gare Breakwater also has a significant influence on the beaches within MA13.1 and MA13.2 to the North.

1.2.5 Retention of both the North Gare Breakwater and Seaton Channel Training Wall control structures is crucial to prevent the loss of the SPA and Ramsar sites and also prevent significant volumes of sediment reaching the Tees Estuary and Seaton Channel which would otherwise impede the operation of the Teesport and the Hartlepool Nuclear Power Station. Both structures are owned by PD Teesport, who carry out maintenance to the structures in response to damage caused during storm events. There remains significant residual risk that either or both these structures would fail during a severe storm.

## 1.3 Options

1.3.1 In developing the strategy the first stage of the option development process was to undertake a review of the SMP2 policies. The SMP policy review is followed by an appraisal of defence options from which preferred options are selected. Figure 1 below outlines the option development process.

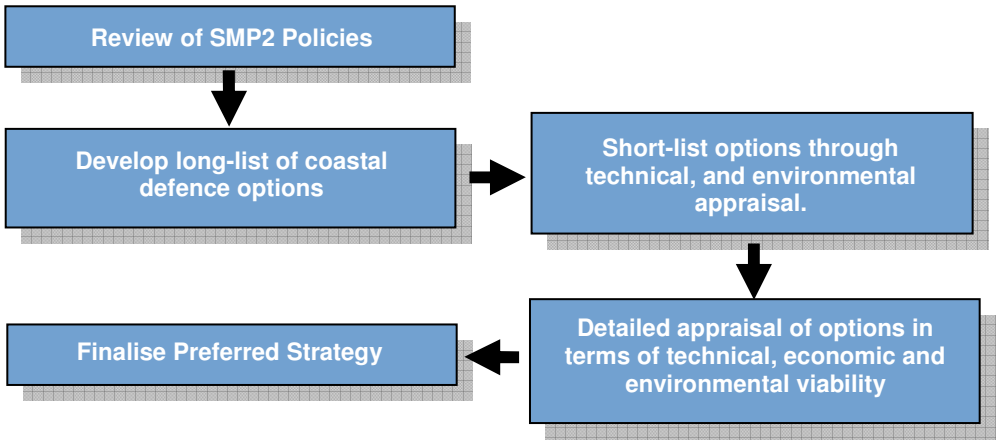



**Figure 1: Option Development Process**

1.3.2 From a long list of potential defence options for the frontage the following options were considered for detailed appraisal:

- Maintenance of existing defences;
- Reinstatement of control structures;
- Toe protection;
- Rock revetments
- Seawalls

## 1.4 Recommended Strategy

1.4.1 The Strategy recommends managing the coastline as two Management Units with a series of phased works based on the residual life of existing structures.

1.4.2 The proposed works comply with the recommended SMP2 policies over the entire Strategy frontage and duration.

1.4.3 The selection of the preferred strategy options followed the option development process as shown in Figure 1 and was based on a balanced assessment of economic, environmental and technical viability. As such the most cost-beneficial solution which was technically viable and environmentally acceptable was selected as the preferred option.

### Northern Management Unit:

1.4.4 Capital works to MA13.1A would be undertaken as a priority to provide Toe Protection (in the form of a low crested rock revetment) to prevent any further undermining or breaching. As part of these works the 'North Shelter' area would be raised to a level consistent with adjacent defences.

1.4.5 The type and condition of defences along Management Area 13.1B to 13.1E is such that the entire length is in need of replacement. The preferred coastal management option is to improve the defences within the next 5 years either by constructing a new sea wall, with a later addition of a low-crested rock revetment, or by immediate construction of a full height rock revetment. Both options have been demonstrated as viable and the implemented approach will need to be resolved at a more detailed level (PAR stage).

1.4.6 Increases in overtopping rates (due to future sea level rise) would be managed using promenade closures during storms, rather than wall raising, in order to reduce the risk to the public.

### Southern Management Unit:

1.4.7 In MA13.2 no works are proposed, and the recommended policy is to continue with "No Active Intervention".

1.4.8 The North Gare breakwater is a critical structure for the frontage, preventing loss of the dunes (which are designated as SPA and Ramsar) and beach to the north and protecting the shoreline to the south. Capital works are required to reinstate an effective structure. The recommended coastal management option is to provide a full height concrete armour layer to the existing structure within 10 years (the current estimate of residual life).

1.4.9 For the Seaton Channel Training Wall (within MA13.4) the existing structure needs to be reinstated such that it effectively traps sand. This will prevent uncontrolled erosion of the dunes to the north of the structure which are designated as SPA and Ramsar. It would also prevent the exposure of the contamination from the old Leathers Chemical Works. Works would be undertaken within 10 years based on the residual life of the existing structure.

1.4.10 No coastal protection works are proposed along the shoreline within MA13.4 between the North Gare Breakwater and the Seaton Channel Training Wall which would be managed under a "No Active Intervention" policy provided the control structures are held.

1.4.11 The projects have been re-assessed against revised Climate Change guidance and under the new Flood & Coastal Resilience Partnership Funding. The scheme options

and relative priorities of the schemes do not change. The results of the impact of funding can be found in Appendix Q.

## 1.5 Economic Case

1.5.1 The costs for the preferred strategy are summarised in Table 1.1 below. PV Costs have been determined by involving an experienced local Contractor who has undertaken similar works along the frontage. Benefits were developed in accordance with FCDPAG3 and include property, infrastructure and tourism and recreation.

1.5.2 Contributions from commercial beneficiaries of the proposed schemes have been identified within the Strategy and initial consultation has been undertaken during the production of the Strategy and is ongoing. Contributions should be confirmed during the PAR Stage of schemes.

**Table 1.1: Summary of Preferred Strategy**

| | Northern Management Unit | Southern Management Unit | Total |
|---|---|---|---|
| **Households Lost** | | | |
| **Years 0-20** | 0 | 0 | 0 |
| **Years 21-50** | 153 | 0 | 153 |
| **Years 51-100** | 333 | 0 | 333 |
| **Total** | 486 | 0 | 486 |
| **Do Nothing Losses (PV)** | | | |
| **Residential/Commercial** | 18.59 | 0 | 18.59 |
| **Industrial** | 0 | 82.12 | 82.12 |
| **Services** | 2.41 | 0 | 4.99 |
| **Infrastructure** | 29.17 | 0 | 18.80 |
| **Recreational** | 44.35 | 0 | 22.81 |
| **Total** | 94.52 | 82.12 | 147.31 |
| **Key Issues** | | | |
| | Health and Safety Issue in MA13.1A, North Gare Breakwater Potential Residential and Commercial losses. | Contributions, Contaminated Land and Environmental Areas, Hartlepool Nuclear Power Station and Tees Estuary, North Gare Breakwater and Seaton Channel Training Wall. | |
| **Standard of Protection (Years)** | N/A* | N/A** | |
| **PV Costs (£k)** | | | |
| **Capital** | 7,240 | 10,070 | 17,310 |
| **Non-capital** | 290 | 440 | 730 |
| **Total PV Costs (£k)** | 7,530 | 10,510 | 18,040 |
| **PV Benefits (£k)** | 94,520 | 82,120 | 176,640 |
| **Average Benefit/Cost Ratio** | 12.56 | 7.8 | |
| **Cash Costs (£k)** | | | |
| **Capital** | 12,504 | 14,752 | 27,256 |
| **Non-capital** | 739 | 1,110 | 1,849 |
| **Total Cash Costs (£k)** | 13,243 | 15,862 | 29,105 |
| **OUTCOME MEASURE** | 4.04 | 2.11 | |

| | | | |
|---|---|---|---|
| **(Without Contribution)** | | | |
| **OUTCOME MEASURE (With Contribution)** | 4.67 | 5.53 | |

* - Flood risk to assets is not an issue along this frontage. New defences should be designed to a suitable structural standard. The risk of overtopping should be addressed at scheme level and should consider the risks to pedestrians

** - Overtopping and flooding are not issues for these types of structure. Structures should be designed to a suitable structural standard.

1.5.3 Total years 0-5 expenditure is £12.69m. Total cash spend is £29.11m including £14.7m for assets owned by PD Tees Port. The above table excludes any potential contributions identified during the Strategy for the Cash and PV Costs. However expected contributions have been used for the calculation of OM Scores (Northern Management Unit £1m, Southern Management Unit £6.5m)

1.5.4 The projects have been re-assessed under the new Flood & Coastal Resilience Partnership Funding and the relative priorities of the schemes do not change. The results of the impact of funding can be found in Appendix Q.

## 1.6 Environmental and Social Considerations

1.6.1 A wide consultation process has been carried out at key stages to ensure that any potential social and community impacts were identified. The proposed Strategy has not received any significant objections from the public or stakeholder organisations. (Refer to the Stakeholder Engagement Strategy Report – See Appendix N)

1.6.2 A Strategic Environmental Assessment (SEA) has been carried out and is reported in full in the Seaton Carew Coastal Strategy SEA Environment Report (Refer to Appendix L). The Seaton Carew Coastal Strategy Study frontage contains both Ramsar and SPA sites. In order to ascertain whether or not site integrity will be affected, a Habitats Regulations Assessment has been undertaken of the preferred options proposed within the Seaton Carew Coastal Strategy HRA Screening Report (Refer to Appendix M).

1.6.3 Neither the SEA nor the HRA has identified any significant impacts that would prevent the preferred Strategy being adopted. A letter of support for the Environmental Assessment of the Strategy has been received from Natural England and a copy is contained in Appendix I.

1.6.4 The implementation of the Seaton Carew Coastal Strategy will maintain a suitable level of coastal protection taking into account climate change and sea level rise. This will ensure that the residential, commercial and industrial properties behind the defences will be protected from inundation and coastal erosion, and that people are living in a safe environment. The Strategy will not have any significantly long-term adverse impact on landscape, water resources or water quality, and will maintain and enhance access for amenity, tourism and recreation.

1.6.5 In the Southern Management Unit the dune systems will be maintained by the strategy which is considered to have a positive impact on the landscape. The proposed works in MA13.3 and MA13.4 would marginally increase the footprint of the existing structures and therefore will have a direct impact on the Teesmouth and Cleveland Coast SPA and Ramsar site. Natural England have stated that there may be a legal obligation to prevent the loss of the SPA and Ramsar areas which are supported/protected by the existing structures.

## 1.7 Risks

1.7.1 An assessment of the High Level risks to implementing the recommendations of the Strategy has been undertaken along with potential mitigation. This has influenced the level of Optimism Bias applied to the Strategy options. Non implementation of the Strategy would result in significant adverse impacts in the form of increased risk of loss of life, property, and environmental assets.

1.7.2 Within the Northern Management Area MA13.1A there are significant risks relating to public health and safety. The condition of the existing seawall is such that sections have a very limited (up to 5 year) residual life, due to undermining. This was demonstrated in 2007, after a storm event an area of the promenade behind the defence collapsed due to undermining of the seawall toe trapping a member of the public, Temporary reactive remedial works were undertaken by HBC but a permanent solution needs to be provided. Pro-active or planned intervention would mean the existing seawall could be retained with scour protection provided at the toe and the lower 'North Shelter section in-filled to raise crest levels equal to adjacent sections. Continuation of the current reactive maintenance would result in the failure of the seawall or promenade and would cost significantly more to repair.

1.7.3 Tourism within the Northern Management Area is also at risk if the seafront with promenade and beach is lost or access/use is significantly reduced. If reactive maintenance continues and the seawall fails it would have a significant adverse impact on tourism and the future of redevelopment within Seaton Carew. The potential for developer contributions to sections of the frontage where redevelopment has been identified may also be lost.

1.7.4 Northumbrian Water have a significant infrastructure asset (Headworks) along the Seaton Carew frontage. This asset accepts combined sewage flows from Hartlepool, Durham County and other area's within the Tees Valley. Continuous protection along the frontage and specifically at the location of the headworks is required to reduce the risk to the asset, which would cause significant disruption and damage to people, and property. Contributions to providing the protection to this asset are being sought.

1.7.5 Implementation of the Strategy within the Southern Management Area is required to reduce the risk of severe disruption/loss of key infrastructure of national importance, as follows:-

- Hartlepool Nuclear Power Station, and associated water intakes along the southern boundary of the strategy
- Teesport, (which as a minimum would need to significantly increase maintenance dredging or at worst case would cease to operate due to siltation of the entrance channels)

1.7.6 Within the Southern Management Area there is also a risk that failure of the existing control structures could lead to accelerated erosion and the subsequent exposure of a significant site of contaminated land which would have large implications on the environment within Seaton Channel and the wider area.

1.7.7 A further risk to delivery is the level of contributions from beneficiaries. At present significant beneficiaries have been identified and informed of the strategy, its purpose and the process through which it has been developed. They have also been informed that contributions to the strategy would be sought, however the level of contributions to the implementation strategy have not been agreed. Discussions on potential contributions have been progressed and are being taken forwards at Director Level

between the Council and all potential contributors. Contributions should be fixed during the PAR process and a decision on funding can be taken dependant on the level of contributions received.

1.7.8 Successful negotiation with potential contributors is important since the preferred options for the North Gare Breakwater and the Seaton Channel Training Wall are unlikely to be implemented without substantial contributions from commercial benefactors and the defence owners. All contributions have been applied to the derivation of the Outcome Measure score only and are not included in the benefit-cost calculations to ensure that the business case for each option is robust.

## 1.8 Implementation

1.8.1 The strategy for the long term management of the coastal defences along the Seaton Carew frontage is to carry out a series of capital works schemes developed through a series of PAR's in priority order. Schemes have been prioritised on the basis of the residual life of existing structures and the risk of failure leading to Health and Safety issues.

1.8.2 Table 1.2 shows the annualised spend profile for the Strategy. Contributions to capital works have been sought from all key commercial beneficiaries of the proposed schemes and discussions are ongoing. Final levels of contributions should be confirmed at the PAR stages.

**Table 1.2: Annualised Spend Profile and OM Score**

| Costs (£k) | 2010/11 (£k) | 2011/12 (£k) | 2012/13 (£k) | 2013/14 (£k) | 2014/15 (£k) | Future Years | Total |
|---|---|---|---|---|---|---|---|
| **Northern Management Unit - Outcome Measure Score = 4.67 (SMP Areas MA12.2 and MA13.1)** | | | | | | | |
| **Capital** | 300* | 1,713* | 2,000 | 1,882 | | 6,579 | 12,474 |
| **Non-capital** | 100 | 30 | | | | 640 | 770 |
| **Southern Management Unit - Outcome Measure Score = 5.53 (SMP Areas MA13.2 to MA13.4)** | | | | | | | |
| **Capital** | | | | | 3,210 | 11,542 | 14,752 |
| **Non-capital** | 5 | 5 | 155 | 5 | 5 | 935 | 1,110 |

* 300k and 1,200k have already been secured through the completion of the PAR and construction of the urgent works along MA13.1A.

1.8.3 After consultation with the EA Area Coastal Engineer due to significant health and safety issues and potential failure of the assets within MA13.1A (within the Northern Management Unit, a Project Appraisal Report (carried out under an approved FRM7) has been undertaken in parallel with the development of the Strategy. This work was awarded under a variation of the Strategy contract (in accordance with HBC contract rules).

1.8.4 The PAR for MA13.1A was completed and presented at PAB on the 9th December 2011 and gained approval. Works are designed and supervised by Hartlepool Borough Council and the appointed contractor is Hall Construction. Works commenced on-site in April 2011 and are due for completion within the allocated funding in December 2011.

1.8.5 All Project Appraisal Reports will be procured under competition in accordance with Hartlepool Borough Council Constitution and Standing Orders relating to procurement. All physical works will be subject to formal legal assessments with key beneficiaries for agreed contributions prior to final approval and budget allocation from the EA. These

works once approved will also be procured in accordance with HBC constitution and Standing Orders relating to procurement.

1.8.6 The projects have been re-assessed under the new Flood & Coastal Resilience Partnership Funding and the relative priorities of the schemes do not change. The results of the impact of funding can be found in Appendix Q.

# 2 Introduction and Background

## 2.1 Purpose of this Report

2.1.1 The Seaton Carew Coastal Strategy details the business case to manage coastal erosion over the next 100 years. The key issues within the Strategy are summarised in this Strategy Appraisal Report (StAR). Approval of the Strategy will lead to PAR's to gain FDGiA funding for coastal defences.

2.1.2 The Strategy and business case has been developed in-line with Defra FCDPAG guidance and associated Environment Agency policy and procedures. The adoption of FCERM-AG would not affect the outcomes of this strategy.

## 2.2 Background

### Strategic and Legislative Framework

2.2.1 The Environment Agency (EA) and Hartlepool Borough Council (HBC) share coastal management responsibilities within the study area. HBC has powers under the Coast Protection Act 1949 to undertake coastal works along the frontage. The EA have responsibility for strategic management of the coastline.

2.2.2 Within the Southern Management Area of the Strategy PD Teesport own and maintain two of the critical structures along the frontage; the North Gare Breakwater and Seaton Channel Training Wall. In combination the North Gare Breakwater and the Seaton Channel Training Wall stabilise the frontage and retain sediments that would otherwise enter Seaton Channel and inhibit the operation of Teesport, Consequently, these structures are essential to the continued defence of the frontage.

2.2.3 The North Gare Breakwater exerts a beneficial influence on the southern frontage of Seaton Carew town and retains sediments within the dunes of Seaton Sands, whilst the Seaton Channel Training Wall retains sediments within the dunes of North Gare Sands. These structures have created areas which are now environmentally designated under SPA and Ramsar conventions. There may be a legal duty to maintain these structures to sustain the existence of the designated areas (this is to be confirmed by Natural England). It is therefore considered that a partnership approach, co-ordinated and managed by HBC, is the most appropriate way of securing the future of these critical structures with all identified beneficiaries (currently PD Teesport, Frutarom and EDF/British Energy) providing funding contributions. It is recommended that a legal framework which requires the significant beneficiaries to adopt the strategy (and provide contributions) be formed. This framework should outline the roles and responsibilities of the structures with the EA's responsibility limited to providing the strategic overview of the coastline.

2.2.4 The Seaton Carew Strategy was identified as a priority action in both 1st and 2nd Generation Shoreline Management Plans (SMPs). The 2nd Generation SMP was recommended for approval by the EA's National Review Group in April 2009.

2.2.5 To comply with the Habitats Regulation Assessment (HRA) process a scoping report was undertaken and submitted to Natural England (NE) who confirmed that the Strategy did not require an Appropriate Assessment to be undertaken. (Refer to Appendix M for the HRA Screening Report)

2.2.6 A Strategic Environmental Assessment (SEA) was produced in consultation with statutory stakeholders. NE confirmed that the SEA was completed to a sufficient level of detail to support the Strategy. (Refer to Appendix L for the SEA Environmental Report)

## Previous Studies

2.2.7 Two flood risk studies of the Tees Estuary have been undertaken by the EA; the Tees Tidal Flood Risk Management Strategy and the River Tees Catchment Flood Management Plan (CFMP). However, neither study is relevant to the management of the Seaton Carew frontage.

2.2.8 No other relevant studies have previously been carried out along this frontage.

## Social and Political Background

2.2.9 The Seaton Carew frontage protects 486 households within the 100 Year erosion envelope as well as a range of commercial properties, including hotels and shops.

2.2.10 The frontage also provides access to large amenity beaches and is therefore an important area for local tourism and recreation which contribute significantly to the local economy.

2.2.11 The regeneration of the Seaton Carew frontage is a primary objective for HBC. Preliminary regeneration proposals are to regenerate an area to the south of Seaton Carew behind the existing defences. HBC consider the provision of coastal defences compatible with these proposals as essential to the long-term regeneration of Seaton Carew. (Refer to Appendix C – Figure 9)

## Location and Designations

2.2.12 The Seaton Carew Strategy area is defined as the coastline between Newburn Bridge to the north and Hartlepool Nuclear Power Station in the south as shown in Figure 2-2.

2.2.13 The majority of the frontage is directly exposed to tidal and wave conditions within the North Sea. The northern section of the frontage (MA12.2 and MA13.1) consists of linear defences comprising revetment and seawalls; which protect the town of Seaton Carew. The southern section of frontage (MA13.2 to MA13.4) consists of dunes controlled by two terminal structures, the North Gare Breakwater and the Seaton Channel Training Wall. The southern boundary of the Strategy within MA13.4 faces the Tees Estuary.

2.2.14 The Seaton Carew Strategy frontage contains several areas with environmental designations; Table 2.1 lists the environmentally designated areas within each Management Area. Figure 2-3 shows the approximate location of each designated site and also identifies key assets within the Strategy area.

**Table 2.1: Environmental Designations**

| Management Area | Local Name | Name and Designation |
|---|---|---|
| MA12.2 | Seaton Carew Frontage | Hartlepool Submerged Forest – Site of Special Scientific Interest (SSSI) |
| MA13.1 | Seaton Carew Frontage | No Designated Sites |
| MA13.2 | Seaton Dunes | Seaton Dunes and Common – SSSI<br>Seaton Dunes and Common – Local Nature Reserve (LNR)<br>Teesmouth and Cleveland Coast – Special Protection Area (SPA) and Ramsar |

| Management Area | Local Name | Name and Designation |
|---|---|---|
| MA13.3 | North Gare Breakwater | Seaton Dunes and Common – SSSI<br>Teesmouth – National Nature Reserve (NNR)<br>Teesmouth and Cleveland Coast – Special Protection Area (SPA) and Ramsar |
| MA13.4 | North Gare Sands | Seaton Dunes and Common – SSSI<br>Teesmouth – National Nature Reserve (NNR)<br>Teesmouth and Cleveland Coast – Special Protection Area (SPA) and Ramsar |

## Historic Geomorphology

2.2.15 Before the mid 19th century the Tees Estuary was a 'delta system' of continually shifting channels. The attempts to train and develop a functional channel have played a major part in the shaping of the shoreline along the study frontage. The historical coastal evolution of the frontage was evaluated by digitising the position of the mean high water mark from historical Ordnance Survey maps (See Figure 2-1).

2.2.16 Along the frontage of Seaton Carew (now SMP2 MA's 12.2, 13.1) relatively little change has occurred since the late 1800's. This urbanised part of the shoreline has been defended with hard defences limiting any change in the shoreline position, although there have been a number of historic advances in the defence line.

2.2.17 The area south of Seaton Carew (now SMP2 MA's 13.2, 13.3 & 13.4) has historically been dynamic and mobile, displaying large magnitudes of shoreline movement, especially south of the North Gare Breakwater position (prior to its construction).

2.2.18 Work started on the North Gare Breakwater in 1882 with the aim to protect the entrance of the Tees from extreme wave conditions and to stabilise and maintain the main navigation channel. The root of the North Gare breakwater was originally a sand spit. This spit was extended with slag material to reclaim a large area of land; which currently accommodates Hartlepool Nuclear Power Station and the Frutarom Chemical works. The breakwater was proposed to be 2km in length although works halted in 1891 to leave a structure 1km in length. This was considered to give sufficient protection to the estuary and has not been extended since.

2.2.19 Since construction of the North Gare Breakwater substantial accretion has stabilised the shoreline further North creating the wide beach and Seaton Dunes.

2.2.20 South of the North Gare Breakwater wind blown sand has built up on the slag material to produce the North Gare Sands dune system. Historically, this section of shoreline was retreating with sediment transported towards the mouth of the Tees Estuary. After construction of the North Gare Breakwater accretion in the lee of the breakwater is evident up to 1920. Since 1920 the MHW mark has retreated inland, this triggered the construction of a slag training wall in the early 1970's (referred to as the Seaton Channel Training Wall), which was refurbished and increased in height in the 1980's. The training wall prevents sedimentation of the navigation channel and prevented further retreat of the shoreline.

2.2.21 The combination of these works carried out to protect the navigation channels at the southern extent of the study area in the Tees estuary has shaped the coastline into the form that it is today.

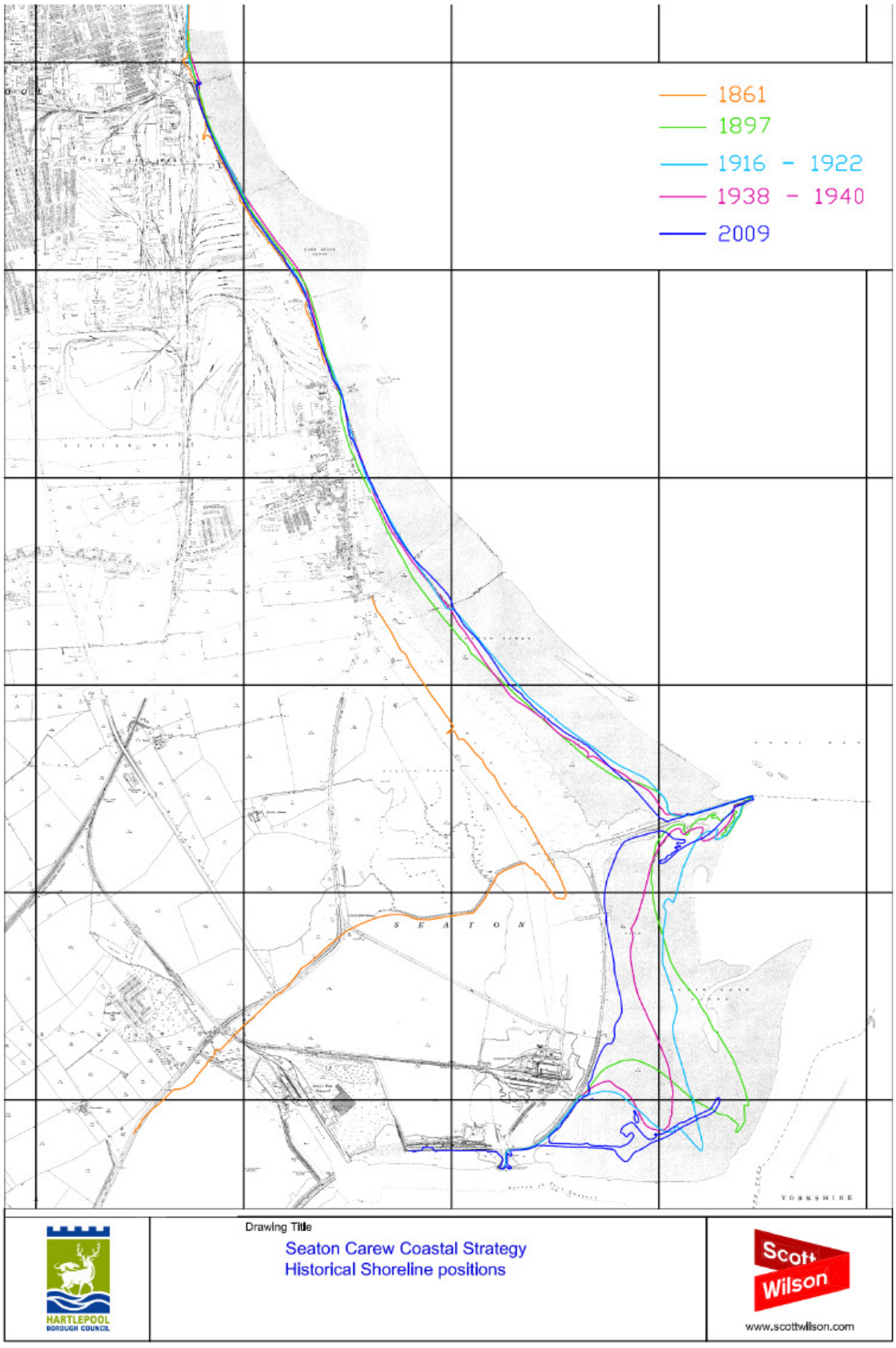



**Figure 2-1: Historic Shoreline Positions from 1861 - 2009**

2.2.22 It is evident from the geomorphology and analysis of the performance if the structures that sediment transport runs from the north to the south. Sediment is predominantly supplied to the area from the north coming around the Hartlepool Headland.

## Future Geomorphology

2.2.23 Climate change is predicted to result in raising sea levels by approximately 1m, over the next 100 years, along the Hartlepool coastline (Defra 2006). Sediment transport modelling was carried out to determine how the increase in water depth and wave exposure would impact transport rates along the frontage. A sensitivity test showed that transport rates could increase by up to 25% depending on the changes in conditions.

2.2.24 It is uncertain if the contribution of sediment from the north of Hartlepool Headland would remain or increase under climate change. The worst case would be if the increase in sediment transport along the Seaton Carew frontage (i.e. loss from the frontage) was not matched by additional contributions (i.e. supply) from the north.

2.2.25 This would result in the drawdown and steepening of the foreshore along the beaches of the Seaton Carew frontage. Resulting in increased wave exposure at the toe of the defence structures potentially causing undermining. Provision for increasing the protection at the toe of structures to prevent undermining has therefore be given within the strategy.

2.2.26 An assessment of overtopping rates in the future given sea level rise was undertaken. The assessment demonstrated that the increase in overtopping is therefore a key consideration for rates and volume was not sufficient to cause significant inundation of residential properties and therefore did not warrant a significant modification of the coastal defences along the entire length of frontage. The health and safety risk to pedestrians could be managed through controlled access to the promenade area.

2.2.27 In the Southern Management Unit the undefended dunes may experience some roll back or coastal squeeze as sea levels increase. Maintaining the effectiveness of the control structures (North Gare Breakwater and Seaton Channel Training Wall) would significantly reduce the loss of sediments and minimise the rate at which roll back would occur.

2.2.28 The increase in sea levels would not impact the structural integrity of the North Gare Breakwater or the Seaton Channel Training Wall (providing capital works are carried out to extend the residual life of the structures). Increased overtopping of these structures would not significantly affect their performance or introduce any additional risks to people or assets.

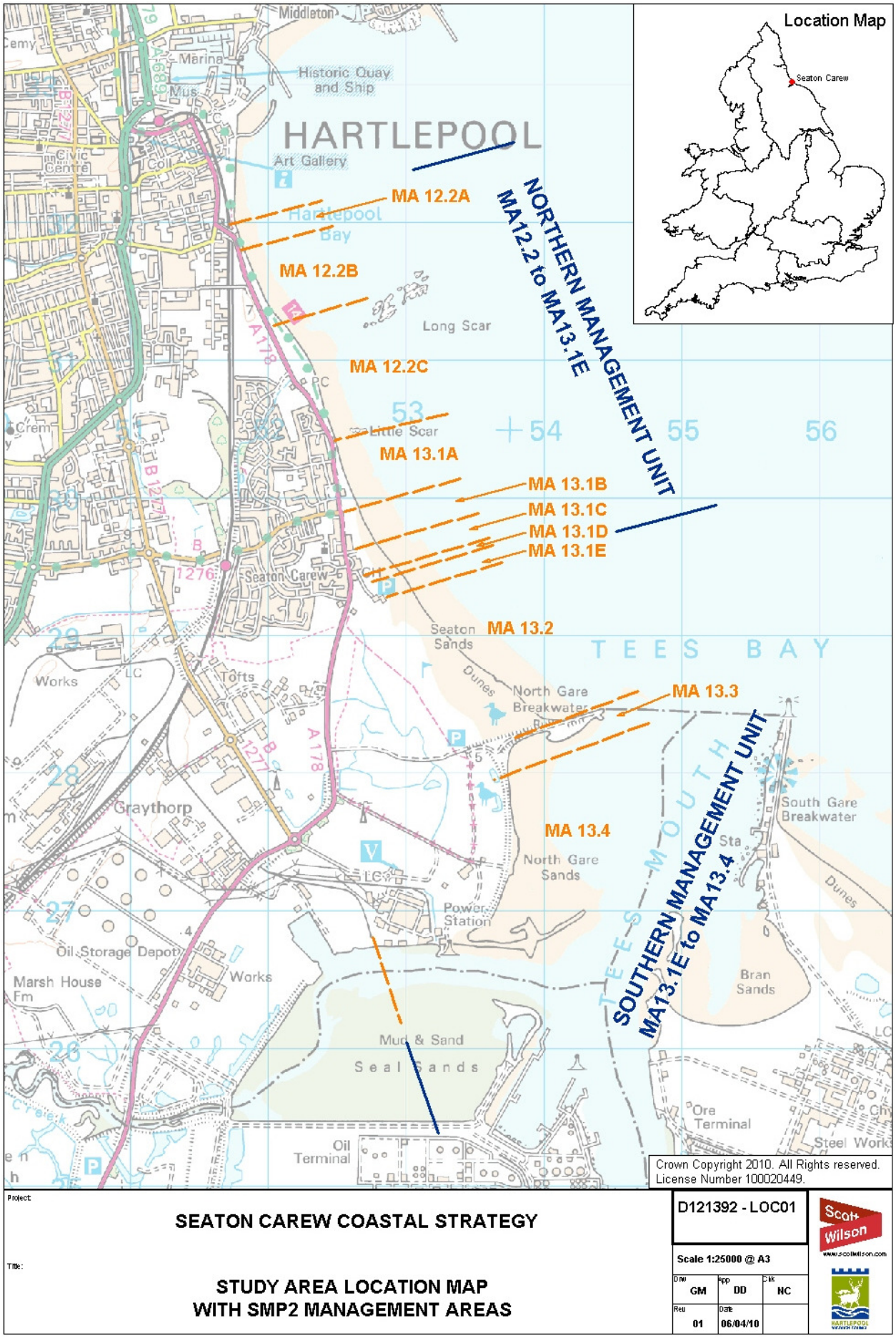



**Figure 2-2. Study area and location map**

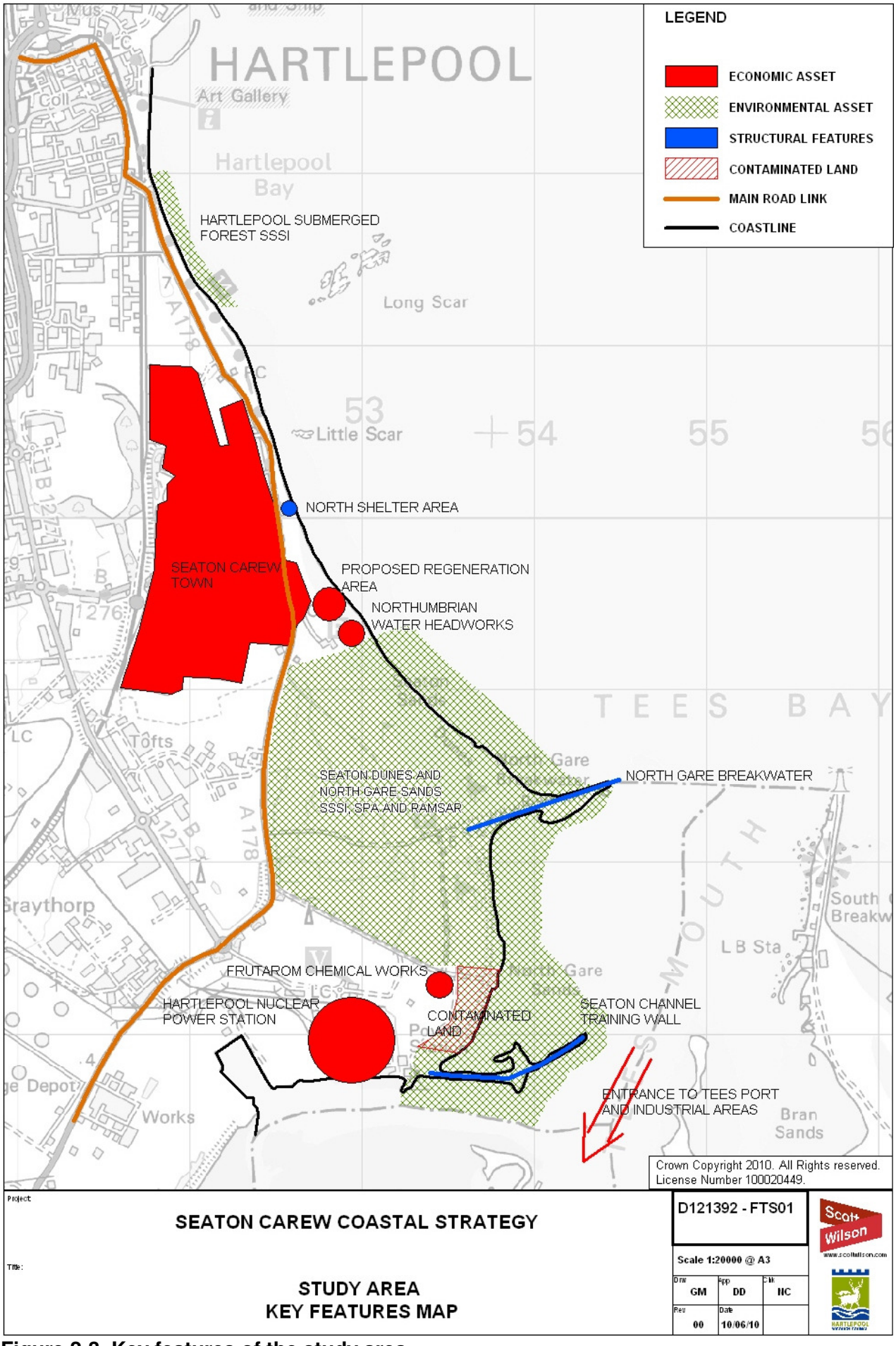



**Figure 2-3. Key features of the study area**

### History of Coastal Flooding and Erosion

2.2.29 There have been historic reports of localised flooding (circa 1950's-60's) along the Seaton Carew frontage at the location of ramps leading on to the beach. These ramps have now been modified with increased crest levels.

2.2.30 Current and estimated future tidal levels are not sufficient to cause tidal inundation without failure of the existing defences. Therefore, the frontage is primarily at risk from erosion of the beach and high land behind the defences, following defence failure.

2.2.31 For a history of defence failures along the Strategy frontage refer to section 3.1.

## 2.3 Current Approach to Erosion Risk Management

### Measures to Manage Coastal Erosion

2.3.1 Table 2.2 shows a summary of the primary defences within each Management Area of the Strategy. For full details of the defences and their current conditions reference should be made to the Seaton Carew Coastal Strategy: Stage A Report (Refer to Appendix J).

**Table 2.2: Management Area Defences**

| Management Area | Defence Type |
|---|---|
| MA12.2 | Full height rock revetment in front of seawall |
| MA13.1 | Northern section comprises seawall with narrow beach crest<br>Southern section comprises seawalls fronted by wide beach crest |
| MA13.2 | Natural dunes |
| MA13.3 | North Gare Breakwater, acts as a control structure supporting the dunes and beaches of MA13.1 and MA13.2 |
| MA13.4 | Coastline consists of dunes supported by Seaton Channel Training Wall as a control structure. |

2.3.2 There is currently no adopted coastal strategy to manage the increased risks along the frontage as a result of defence degradation, and future sea level rise. HBC currently manages the coastal defences along MA12.2 and MA13.1 on a general and reactive maintenance basis. The two control structures within MA13.3 and MA13.4 are privately owned by PD Teesport.

2.3.3 Policies by which the Seaton Carew frontage is recommended to be managed were presented in the 2nd Generation SMP; Table 2.3 shows the recommended policies.

**Table 2.3: SMP2 Coastal Policies for Seaton Carew**

| Management Area | Present to 2025 | 2026 to 2055 | 2056 to 2105 |
|---|---|---|---|
| Seaton Carew North MA12.2 | Hold The Line | Hold The Line | Hold The Line |
| Seaton Crew Town MA13.1 | Hold The Line | Hold The Line | Hold The Line |
| Seaton Sands MA13.2 | No Active Intervention | No Active Intervention | No Active intervention |
| North Gare Breakwater MA13.3 | Hold The Line | Hold The Line | Hold The Line |
| North Gare Sands MA13.4 | No Active Intervention – Controlled by structure to the South | Managed Realignment – Controlled by structure to the South | Managed Realignment – Controlled by structure to the South |

# 3 Problem Definition and Objectives

## 3.1 Outline of the Problem

3.1.1 A visual condition survey and assessment of the defences was carried out along the Seaton Carew frontage by a competent Structural Engineer. In combination with the visual inspection, physical intrusive investigations, concrete testing, and collation of the history of the defences and repairs were used to determine the residual lives of the defences.

**Seaton Carew North MA12.2**

3.1.2 These defences are currently in good condition (Appendix D – Plate 1 and Plate 2) with a residual life of approximately 30 years without significant maintenance. They currently provide a good standard of protection against overtopping; to approximately the 1 in 200 year pedestrian standard. Although projected sea level rise will reduce the protection provided, the defences are estimated to maintain a good level of overtopping protection over the Strategy duration.

**Seaton Carew Town North MA13.1A**

3.1.3 The defences along this section were built circa 1938, but are generally in good condition and comprise vertical concrete walls with a recurved parapet. Whilst the walls themselves are in good condition, reduced beach levels have resulted in undermining of the defence toe and loss of fill material from behind the wall (Appendix D – Plate 3 to Plate 10). Therefore, the walls have been assessed as having a residual life of approximately 5 years due to the undermined foundations which leave the walls vulnerable to catastrophic failure during significant storm events. Temporary emergency toe protection has been provided to prevent further undermining, however this does not extend the full length of the wall at risk and is inadequate in its volume.

3.1.4 Within the southern section of this defence length there is a low level area, known as the 'North Shelter', with a significantly lower crest level which is particularly vulnerable to overtopping and breaching. Damage events have occurred at this section in 2006 and 2007. The 2007 event resulted in a near fatal accident when a member of the public fell into a void that opened up in the promenade behind the defence (Appendix C – Figure 2). HBC has since closed this area to public access due to the residual risk of further failures. This incident highlights the urgent need for works to prevent further undermining, wash out of fill material, and failure of the promenade behind the existing walls.

**Seaton Carew Town South MA13.1B, MA13.1C and Fairground Site MA13.1D**

3.1.5 Defences along this section were constructed during 1916-1938 of masonry walls with the later addition of mass concrete walls along the promenade. These defences are currently protected by a wide sandy beach but are becoming increasingly exposed to waves.

3.1.6 In places the defences are in a state of disrepair with spalling concrete exposing the reinforcement (Appendix D – Plate 11 and Plate 13). Intrusive surveys indicated that the quality of concrete is poor and of low strength. These defences are assessed as having a residual life of 5 to 15 years. They currently rely on the presence of the wide beach, which is essential to reduce the size and frequency of waves reaching the wall.

3.1.7 Predicted future sea level rise will reduce beach levels and crest width in front of the defences and will expose the walls to direct wave attack for which they were not designed, and would result in catastrophic failure.

**Southern Fairground Site MA13.1D and Coach Park MA13.1E**

3.1.8 The southern section of MA13.1D is a sloping concrete revetment with low crest levels and MA13.1E comprises a low crested boundary wall around the car park – which has failed in places (Appendix D – Plate 14).

3.1.9 These defences rely on the wide beach fronting them to provide effective erosion protection. Flood protection is provided by higher land levels behind the defences; however, the Northumbrian Water Pumping Station, situated immediately behind the defences, remains vulnerable to inundation.

**Seaton Dunes MA13.2**

3.1.10 The Seaton Dunes are a SPA and Ramsar designated environmental area (Refer to Table 2.1) and provide natural flood and erosion protection to MA13.2. The dune system is in a healthy condition, naturally stabilised by Marram Grass, it has shown no signs of landward movement since the construction of the North Gare Breakwater in 1882 (Appendix D – Plate 15 and Plate 16).

3.1.11 Sediment transport modelling has indicated erosion of the beach below the low water mark resulting in a steepening nearshore profile. This could lead to future erosion of the dune field which would be exacerbated if sediment supply from the north is reduced or prevented. Major erosion and loss of the dunes would result if the North Gare Breakwater was lost.

**North Gare Breakwater MA13.3**

3.1.12 The North Gare Breakwater provides Strategic control to a significant length of the Strategy frontage from MA13.3 up to the southern areas of MA13.1 supporting the beach and Seaton Dunes. Constructed from 1882 to 1892 from a slag waste core and mass concrete the structure extends approximately 1km. Currently the breakwater is in poor condition with and is expected to fail completely within 10 years. A number of failures in recent years have been repaired with reactive maintenance but the structure is at significant risk of catastrophic failure during a storm. Failure would result in substantial loss of beach along MA13.1 and MA13.2. The North Gare Breakwater supports the Seaton Dunes and protects the North Gare Sands, both environmentally designated areas (Refer to Table 2.1).

**North Gare Sands MA13.4**

3.1.13 This section of coastline consists of dunes and beach supported by the Seaton Channel Training Wall to the South of the Management Area and protected to the north by the North Gare Breakwater.

3.1.14 The Training Wall prevents sand migrating into the Seaton Channel and Tees Estuary. Historic accretion of sand has caused the building of a dune system between the North Gare Breakwater and the Training Wall. However, the condition of the Seaton Channel Training Wall is such that it is no longer effective at retaining sediment. Ongoing sand extraction for construction also poses a risk to long-term beach levels.

3.1.15 The dunes provide protection to the large reclaimed hinterland which includes Hartlepool Nuclear Power Station and the redundant Leather Chemical site which

contains significantly contaminated land. Failure of the Seaton Channel Training Wall would result in increased risk that the contaminated land would be exposed and leach into the Tees Estuary.

## 3.2 Consequences of Doing Nothing

3.2.1 The "Do Nothing" scenario assumes there is no expenditure on maintaining or improving defences and as a result defences along the frontage would fail depending on their residual life (Refer to Appendix C – Figure 3).

3.2.2 Along the Seaton Carew frontage failure of a defence section would lead to commencement of erosion of the hinterland behind the defences and eventual loss of assets. Full development of the erosion scenario along the Seaton Carew frontage is documented in the Seaton Carew Coastal Strategy – Stage B: Technical Assessment Report, Appendix K. Erosion lines were calculated for the entire Strategy period of 100 years the progression of erosion is shown in Appendix C – Figures 4 to 8.

**Table 3.1: Households Lost under "Do Nothing"**

| Epoch | Households Lost | |
|---|---|---|
| | Northern Management Unit (MA12.2 and MA13.1) | Southern Management Unit (MA13.2 / MA13.3 / MA13.4) |
| 0-20 | 0 | 0 |
| 21-50 | 153 | 0 |
| 51-100 | 333 | 0 |
| **Total** | **486** | **0** |

3.2.3 Within the Strategy there are a range of key assets, services and other damages that would occur as a consequence of the "Do Nothing" scenario. Table 3.2 outlines the key damages that occur within the Management Units and indicates the value of damage that would occur.

3.2.4 Hartlepool Nuclear Power Station has a minimum estimated cost of replacement of £2 billion. The inclusion of such losses would significantly skew the economic analysis and result in all options being economically viable. Due to the national importance of the Nuclear Power Station for power production it would not be allowed to be lost to erosion. Therefore, a substitute loss for providing new intakes and coastal defences has been included in the economic analysis as the damage value at a notional level of £25 million.

**Table 3.2: Key Damages under "Do Nothing" Scenario**

| Management Unit | Damage | Value |
|---|---|---|
| **Northern** | Residential and Commercial Assets | £92 million |
| | General Infrastructure / Services | £17 million |
| | Northumbrian Water Headworks – Including supporting Infrastructure and Outfall | £40 million |
| | Recreation and Tourism | £157 million |
| | Major Health and Safety Risks | Not Costed |
| | Loss of Coronation Drive - critical transport link. | £2 million |
| **Southern** | Loss of Functionality of Teesport Entrance Channel and supported Teeside Industrial Area | £100 million (conservative estimate) |
| | Loss of Operation / Protection to Hartlepool Power Station | £2 Billion – (Substitute value of providing additional defences £25 million) |
| | Exposure and Disposal of Contaminated Land | Not Costed |
| | Loss of Chemical Works | £12 million |
| | ~~Loss of Environmentally Designated Areas including~~ | Not Costed |

| Management Unit | Damage | Value |
|---|---|---|
| | SPA and Ramsar | |
| | Loss of Golf Course | Not Costed |

3.2.5 The area of contaminated land behind the North Gare Sands dunes would be exposed if the dunes were subject to erosion. This issue needs to be considered in the strategic management of the coastal defences along this frontage.

3.2.6 Table 3.3 provides a summary of the total monetised Present Value losses accrued under the "Do Nothing" scenario. These are the losses that have been used in the benefit-cost analysis.

**Table 3.3: Summary of "Do Nothing" Present Value (PV) Losses**

| Sector | Estimated Present Value Losses (£ millions) | |
|---|---|---|
| | Northern Management Unit (MA12.2 and MA13.1) | Southern Management Unit (MA13.2 / MA13.3 / MA13.4) |
| Residential/Commercial | 18.59 | 0 |
| Industrial | 0 | 82.12 |
| Services | 2.41 | 0 |
| Infrastructure | 29.17 | 0 |
| Recreational | 44.35 | 0 |
| **Total** | **94.52** | **82.12** |

3.2.7 Tables 3.4 and 3.5 show a summary of the current issues and the consequences of the 'Do Nothing' scenario within the Northern and Southern Management Units.

**Table 3.4: Northern Management Area Summary of 'Do Nothing' Scenario**

| | NORTHERN MANAGEMENT UNIT | | |
|---|---|---|---|
| **Management Area** | **MA12.2** | **MA13.1A** | **MA13.1B-E** |
| **Issues** | No significant issues as the new defences in good condition that offer protection to the northern area of Seaton Carew Town | Undermining and overtopping damage of defences. Temporary emergency works have been carried out. Defences are needed to protect Seaton Carew Town. | Undermining of defences. Generally badly deteriorated defences. Poor condition of defences is hindering the Council's regeneration objective in this area. |
| **Condition of Defence / Residual Life** | Defences in good condition. Only maintenance required until upgrade in year 50 of the defence strategy. | Poor condition, locally breached. Residual life up to 5 years. | Poor condition. Residual life between 5 - 10 years. |
| **Assets at Risk** | 82 Residential / Commercial properties over 100 years, none in yrs 0-20, 31 in yrs 21-50, 51 in yrs 51-100. Important infrastructure such as a major transport link (Yr 50), Northumbrian Water outfalls (Yrs 20, 35), mains sewers and gas and cable services. Loss of recreation and tourism | 212 Residential / Commercial properties over 100 years, none in years 0-20, 58 in years 21-50, 154 in yrs 51-100. Important infrastructure such as a major transport link (Yr 20), mains and combined sewers and gas and cable services. Loss of recreation and tourism. | 193 Residential / Commercial properties over 100 years, none in yrs 0-20, 65 in years 21-50, 128 in years 51-100. Important infrastructure such as a major transport link (Yr 20), Northumbrian Water Headworks (Yr 15), mains and combined sewers and gas and cable services. Loss of recreation and toursim |
| **Value of Damages** | Present Value: £9.17m<br>Cash Value: £43.20m | Present Value: £27.11m<br>Cash Value: £96.23m | Present Value: £58.23m<br>Cash Value: £163.80m |

**Table 3.5: Southern Management Area Summary of 'Do Nothing' Scenario**

| | SOUTHERN MANAGEMENT UNIT | | |
|---|---|---|---|
| **Management Area** | **MA13.2** | **MA13.3** | **MA13.4** |
| **Issues** | This area of beach and dunes is artificially held by the North Gare Breakwater situated in MA13.3 and consists of SPA, Ramsar and SSSI environmentally designated areas. | North Gare Breakwater controls the morphology of large areas of the strategy frontage both north and south and is crucial to prevent loss of beaches and SPA/Ramsar site | Seaton Channel Training wall controls the morphology of this Management Unit. Retains the SPA/Ramsar designated sites and prevents the contaminated land from being exposed. |
| **Condition of Defence / Residual Life** | Continued existence of these soft defences relies on the North Gare Breakwater being maintained | The North Gare Breakwaater is strategically important to the entire frontage. Currently in poor condition the breakwater is nearing the end of its structural life. Residual life upto 10 years having sustained significant breaches in recent years | Seaton Channel Training Wall is currently in poor condition. Residual life approximately 5 years. |
| **Assets at Risk** | No properties at risk. Environmentally designated sites (Ramsar/SPA/SSSI) would be lost if North Gare Breakwater fails. | Frutarom Chemical works (Yr 30), Hartlepool Nuclear Power Station (Yr 50) and Port Access channel (Yr 10) Environmentally designated sites (Ramsar/SPA/SSSI) would be lost if North Gare Breakwater fails. | Frutarom Chemical works (Yr 30), Hartlepool Nuclear Power Station (Yr 50) and Port Access channel (Yr 10). Environmentally designated sites (Ramsar/SPA/SSSI). |
| **Value of Damages** | No monetised benefits | Present Value: £41.06m<br>Cash Value: £68.50m | Present Value: £41.06m<br>Cash Value: £68.50m |

3.2.8 Note: The value of assets protected in MA13.3 and MA13.4 has been split equally between the Management Units – the Total PV Benefit for the Management Area is £82.12m. (i.e. these benefits are not double counted)

## 3.3 Strategic Issues

3.3.1 The Seaton Carew Coastal Strategy has reviewed the policies recommended by the SMP and investigated management methods to implement the policies along the frontage. The Seaton Carew frontage benefits from a strategic approach as the North Gare Breakwater controls a significant length of the frontage and the impact of how the structure is managed would be felt along a wide area of the frontage.

3.3.2 In developing the Strategy for Seaton Carew it has made strategic sense for the appraisal of existing defences, potential management options, and in the assessment of benefits to consider the frontage as the Northern Management Unit and the Southern Management Unit as defined below.

3.3.3 Management Areas 12.2 and 13.1 are currently protected by linear defences fronted by a beach which widens further south along the frontage. These Management Areas have been combined to form the **Northern Management Unit** within the Strategy. These defences are all similar in structure and form the main frontage of Seaton Carew town, protecting residential, commercial, and infrastructure assets from erosion. Many of the defences along this frontage also have the same issues with undermining the toe and management of overtopping.

3.3.4 The **Southern Management Unit** (MA13.2 to MA13.4) is dominated by the two main control structures the North Gare Breakwater and the Seaton Channel Training Wall. These structures control the shoreline throughout the MA13.2 and MA13.4 frontage – though the influence of the North Gare is also crucial to the beaches in the southern section of MA13.1 where it supports the wider beach crest in front of the defences. The management of the North Gare Breakwater and Seaton Channel Training Wall also have similar issues in terms of the environmentally designated sites which are supported by the structures.

## 3.4 Key Constraints

3.4.1 North Gare Sands and Seaton Sands are designated under SPA and Ramsar designations. Natural England has advised there may be a legal obligation to ensure that these areas are not lost with the failure of the North Gare Breakwater or the Seaton Channel Training Wall.

3.4.2 Some works within the Southern Management Unit will take place within the environmentally designated sites. Construction works would be temporary and necessary mitigations should be provided to reduce the impact on over-wintering birds. Long-term impact on the designated area from increases in structure footprints should be minimised where possible. Any increases should be discussed and agreed with Natural England at detailed design stage when the footprint extent can be fixed. Significant compensation areas are unlikely to be required given the marginal structure footprint increases.

3.4.3 MA13.4 is a critical area as it includes Hartlepool Nuclear Power Station which is an infrastructure asset of National importance. An area adjacent to the existing site has also been designated as a potential location for the development of a new Nuclear Power Station.

3.4.4 PD Teesport has an obligation to maintain the navigation within Seaton Channel and the Tees Estuary. The North Gare Breakwater and Seaton Channel Training Wall are required to prevent significant volumes of sediment entering these areas, which would impact a significant number of industrial assets within the Tees Estuary area. Seaton Channel is also required for water intake for the Hartlepool Nuclear Power Station.

3.4.5 The North Gare Sands dune system prevents the exposure of contaminated land within the old Leather Chemical Works.

## 3.5 Objectives

3.5.1 The key coastal objectives for the Strategy are:

- achieve the SMP2 Management Policy over the entire strategy period, where this is shown to be justified in terms of economic and environmental assessment;

- prevent the loss of assets (economic and environmental) to coastal erosion
- prevent the coastal flooding of assets along the study frontage;
- retain the natural protection provided by the beach and dune systems specially those designated under SPA and Ramsar;
- address the increased pressure on the existing coastal defences as a result of rising sea levels;
- achieve the above with minimal adverse impact on the existing social and environmental assets and where possible enhance these assets;
- reduce risks with regards to public safety along the frontage;
- prioritise works to address the most significant risks.

# 4 Options for Managing Coastal Erosion Risk

## 4.1 Potential FCRM Measures

4.1.1 In order to manage the frontage a review of the recommended SMP policies was undertaken. Based on the SMP2 policies (refer to Table 2.3) an initial assessment was undertaken to determine:

- if the SMP policy is sustainable to implement;
- if the implementation of the policy would require capital works; and,
- where works are required to implement the policy is there a suitable alternative policy that would not require capital expenditure.

**Table 4.1: SMP Policy Review**

| Management Area | SMP2 Policy | Implementation is Sustainable | Capital Works | Suitable Alternative Policy |
|---|---|---|---|---|
| Seaton Carew North MA12.2 | Hold The Line All 3 Epochs | **Yes.** Policy does not conflict with environmental or technical objectives | **Yes** | **No.** Alternative policies would result in loss of assets with little environmental or technical benefit |
| Seaton Carew Town MA13.1 | Hold The Line All 3 Epochs | **Yes.** Policy does not conflict with environmental or technical objectives | **Yes** | **No.** Alternative policies would result in loss of assets with little environmental or technical benefit |
| Seaton Sands MA13.2 | No Active Intervention All 3 Epochs | **Yes.** Policy does not conflict with environmental or technical objectives | **No** | **Not Required** |
| North Gare Breakwater MA13.3 | Hold The Line All 3 Epochs | **Yes.** Policy does not conflict with environmental or technical objectives | **Yes** | **No.** Alternative policies would result in loss of SPA and loss of beach to the North which forms part of the coastal defence. |
| North Gare Sands MA13.4 | No Active Intervention Epoch1 with Managed Realignment in Epoch 2 and 3 | **Yes.** Though policy needs to consider contaminated land. | **To control structure only** | Policy needs to address contaminated land. |

4.1.2 Table 4.1 shows the outcome of the SMP policy review; in general the policies selected at SMP level would meet the technical and environmental objectives of the Strategy and are sustainable in the long-term given suitable management responses.

4.1.3 For MA13.4 the SMP2 states that holding the position of the linear frontage is unwarranted provided flooding of the hinterland is prevented. The SMP2 identifies the importance of retaining control of the sediment at the southern extent of this Management Area and potentially midway (between the North Gare Breakwater) along the frontage in order to prevent potential infilling and siltation of the Tees Estuary. No consideration was given in the SMP2 to the contaminated land situated behind the slag

bank at the rear of the frontage. The SMP2 concludes that further examination of the policies within MA13.4 is required, this has been addressed within this strategy.

4.1.4 Table 4.2 shows a review of all potential management policies against the Management Units proposed by the Strategy. The table shows that the management policy is generally unaffected by the grouping of the frontage into the two Management Units.

**Table 4.2: Strategy Management Unit Policies**

| Policy | Northern Management Unit | Southern Management Unit |
|---|---|---|
| Do Nothing "No Active Intervention" | Significant economic losses including residential/commercial assets, key infrastructure and recreational assets. Significant Health and Safety impacts. | Loss of key control structures would impact Northern and Southern Management Units. Loss of port and disruption to power station. Major economic damage. |
| Managed Realignment | Not feasible due to presence of town. Economically unfeasible to develop new defence line behind existing defences. | Feasible in respect to undefended frontages between control structures, but not feasible for structures themselves. |
| Advance the line | No driver for this – would be more costly and more risky than hold the line. | No driver for this – would be more costly and more risky than hold the line. |
| Hold the Line | Feasible – subject to outcome of economic analysis and confirmation from SEA/HRA | Feasible – in respect of holding key structures subject to outcome of economic analysis and confirmation from SEA/HRA |

4.1.5 The North Gare Breakwater (MA13.3) and the Seaton Channel Training Wall (MA13.4) run perpendicular to the shoreline. Provided that the two control structures remain effective, the 1.5km shoreline between the structures could be managed under a 'No Active Intervention' policy; as proposed by the SMP2.

4.1.6 The Seaton Channel Training Wall is not specifically identified by the SMP2, however it currently retains the sediments which form the Dunes of North Gare Sands. The SMP2 highlights that retaining sediment along the southern end of MA13.4 is critical and this function is currently performed to some extent by the Seaton Channel Training Wall. This structure already performs the function of maintaining navigable access to Teesport and Seaton Channel and also maintaining the operation of the cooling water intakes of the nuclear power station,

4.1.7 Strategic management of MA13.4 is further complicated by the presence of contaminated land on the site of the abandoned Leathers Chemical Works. Within the natural dunes of MA13.4 exists an informal defence line where the dunes have previously been reinforced with slag barrels. This existing linear defence line is proposed as the landward limit of any "Managed Realignment" pending the remediation of the contaminated land. The morphology of the MA13.4 area and the implemented management policy should be reviewed within future strategies to ensure that the risk of exposing contaminants is minimised.

4.1.8 Therefore, it is recommended by the strategy that the Seaton Channel Training Wall is held and the frontage between the North Gare Breakwater and the Seaton Channel Training Wall (MA 13.4) will be managed under a "No Active Intervention" policy initially with managed realignment in the future with the position of the realigned frontage being subject to remediation of the contaminated land.. This complies with the recommendations of the SMP2.

## 4.2 Long List of Options

4.2.1 The review of SMP policies identified that where a "Hold the Line" policy is the preferred management policy capital works would be required. Unless shown to be uneconomic the implemented management policy would be to "Hold the Line" for these

sections. Therefore the Strategy has investigated options to maintain the provision of defences over the entire strategy period (100 Years).

4.2.2 Following the review of coastal processes along the frontage two forms of works were reviewed; beach management techniques and defence structures. Details of the Long List of options can be found in the Seaton Carew Coastal Strategy Stage B Report (Refer to Appendix K).

4.2.3 Beach management techniques included:

- Beach Recharge – Periodic artificial renourishment of beaches along the frontage to maintain beach levels and widths;
- Groynes – Construction of structures perpendicular to the shore to hold beach sediment along the frontage to increase beach levels;
- Offshore Breakwaters – Construction of breakwaters to reduce waves reaching existing defence structures and promote increased beach levels.

4.2.4 Defence Structures included:

- Maintenance of Existing Defences – This would be the "Do Minimum" approach providing patch repairs to existing defences but not a substantial increase in structural integrity.
- Toe Protection – Provision of additional scour protection at the toe of existing defences to prevent undermining.
- Revetments – Provision of a revetment in front of existing defences to prevent undermining and reduce overtopping
- Seawalls – Provision of new or modified seawall to provide increased protection from wave attack or reduce overtopping.

4.2.5 Non-Capital options were considered along the frontage to manage specific issues such as the risk to pedestrians from overtopping, in areas where overtopping is not sufficient to cause inundation of assets. In such areas overtopping could be managed through promenade closures rather than through provision of increased defences. Where these options are adopted they are detailed in the preferred strategy.

## 4.3 Options Rejected at Preliminary stage

4.3.1 Options from the Long List were assessed to determine those options taken forward for more detailed consideration. This section provides a summary of the overall options that were rejected, during this assessment. For full details of the assessment of options refer to Seaton Carew Coastal Strategy Stage B Report (Refer to Appendix K).

4.3.2 Options were initially assessed on a Management Unit basis in order to shortlist options relevant to the implementation of the management policies; refer to Table 4.3 for the Northern Management Unit and Table 4.4 for the Southern Management Unit.

**Table 4.3: Northern Management Unit - Options Rejected at Preliminary Stage**

| Management Option | Tech | Env | Econ | Key Reasoning | Rejected |
|---|---|---|---|---|---|
| Beach Recharge | | | | Not sustainable in the long-term due to high capital costs | YES |
| Groynes | | | | Would change character of frontage and impact amenity of the beach. It is also unsustainable due to high capital costs. | YES |

| Management Option | Tech | Env | Econ | Key Reasoning | Rejected |
|---|---|---|---|---|---|
| Offshore Breakwaters | | | | Would significantly alter the character of the frontage and is unsustainable due to high capital costs. | YES |
| Maintenance of Existing Defences | | | | Maintenance would be suitable for areas of good defence or to maintain improved defences in the future. | NO |
| Toe Protection | | | | Would address undermining issues. Cost effective solution | NO |
| Revetments | | | | Would address undermining and overtopping issues | NO |
| Seawall | | | | Would address structural and overtopping issues | NO |

**Table 4.4: Southern Management Unit - Options Rejected at Preliminary Stage**

| Management Option | Tech | Env | Econ | Key Reasoning | Rejected |
|---|---|---|---|---|---|
| Beach Recharge | | | | Would be contradictory to management policies. Option would not meet environmental objectives and is unsustainable due to high capital costs. | YES |
| Reinstate Existing Control Structures | | | | Would not impact coastal processes. | NO |
| Offshore Breakwaters | | | | Would be contradictory to management policies. Option would not meet environmental objectives and is unsustainable due to high capital costs. | YES |
| Maintenance of Existing Defences | | | | Structures have failed, therefore require reinstatement to be effective. Would not meet environmental objectives. | YES |
| Toe Protection | | | | Would not address structure issues or assist policy implementation. Unsustainable due to high capital costs. | YES |
| Revetments | | | | Provision of shoreline defences would be contradictory to management policies. Would not meet environmental objectives. | YES |
| Seawall | | | | Provision of shoreline defences would be contradictory to management policies. Would not meet environmental objectives. | YES |

4.3.3 Defence solutions along the Seaton Carew frontage are not particularly sensitive to wave height and storminess. Littoral drift in the area is predominantly southwards and is not susceptible to minor changes in mean wave height and direction. Current beach levels are maintained by the North Gare Breakwater to the south and maintenance of this structure is key to the frontage. A non-linear approach to beach management (groynes or offshore breakwaters) may provide some benefit to combat beach lowering, however comparison of the costs has shown that adopting non-linear defences would require substantial capital investment and consequently are far less economically viable than amending and maintaining the existing linear defences.

4.3.4 For the Northern Management Unit there are a range of feasible options that should be investigated further to assist in the implementation of the management policy.

4.3.5 For the Southern Management Unit the only feasible options, in order to be compliant with the SMP2 policies, are to reinstate the failed North Gare Breakwater and Seaton

Channel Training Wall. Whilst these structures still exist they require capital works beyond simple maintenance to ensure they remain functional.

## 4.4 Options Short-listed for Appraisal

4.4.1 The baseline option against which economics will be appraised is the "Do Nothing" scenario as detailed in Section 3.2. All short-listed options within the Strategy have been developed and costed to provide continued protection throughout the Strategy period and would accrue all the Benefits identified under the "Do Nothing".

### Northern Management Unit

4.4.2 The options short-listed for use in implementing the management policy of "Hold The Line" within the Northern Management Unit include:

- Maintenance of existing defences;
- Toe Protection;
- Revetments;
- Seawalls.

4.4.3 **MA12.2** is in good condition and provides a good level of protection to the frontage from overtopping. This section of defence does not require any capital works in the short to medium term and would only require periodic maintenance.

4.4.4 **MA13.1A** is at the most significant risk of failure and maintenance for this section is not an option. If suitably protected from undermining the existing seawall would not require replacement. Options considered for this length are:

- Provision of toe protection in the form of a low crested revetment (Refer to Appendix G for schematic diagram).
- Construction of a full height revetment similar to that along MA12.2 (Refer to Appendix G for schematic diagram).

4.4.5 **MA13.1B to MA13.1E** defences along this section of wall are unsuitable to be maintained as they are not currently designed for significant wave attack. Options considered for this length of shoreline are:

- Provision of a full height revetment with a concrete crest beam (Refer to Appendix G for schematic diagram).
- Provision of a seawall now to protect against overtopping with future provision of a low crested rock revetment when beach levels are affected by sea level rise (Refer to Appendix G for schematic diagram).

4.4.6 Where overtopping now or in the future (as demonstrated in the Seaton Carew Stage B Report. Refer to Appendix K) is shown to pose a risk to pedestrians during storms access to the promenade should be restricted. This management approach will maintain the safety of pedestrians without the need for expensive and obtrusive upgrades to the existing seawalls along the frontage.

### Southern Management Unit

4.4.7 For the Southern Management Unit, the main coastline would be managed under a "No Active Intervention" and would therefore not require any works. Coastline monitoring should be undertaken to monitor any accretion or erosion that may occur.

Particularly with regards to the North Gare Sands area and the proximity of the coast to the contaminated land area.

4.4.8 Works would be required to reinstate the existing control structures to a suitable level of structural performance and effectiveness. Where feasible the remaining portions of structures would be utilised to minimise the impact on adjacent environmental areas.

4.4.9 For the **North Gare Breakwater**, reinstatement would require the provision of a formal layer of armour protection (concrete cubes or suitable armour unit) to encase the existing structure (Refer to Appendix G for schematic cross section and plan). The armour units would dissipate wave energy and ensure that the existing structure, which would form the core, did not deteriorate further, preventing further breaches.

4.4.10 For the **Seaton Channel Training Wall**, reinstatement would require the creation of an armoured groyne to prevent further breaches and allow capture of sand to help build the dunes and prevent siltation of the Tees Estuary and Seaton Channel. (Refer to Appendix G for schematic layout).

# 5 Options Appraisal and Comparison

## 5.1 Technical Issues

5.1.1 This section provides a summary of the detailed technical and environmental assessment of individual options along the Management Units. For a full assessment reference should be made to the Seaton Carew Coastal Strategy Stage B Report.

### Northern Management Unit

5.1.2 The main technical issues for the Strategy to address along this management unit are the continued protection of assets against erosion and the overtopping risks to pedestrians. MA13.1A also has significant health and safety aspects to be addressed where failure of the defences has previously occurred.

5.1.3 The **MA12.2** defences are in good condition and provide good overtopping protection. These defences only require maintenance to provide continued effective protection from erosion; this is the "Do Minimum" approach. Further options have not been investigated as no additional technical benefits have been identified from capital expenditure on the existing defences. The "Do Minimum" approach is technically simple to implement. Table 5.1 provides a summary of the "Do Minimum" option.

**Table 5.1: Northern Management Unit (MA12.2) – Assessment Summary**

| Option | Technical | Environment | Economic (Indicative benefit-cost ratio) |
|---|---|---|---|
| Maintenance "Do Minimum" | This option is for general maintenance of the existing structures due to their current high standard of protection and residual life. Stage A report illustrated that overtopping is acceptable for the next 50 years. | Minimal impact on the existing environment. No impact on nearby SSSI. | 5.5 |

5.1.4 The **MA13.1A** defences require protection through additional works. Due to the previous failures of the defences it is clear that a maintenance only or "Do Minimum" option would result in further failures. Two capital works options have therefore been assessed, a summary of the assessment is provided in Table 5.2.

**Table 5.2: Northern Management Unit (MA13.1A) – Assessment Summary**

| Option | Technical | Environment | Economic (Indicative benefit-cost ratio) |
|---|---|---|---|
| Full height rock revetment | Would prevent further undermining of the defences. Defence would significantly reduce future overtopping rates. Would reduce wave reflection during storms aiding beach retention. | The environmental impact would be moderate due do to the increased footprint of the structure, However it would be visually compatible with the defences to the north. | 5.0 |

| Option | Technical | Environment | Economic (Indicative benefit-cost ratio) |
|---|---|---|---|
| Toe Protection (in the form of a low crested revetment) | Would prevent further undermining of the defences but would not significantly reduce future overtopping. Could be upgraded to Full Height Revetment in the future. | The environmental impact would be minimised as a smaller footprint would be required. Would also be visually compatible with the defences to the north. | 8.0 |

5.1.5 For **MA13.1A** both options would fill the 'North Shelter' area where previous breaching has occurred. At this area defences would be raised to the level of the adjacent seawall and then protected by either the full height rock revetment or the toe protection. This would address the significant health and safety risks currently posed to pedestrians using this area.

5.1.6 The **MA13.1B to MA13.1E** defences are insufficient to withstand any significant wave action as they currently consist of poor quality concrete. "Do Minimum" maintenance would result in failure should significant wave attack occur during a storm. Options have been investigated to refurbish or replace the existing defences and address the potential for loss of beach and scour at the toe of the defences. Table 5.3 provides a summary of the assessment.

**Table 5.3: Northern Management Unit (MA13.1B to MA13.1E) – Assessment Summary**

| Option | Technical | Environment | Economic (Indicative benefit-cost ratio) |
|---|---|---|---|
| Full height rock revetment in front of the existing Wall | Would leave residual risk of wall failure behind revetment during storms. Would provide some additional protection against future overtopping rates but crest level would be limited to existing defence levels | Not considered as an option. Technically unsuitable. | |
| Toe protection in front of the existing Wall | Would leave significant risk of wall failure during storms. No additional protection offered against future overtopping levels. | Not considered as an option. Technically unsuitable. | |
| Full height rock revetment to replace existing defences | Existing wall would be replaced with a rock revetment with a defence level suitable for future overtopping rates. Existing defence line would be marginally adjusted to prevent significant alignment changes causing wave focussing. | The environmental impact would be moderate due to the increased footprint. | 8.0 |
| New seawall with phased toe protection (in the form of low crested revetment) | Would provide defences suitable to withstand direct wave attack. Would also be to a level to provide good overtopping protection. Phased approach allows a bespoke response to potential undermining and overtopping risk caused by future sea level rise. Defence line would be marginally adjusted to prevent significant alignment changes causing wave focussing. | The environmental impact would be phased. Replacement of the seawall would have minimal impact. Future toe protection would require a marginal increase in footprint. Phasing allows a response to actual sea level rise and future risk. | 8.1 |

5.1.7 All proposed options within the Northern Management Unit are straightforward to implement as the solutions are well understood and are in existence along the frontage. All options (except those rejected on technical grounds) proposed have little residual risk involved.

5.1.8 The analysis of options has not considered the optimisation of differing levels of protection against overtopping. This is because (a) the levels of overtopping do not generate significant damages and hence improved protection does not generate monetary benefits, and (b) the marginal cost of providing a slightly higher or lower level of crest wall or promenade would not be significant in the overall cost estimation at this stage. It is intended that where works are proposed PAR's will address this issue.

5.1.9 As overtopping is not a key driver for providing the defence and determining the standard of defence, incremental benefit cost ratios do not apply to the selection of defence options. Where overtopping remains a residual risk, to pedestrians using the promenade (but not to assets), this will be managed by controlling public access rather than providing a uniform and high level of overtopping protection. This is a more economic and cost-beneficial approach.

5.1.10 All options have been developed to provide 100 years of continued erosion protection. This duration is considered appropriate in the strategy context. For protection to be maintained over the 100 years duration allowances for appropriate maintenance and future capital works have been included where necessary in the economic assessment of options.

5.1.11 Defences should be maintained and designed such that they can withstand a minimum 1 in 200 year storm without failure.

5.1.12 Potential increases in future overtopping rates are not specifically addressed by all options. Where only toe protection is provided alternative management of overtopping risks including restricting public access to the promenade area offer a significantly more cost effective approach than increasing crest levels of existing defences. The risk of increased overtopping rates is to the safety of promenade users and not risk of inundation of assets due to the wide promenade area that exists behind the defences.

5.1.13 Due to the simple nature of the solutions none of the potential options prejudice any future upgrades should sea level rise or overtopping rates exceed current estimates.

5.1.14 The options have been re-assessed against revised Climate Change guidance and under the new Flood & Coastal Resilience Partnership Funding. The scheme options and relative priorities of the schemes do not change. The results of the impact of funding can be found in Appendix Q.

### Southern Management Unit

5.1.15 The main technical issue to be addressed in the Southern Management Unit is to achieve the continued presence of the existing control structures in order to provide protection to the Seaton Channel / Tees Estuary and to support the designated SPA and Ramsar areas.

5.1.16 **MA13.2** is to be managed under a "No Active Intervention" policy and therefore no options require assessing.

5.1.17 The North Gare Breakwater has previously failed and is currently maintained by patch repairs. To date these repairs are insufficient to deal with the continued large wave exposure experienced by the structure, therefore the "Do Minimum" maintenance approach is rejected. Options for reinstating the structure to a sufficient standard to remain effective have been assessed and summarised in Table 5.4.

**Table 5.4: Southern Management Unit (MA13.3) – Option Assessment**

| Option | Technical | Environment | Economic (Indicative benefit-cost ratio) |
|---|---|---|---|
| Reinstate structure with full height armour layer | This option would prevent undermining and significantly improve the structural performance. A full height armour layer could utilise the existing structure as a core as it would sufficiently reduce wave impact loadings. | Compared to the large area supported by the structure the environmental impact due to the increased footprint is considered minimal and could be mitigated. | 5.9 |
| Reinstate structure with low crested armour layer | This option would prevent the structure undermining. However this option would expose the existing structure to significant wave forces and would have a high residual risk of structural failure. Given the strategic nature of this structure this option is not considered technically feasible. | Not considered as an option. Technically unsuitable. | |

5.1.18 The Seaton Channel Training Wall requires reinstating to a level such that it continues to provide effective retention of sand in order to provide continued protection of the dunes. "Do Minimum" maintenance is rejected on the basis that it would not improve the effectiveness of the structure sufficiently. Table 5.5 shows the summary assessment of the reinstatement of the existing structure.

**Table 5.5: Southern Management Unit (MA13.4) – Option Assessment**

| Option | Technical | Environment | Economic (Indicative benefit-cost ratio) |
|---|---|---|---|
| Reinstate Seaton Channel Training Wall | Would effectively continue retention of sediment on North Gare Sands. Could utilise parts of the existing structure as a foundation. Structure alignment could also be improved. | Would provide continued support to the existing dunes (SPA and Ramsar) and help to contain the contaminated land. | 10.5 |

5.1.19 All proposed options within the Southern Management Unit are straightforward to implement. Due to the strategic nature of the two control structures options with high residual risk have been rejected.

5.1.20 Option designs would need to take account of future sea level rise and climate change in terms of armour sizing; overtopping is not an issue for either structure.

5.1.21 The options proposed all achieve the main objectives outlined in Section 3.5. The implementation of these options will ensure the continued effectiveness of the control structures and ensure that support and protection of the SPA and Ramsar sites is maintained. Ensuring continued effectiveness of the structures allows the shoreline of MA13.2 and MA13.4 to be managed under "No Active Intervention" policies in order to meet environmental objectives.

5.1.22 The options have been re-assessed against revised Climate Change guidance and under the new Flood & Coastal Resilience Partnership Funding. The scheme options and relative priorities of the schemes do not change. The results of the impact of funding can be found in Appendix Q.

## 5.2 Environmental Assessment

5.2.1 Key environmental sites within the Strategy area are identified in Figure 2.

5.2.2 The European Union legislated for Strategic Environmental Assessment (SEA) with the adoption of Directive 2001/42/EC (the 'SEA Directive'). Whilst coastal strategies are not specifically covered by the SEA Directive, the Seaton Carew Coastal Strategy has followed these requirements to provide a structured methodology for the assessment of options and ensure compliance with environmental objectives. The SEA Environmental Report is submitted as a separate report in support of the Strategy (Refer to Appendix L).

5.2.3 In order to comply with the requirements of the EC Habitats Directive 1992, land use plans require an Appropriate Assessment (AA) where they are likely to have a significant effect on a Natura 2000 site. As the Seaton Carew Study frontage contains the Teesmouth and Cleveland Coast SPA and Ramsar a Habitats Regulations Assessment has been carried out. The Habitats Regulations Assessment Screening Report is attached as a separate report with a letter from Natural England confirming that at this stage an Appropriate Assessment is not required (Refer to Appendix I).

5.2.4 Neither the SEA nor the HRA has identified any significant impacts that would prevent the preferred Strategy being adopted.

5.2.5 North Gare Sands and Seaton Sands are designated under SPA and Ramsar conventions; Natural England has advised there may be a legal obligation to ensure that these areas are not lost with the failure of the North Gare Breakwater or the Seaton Channel Training Wall. Reinstatement to provide continued and effective structures is critical to preventing their loss and should therefore be adopted in the preferred Strategy. Reinstatement will have a positive impact on maintaining the SPA.

5.2.6 The implementation of the Seaton Carew Coastal Strategy will maintain a suitable level of coastal protection taking into account climate change and sea level rise. This will ensure that the residential, commercial and industrial properties behind the defences will be protected from inundation and coastal erosion, and that people are living in a safe environment. The Strategy will not have any significantly long-term adverse impact on landscape, water resources or water quality, and will maintain and enhance access for amenity, tourism and recreation.

5.2.7 Key environmental issues relating to individual options are summarised in Table 5.1 to Table 5.5. Key strategic environmental issues for the two Management units are summarised in Table 5.6 and Table 5.7.

**Table 5.6: Northern Management Unit – Key Environmental Impacts, Mitigation and Opportunities**

| Key Positive Impacts | Key Negative Impacts | Mitigation/ Enhancement Opportunity |
|---|---|---|
| **"Do Nothing"** | | |
| Could be considered to be allowing the natural evolution of the coast. | Would result in the loss of beach and promenade along the frontage as well as significant assets.<br>Would have significant impact on the Seaton Carew community, including social, economic and health and safety issues. | N/A |

| Key Positive Impacts | Key Negative Impacts | Mitigation/ Enhancement Opportunity |
|---|---|---|
| **Implementation of "Do Something" Options** | | |
| Would prevent loss of assets within Seaton Carew.<br>Would maintain the frontage as a tourism and recreation area.<br>Addresses health and safety risks to the public. | Some options would involve marginal loss of recreational beach area. | Provision of new defences in MA13.1B to MA13.1E would assist HBC regeneration plans for the area. |

**Table 5.7: Southern Management Unit – Key Environmental Impacts, Mitigation and Opportunities**

| Key Positive Impacts | Key Negative Impacts | Mitigation/ Enhancement Opportunity |
|---|---|---|
| **"Do Nothing"** | | |
| Could be considered to be allowing the natural evolution of the coast. | Loss of SPA, Ramsar and beach frontage.<br>Would expose contaminated land. | N/A |
| **Reinstate Control Structures** | | |
| Would provide continued support of the SPA and Ramsar sites.<br>Would prevent loss of the beach frontage along Seaton Carew. | Some increase in control structure footprint would be required, but could be mitigated by natural accretion or compensation area. | Could be designed to increase height and area of dune systems.<br>Would allow additional time for decision regarding contaminated land issue. |

5.2.8 A Water Framework Directive (WFD) Assessment for the Seaton Carew Strategy was undertaken (Refer to Appendix P). The assessment identified two waterbodies within the vicinity of the strategy; The Yorkshire North coastal waterbody and the Tees transitional waterbody. The Yorkshire North coastal waterbody is currently classified as having good potential, whilst the Tees is classified as moderate. The Yorkshire North waterbody has a target status objective of maintaining its current potential, whereas the Tees waterbody has a status objective of good potential by 2027.

5.2.9 The WFD concluded that the preferred Strategy option of maintaining the existing defences within the Northern Management Unit may lead to beach narrowing and steepening, with a consequent impact on benthic habitats of the coastal water body. Although coastal squeeze is unavoidable where defences are not relocated landward and mitigation opportunities are not practicable, which means that for the Northern Management Unit Environmental Objective WFD2 may not be met for the Yorkshire North coastal waterbody. All Environmental Objectives (WFD1 to 4) will be met by the preferred Strategy option for the Tees transitional waterbody.

5.2.10 Detailed assessment of potential impacts were undertaken and concluded that the scale of the defended coastline along the Northern Management Unit is minor in comparison to the scale of the entire Yorkshire North coastal waterbody. Also, the ecology along the Strategy frontage is not of great significance; the habitats present are of low rarity locally and do not lie within designated conservation sites. On a wider catchment scale the loss of small sections of the inter-tidal area would not be significant. The WFD concluded that the impact of the Strategy options for the Northern Management Unit upon the Yorkshire North coastal waterbody would be minimal.

## 5.3 Social and Community Impacts

5.3.1 Consultation with statutory and local stakeholders has been carried out during the Seaton Carew Coastal Strategy study to ensure that consultees have input to the process and identify any potential social and community impacts. Full details of the consultation process are reported in the Stakeholder Engagement Strategy (refer to Appendix N).

5.3.2 Social and community impacts are covered in the Strategic Environmental Assessment (SEA) which is reported in full in the Environmental Report (refer to Appendix L).

5.3.3 The regeneration of the Seaton Carew frontage and foreshore is a primary objective for Hartlepool Borough Council. As it maintains the defences and the standard of protection, the Strategy is consistent with the aims of the regeneration policy, and the regeneration proposals being considered will be carefully developed to be in line with the defence strategy. The potential for developer contribution to coast protection schemes will be explored at the scheme level.

## 5.4 Option Costs

5.4.1 To ensure complete whole-life costings, costs include future capital, maintenance and monitoring costs as required. No management costs are included as coastal management is provided by HBC. Land purchase or compensation is not applicable.

5.4.2 Option costs have initially been estimated and subsequently benchmarked against a Contractor that carried out similar work along the Seaton Carew frontage and an EA Framework Contractor (May 2010). Breakdowns of costs are provided in the Seaton Carew Coastal Strategy Stage B Report (refer to Appendix K).

5.4.3 Optimism bias adjusted in-line with guidance has also been applied to cost estimates. Investment timings have been based on the estimated residual life of existing structures.

5.4.4 Table 5.8 and Table 5.9 show a summary of the option costs for all viable options considered. Note that for MA13.1A and MA13.1B-E option costs for two options are shown, selection of the preferred option will be detailed in Section 6.

**Table 5.8: Northern Management Unit – Summary of Option Present Value (PV) Costs**

| Element | MA12.2 (£k) | MA13.1A Full Revet (£k) | MA13.1A Toe Protection (£k) | MA13.1B-E Revetment (£k) | MA13.1B-E Seawall (£k) |
|---|---|---|---|---|---|
| Initial implementation cost (Year 0-5) | | | | | |
| Capital | 0 | 3,720 | 1,980 | 4,860 | 3,560 |
| Non-capital | 0 | 0 | 50 | 0 | 50 |
| **Sub Total** | 0 | 3,720 | 2,030 | 4,860 | 3,610 |
| Future Costs (Year 6-100) | | | | | |
| Capital | 1,140 | 0 | 0 | 0 | 570 |
| Non-capital | 50 | 50 | 50 | 50 | 70 |
| **Sub Total** | 1,190 | 50 | 50 | 50 | 640 |
| **Total PV Cost** | **1,190** | **3,770** | **2,080** | **4,910** | **4,250** |

**Table 5.9: Southern Management Unit – Summary of Option Present Value (PV) Costs**

| Element | MA13.2 (£k) | MA13.3 (£k) | MA13.4 (£k) |
|---|---|---|---|
| Initial implementation cost (Year 0-5) | | | |
| Capital | 0 | 5,690 | 0 |
| Non-capital | 30 | 75 | 75 |
| **Sub Total** | 30 | 5,765 | 75 |
| Future Costs (Year 6-100) | | | |
| Capital | 0 | 465 | 3,925 |
| Non-capital | 130 | 60 | 60 |
| **Sub Total** | 130 | 525 | 3,985 |
| **Total PV Cost** | **160** | **6,290** | **4,060** |

5.4.5 Further details on the build-up of Option Benefits and Costs can be found in the Economic Addendum to the StAR (Doc Ref: D121392/TR3 – Attached as Appendix O)

## 5.5 Options Benefits (Damages Avoided)

5.5.1 Benefits have been derived using the guidance provided in Defra FCDPAG3, associated Supplementary Guidance, the Green Book (HM Treasury, 2003) and the Multicoloured Manual. Due to the importance of tourism to the area recreational benefits have been included in the assessment. However, to demonstrate a robust business case sensitivity analysis on the level of recreation benefits has been carried out, refer to Section 6.1.14.

5.5.2 All options within the Strategy have been developed to provide continued protection over the 100 year assessment period. Therefore, Benefits are equal to the Damages defined under the "Do Nothing". For details of the assets included in the benefits refer to Section 3.2.

5.5.3 All options have the same benefits as they protect against erosion with the same structural standard. As there is no change in benefits between options no incremental benefits are used in the economic analysis.

**Table 5.10: Summary of Options Present Value (PV) Damages and Benefits (£k)**

| | Damage (PVd) | Damage Avoided | Benefits (PVb) |
|---|---|---|---|
| **All Options** | **0** | **176,640** | **176,640** |

5.5.4 Key non-monetised benefits include (Also refer to Table 3.2):

- Mitigation of Health and Safety risks;
- Future increases in economic activity as a result of the regeneration of the Seaton Carew frontage;
- The proposed new Nuclear Power Station site adjacent to the existing Nuclear Power Station. The new station is estimated to cost up to £5 billion to construct and would employ up to 3,000 construction workers for the six year construction period, as well as providing jobs on completion;
- Protection of the environmentally designated SPA and Ramsar areas; and,

- The area of contaminated land behind the North Gare Sands dunes would be exposed if the dunes were subject to erosion. This issue needs to be considered in the strategic management of the coastal defences along this frontage.

# 6 Selection and Details of the preferred option

## 6.1 Selecting the Preferred Option

### Northern Management Unit

6.1.1 Options developed for the Northern Management Unit have focused on suitable solutions to implement a "Hold The Line" policy following a review of appropriate policy options. The development of options undertook an early review to reject options unsuitable for use along the frontage due to technical and environmental reasons.

6.1.2 From the short-list of options implementation was tested on individual Management Areas within the Management Unit due to the varying type and condition of the existing defences. Table 6.1 provides a summary of the options indicating the benefit-cost ratio of the individual schemes, and the key reason for selection as the preferred option.

6.1.3 **MA12.2;** due to the condition of defences along this section options other than the "Do Minimum" provided no additional benefit and therefore no additional options were investigated. "Do Minimum" maintenance also has the least environmental impact of any potential options. The economics of the option was tested to ensure that the "Do Minimum" remained a sustainable and economic solution over the Strategy period.

6.1.4 **MA13.1A;** two options were developed to "Hold The Line", Full Height Revetment and Toe Protection (in the form of a low crested revetment). Both options would achieve the same protection to assets as they would prevent failure of the seawall and thus protect against erosion.

6.1.5 The benefit of the Full Height Revetment would be significantly reduced overtopping rates. However, overtopping is not a risk to assets but to pedestrian safety along the promenade; the provision of Toe Protection combined with management of access to the promenade area during storms offers a more cost efficient option.

6.1.6 The provision of Toe Protection has a lesser impact on the environment due to it's significantly smaller footprint. Toe Protection could also be upgraded to provide a higher level of protection in the future should sea level rise be higher than current estimates. Toe Protection also has a higher benefit-cost ratio due to the reduced structure costs achieving the same protection of assets.

6.1.7 Both options would be combined with the raising of the low area at the "North Shelter" which has previously breached. At this area defences would be raised to the level of the adjacent seawall and then protected by either the full height rock revetment or the toe protection. This would address the significant health and safety risks currently posed to pedestrians using this area.

6.1.8 On this basis the Toe Protection option is selected for MA13.1A – this option also includes the raising of the low "North Shelter" area of defence.

6.1.9 **MA13.1B-E;** two options were developed for this section of frontage to implement the "Hold The Line" policy. A Full Height Revetment or a Seawall with phased Toe Protection (in the form of a low crested revetment). Both options would achieve the same protection in terms of protection to assets and would also achieve similar overtopping performance.

6.1.10 The Full Height Revetment provides opportunity to increase the level of protection along this section of frontage within a single work package. The rock revetment would provide increased structural protection and reduced overtopping.

6.1.11 The Seawall option would be in keeping with the current defences both along this section and within the rest of the Northern Management Unit. It would also have least environmental impact due to the minimal footprint area required. The phased Toe Protection also allows for an adaptive response to actual future sea level rise and allows the performance of the structure to be optimised to future coastline development. Implementation of this option requires commitment to both the initial seawall construction and provision of the later phased Toe Protection.

6.1.12 On the basis that both options provide similar standards of protection and performance and that the benefit-cost ratio are similar at this stage both options should be carried forward to be investigated in further detail at the PAR stage. However, implementation of either option would be suitable to achieve the objectives of the Strategy.

**Table 6.1: Northern Management Unit - Option Benefit-Cost Assessment**

| | PV Costs (£k) | PV Benefits (£k) | Benefit-Cost Ratio | Reason for Selection | Selected as Preferred |
|---|---|---|---|---|---|
| MA12.2 – Maintenance | 1,190 | 9,170 | 7.7 | Most economic and least environmental impact to provide continued defence | YES |
| MA13.1A – Full Height Revetment | 3,770 | 27,110 | 7.2 | N/A | REJECTED |
| MA13.1A – Toe Protection | 2,080 | 27,110 | 13.0 | Most economic and least environmental impact to provide continued defence | YES |
| MA13.1B-E – Revetment | 4,910 | 58,230 | 11.9 | To be investigated further at PAR stage | YES * |
| MA13.1B-E – Seawall | 4,250 | 58,230 | 13.7 | To be investigated further at PAR stage | YES * |
| Northern Management Unit TOTAL | 7,530 | 94,520 | 12.6 | Combined Options | PREFERRED |

6.1.13 * Preferred Option to be chosen at PAR stage.

### Southern Management Unit

6.1.14 **MA13.2;** is to be managed under a "No Active Intervention" policy and therefore no options require assessing.

6.1.15 **MA13.3;** the North Gare Breakwater would be reinstated using the remaining existing structure as a core and providing a layer of protective armour. This solution has been proposed to PD Teesport who own the North Gare Breakwater and has received their support. The North Gare Breakwater is also important to maintain beach widths within the Northern Management Unit.

6.1.16 **MA13.4;** the Seaton Channel Training Wall would be reinstated using rock or armour units to ensure the structure remains effective at retaining sand. This solution has been proposed to PD Teesport who own the Seaton Channel Training Wall and has received their support.

6.1.17 In order to ensure the continued protection of the SPA and Ramsar sites within the Management Unit the options for the two structures should be carried out in combination and therefore an assessment of the combined benefit-cost ratio of the Management Scheme for has been included in Table 6.2.

**Table 6.2: Southern Management Unit - Option Benefit-Cost Assessment**

| | PV Costs (£k) | PV Benefits (£k) | Benefit-Cost Ratio | Reason for Selection | Selected as Preferred |
|---|---|---|---|---|---|
| MA13.3 – Reinstate Control Structure | 6,290 | 41,060 | 6.5 | To protect assets and meet environmental objectives | YES |
| MA13.4 - Reinstate Control Structure | 4,060 | 41,060 | 10.1 | To protect assets and meet environmental objectives | YES |
| Southern Management Unit TOTAL | 10,510 | 82,120 | 7.8 | Combined Options | PREFERRED |

6.1.18 The options have been re-assessed against revised Climate Change guidance and under the new Flood & Coastal Resilience Partnership Funding. The scheme options and relative priorities of the schemes do not change. The results of the impact of funding can be found in Appendix Q.

## 6.2 Sensitivity Testing

6.2.1 Sensitivity testing to ensure that a robust Business Case is proposed has been undertaken on the following elements:

- Testing of the "Do Nothing" Scenario. 20 Year delay in damage occurrence (i.e. assets estimated to be lost in Year 20 are actually lost in Year 40);
- Testing of Option Costs. Increased Construction Costs (by 20%);
- Recreation Benefits (Benefits at 50% of estimated values);
- No Recreation Benefits

6.2.2 A summary of the sensitivity testing is shown in Table 6.3. The results show that in all instances the Business Case is robust under each scenario.

**Table 6.3: Summary of Sensitivity Analysis**

| Management Unit | Base Case | Erosion delayed by 20 years | Option Cost Increased by 20% | Recreation Benefits at 50% | No Recreation |
|---|---|---|---|---|---|
| **North** | 12.6 | 8.4 | 11.0 | 8.7 | 6.7 |
| **South** | 7.8 | 3.9 | 6.3 | N/A | N/A |

## 6.3 Details of the Preferred Option

### Technical Aspects

#### Northern Management Unit

6.3.1 The implementation of the proposed options would achieve the policy of "Hold The Line" along the entire Management Unit and ensure continuous protection of Seaton Carew town. Capital works are provided in the short to medium-term to improve the defence condition and protect the frontage from failure and the onset of erosion.

6.3.2 The implementation of the Strategy in the Northern Management Area would include the following:

- Maintenance of defences along MA12.2;
- Urgent provision of Capital Works consisting of Toe Protection (in the form of a low crested revetment) to MA13.1A within 2 years. This includes

infilling of the “North Shelter” area which has previously breached and is a Health and Safety risk;

- Provision of strengthened defences either in the form of a Full Height Revetment or a Seawall with Phased Toe Protection along MA13.1B-E within 5 years;
- Continued maintenance and monitoring of defence condition throughout the Strategy period;
- Monitoring of beach levels and the impact of sea level rise;
- Management of overtopping risk to pedestrians.

6.3.3 Some areas of the Northern Management Unit would have some residual risk from overtopping. This risk would be to the safety of pedestrians using the promenade area immediately behind the defences, not a flood risk to assets. This risk should be managed by HBC through restricted access along the promenade during significant storm periods. This management approach is suitable and cost effective for the frontage as it avoids the need to provide costly structure upgrades to meet pedestrian safety limits which are extremely onerous to achieve.

### Southern Management Unit

6.3.4 The reinstatement of the two control structures (North Gare Breakwater and Seaton Channel Training Wall) will ensure the continuation of effective sediment retention along the Southern Management Unit frontage. The beaches along the Northern Management Unit also depend strongly on the continued existence of the North Gare Breakwater to retain the sediment and beach levels. The control structures and sediment retention along this frontage is critical to allowing the shoreline between the structures and along MA13.2 to be managed according to a “No Active Intervention” policy.

6.3.5 The implementation of the Strategy in the Southern Management Area would include the following:

- Reinstatement of effective control structures (North Gare Breakwater and Seaton Channel Training Wall);
- Cessation of sand extraction (in the short-term) from MA13.4;
- Maintenance and monitoring of control structures throughout Strategy Period;
- Monitoring of shoreline along the “No Active Intervention” area to inform future policy reviews and management decisions.

## Environmental Aspects

6.3.6 For the Strategy both a SEA and HRA have been undertaken based on the detail provided within the Strategy studies. Natural England has provided letters of support that the processes have been completed sufficiently at the strategic level. However, this does not remove the requirement for further environmental assessment of options at a more detailed level.

6.3.7 Environmental Impact Assessments and Planning Applications will be required for all capital works within the Strategy at the PAR stage where the detail of schemes can be confirmed.

6.3.8 Additional appraisal of options to comply with the requirements of the HRA may also be required particularly on implementation of schemes within the Southern Management Unit to ensure that no detrimental impact occurs to the SPA and Ramsar designated sites.

6.3.9 There will remain a minor residual risk of release of contamination from the abandoned Leather's Chemical Works Site, however, implementation of the Strategy will ensure that the risk is minimised whilst further investigations (already underway by the EA) into the extent and potential remediation are carried out.

6.3.10 Mitigation of the Strategy as a whole is not required as development of the Strategy has considered the impact on the environment throughout and no significant issues have been identified. Potential options for mitigating individual schemes have been identified in the SEA; actual mitigation should be assessed during the PAR stage.

## Costs of the Preferred Option

6.3.11 Table 6.4 and Table 6.5 show the spend profile of the preferred Strategy for the two Management Units. Costs shown are the total Cash costs of the options and are not adjusted to take account of financial contributions from Third Parties.

6.3.12 Reference should be made to Section 7 for further detail on the phasing of the implementation of options.

**Table 6.4: Costs of Preferred Option for Northern Management Unit**

| Cost | 2010/11 (£k) | 2011/12 (£k) | 2012/13 (£k) | 2013/14 (£k) | 2014/15 (£k) | Future Years (£k) | Total (£k) |
|---|---|---|---|---|---|---|---|
| **Capital** | 300 | 1,713 | 2,000 | 1,882 | - | 6,579 | 12,474 |
| **Non-Capital** | 100 | 30 | - | - | - | 640 | 770 |
| **Total** | 400 | 1,743 | 2,000 | 1,882 | - | 7,219 | 13,244 |

**Table 6.5: Costs of Preferred Option for Southern Management Unit**

| Cost | 2010/11 (£k) | 2011/12 (£k) | 2012/13 (£k) | 2013/14 (£k) | 2014/15 (£k) | Future Years (£k) | Total (£k) |
|---|---|---|---|---|---|---|---|
| **Capital** | - | - | - | - | 3,210 | 11,542 | 14,752 |
| **Non-Capital** | 5 | 5 | 155 | 5 | 5 | 935 | 1,110 |
| **Total** | 5 | 5 | 155 | 5 | 3,215 | 12,477 | 15,862 |

6.3.13 Option appraisal analysis for each management unit and a detailed assessment of tourism and damages to different types of assets (including private, commercial and infrastructure) will be undertaken at PAR stage in order to confirm whether the investment is required now or instead later in the future.

6.3.14 The options have been re-assessed against revised Climate Change guidance and under the new Flood & Coastal Resilience Partnership Funding. The scheme options and relative priorities of the schemes do not change. The results of the impact of funding can be found in Appendix Q.

### Contributions and Funding

6.3.15 Funding for the Strategy implementation would be sought through the FDGiA process as well as through contributions from the identified beneficiaries.

6.3.16 Contributions are being pursued for the southern section of the Northern Management Unit where there is potential for contributions from Northumbrian Water and regeneration/developers. Initial discussions have taken place between HBC and Northumbrian Water. For the strategy contributions for this element have been estimated at £1 Million. Formal agreement to funding from third party contributors will be sought during the undertaking of PAR's for each section of works in accordance with the Strategy implementation programme. Approval of the PAR's for works within the Northern Management Unit will be dependant upon a sufficient level of contributions being received from third parties.

6.3.17 Contributions are being pursued for the two control structures in the Southern Management Unit (North Gare Breakwater and Seaton Channel Training Wall) as these structures are owned by PD Teesport. The structures also provide protection and commercial benefit to PD Teesport, Hartlepool Nuclear Power Station and Frutarom Chemical Works, all of whom have been approached during the development of the Strategy for contributions. Formal commitment from beneficiaries to providing a contribution to the implementation of the Southern Management Area of the Strategy will be sought upon approval of the Strategy. Negotiations with those beneficiaries identified (and any beneficiaries subsequently identified) will take place once the Strategy is approved and prior to the completion of the PAR stages, for each element of works, to confirm total contributions. Contributions are currently estimated at £6.5Million. Approval of the PAR's for works within the Southern Management Unit will be dependant upon a sufficient level of contributions being received from third parties.

6.3.18 Successful negotiation with potential contributors is important since the preferred options for the North Gare Breakwater and the Seaton Channel Training Wall are unlikely to be implemented without substantial contributions from commercial benefactors and the defence owners.

6.3.19 All contributions have been applied to the derivation of the Outcome Measure score only and are not included in the benefit-cost calculations to ensure that the business case for each option is robust.

6.3.20 The options have been re-assessed against revised Climate Change guidance and under the new Flood & Coastal Resilience Partnership Funding. The scheme options and relative priorities of the schemes do not change. The results of the impact of funding can be found in Appendix Q.

## 6.4 Summary of Preferred Strategy

6.4.1 Total cash expenditure for the whole strategy is £29.11 million pounds; this figure includes both capital and non-capital costs.

**Table 6.6: Summary of Preferred Strategy**

| | Northern Management Unit | Southern Management Unit | Total |
|---|---|---|---|
| **PV Costs (£k)** | | | |
| **Capital** | 7,240 | 10,070 | 17,310 |
| **Non-capital** | 290 | 440 | 730 |

| | | | |
|---|---|---|---|
| **Total PV Costs (£k)** | 7,530 | 10,510 | 18,040 |
| **PV Benefits (£k)** | 94,520 | 82,120 | 176,640 |
| **Average Benefit/Cost Ratio** | 12.6 | 7.8 | |
| **Cash Costs (£k)** | | | |
| **Capital** | 12,504 | 14,752 | 27,256 |
| **Non-capital** | 739 | 1,100 | 1,849 |
| **Total Cash Costs (£k)** | 13,243 | 15,862 | 29,105 |

6.4.2 Total years 0-5 expenditure is £12.69m. The total cash spend of £29.11m includes £14.7m for capital works on assets owned by PD Tees Port. The above table excludes any potential contributions identified during the Strategy.

# 7 Implementation

## 7.1 Project Planning

### Phasing and Approach

7.1.1 The strategy for the long-term management of the coastal defences along the frontage is to carry out a series of capital schemes over the next 10 years to retain or increase the provision of protection that is currently offered by existing coastal defences.

7.1.2 Works within the Strategy have been prioritised on the basis of the residual life of existing defences. The Toe Protection works in MA13.1A are urgent due to the possible additional failures of the defence through undermining. Therefore, appraisal and procurement of these works have progressed in parallel with the strategy to prevent any further health and safety problems occurring due to undermining and breach incidents. The PAR for MA13.1A was completed and presented at PAB on the 9th December 2011 and gained approval. Works are designed and supervised by Hartlepool Borough Council and the appointed contractor is Hall Construction. Works commenced on-site in April 2011 and are due for completion within the allocated funding in December 2011.

### Programme and Spend Profile

7.1.3 Table 7.1 sets out the proposed key dates for the implementation of the Seaton Carew Coastal Strategy. The programme has taken into account that construction may not be able to take place during the winter months to avoid the passage/wintering bird period.

**Table 7.1: Key Dates**

| Activity | Date | Cash and Contributions |
|---|---|---|
| **Northern Management Unit** | | |
| **MA 12.2**<br>Continued Maintenance and Monitoring | From Strategy Approval | Funded via HBC |
| **MA13.1A**<br>PAR Completed<br>Approval Obtained<br>Construction Started<br>Construction Completion | <br>October 2010<br>December 2010<br>April 2011<br>December 2011 | £1.5 Million Granted |
| **MA13.1B to E**<br>Commence detailed appraisal (PAR)<br>Approval<br>Construction start<br>Construction completion | <br>November 2010<br>April 2012<br>September 2012<br>December 2013 | £3.9 Million Total. Estimated £1 Million 3rd Party Contributions with remainder funded via FDGiA |
| **Southern Management Unit** | | |
| **MA 13.2**<br>Continue with No Active Intervention Policy | From Strategy Approval | Funded via HBC |
| **MA13.3**<br>Commence detailed appraisal (PAR)<br>Approval<br>Construction start<br>Construction completion | <br>April 2012<br>April 2013<br>May 2014<br>December 2015 | £6.4 Million Total. Estimated £4.2 Million 3rd Party Contributions with remainder funded via FDGiA |

| Activity | Date | Cash and Contributions |
|---|---|---|
| **MA13.4**<br>Commence detailed appraisal (PAR)<br>Approval<br>Construction start<br>Construction completion | <br>April 2012<br>April 2013<br>September 2016<br>December 2017 | £4.4 Million Total. Estimated £2.2 Million 3rd Party Contributions with remainder funded via FDGiA |

7.1.4 After consultation with the EA Area Coastal Engineer due to significant health and safety issues and potential failure of the assets within MA13.1A (within the Northern Management Unit, a Project Appraisal Report (carried out under an approved FRM7) has been undertaken in parallel with the development of the Strategy. This work was awarded under a variation of the Strategy contract (in accordance with HBC contract rules).

7.1.5 The PAR for MA13.1A was completed and presented at PAB on the 9th December 2011 and gained approval. Works are designed and supervised by Hartlepool Borough Council and the appointed contractor is Hall Construction. Works commenced on-site in April 2011 and are due for completion within the allocated funding in December 2011.

7.1.6 The control structures within MA13.3 and MA13.4 are owned by PD Teesport. For this reason the above dates in Table 7.1 are notional and agreement is required with PD Teesport on the programme for implementing the recommended works. The estimated contributions are to be confirmed at PAR level when additional detail of the schemes will be available.

7.1.7 Table 7.2 sets out the annual spend profile and Outcome Measure scores for both Management Units. The Outcome Measure scores incorporate external contributions to the funding.

**Table 7.2: Annualised Spend Profile and OM Score**

| Costs (£k) | 2010/11 (£k) | 2011/12 (£k) | 2012/13 (£k) | 2013/14 (£k) | 2014/15 (£k) | Future Years | Total |
|---|---|---|---|---|---|---|---|
| **Northern Management Unit - Outcome Measure Score = 4.67** | | | | | | | |
| **Capital** | 300* | 1,713* | 2,000 | 1,882 | - | 6,579 | 12,474 |
| **Non-capital** | 100 | 30 | - | - | - | 640 | 770 |
| **Southern Management Unit - Outcome Measure Score = 5.53** | | | | | | | |
| **Capital** | - | - | - | - | 3,210 | 11,542 | 14,752 |
| **Non-capital** | 5 | 5 | 155 | 5 | 5 | 935 | 1,110 |

* 300k and 1,200k have already been secured through the completion of the PAR and construction of the urgent works along MA13.1A.

## Outcome Measures Contributions

7.1.8 Table 7.3 and 7.4 provide a summary of the outcome measure calculations for each of the management units with and without contributions. Full details of the calculations can be found in Appendix A. Outcome Measures scores are inclusive of estimated contributions (Northern Management Unit £1m, Southern Management Unit £6.5m).

**Table 7.3: Outcome Measure Scores (Excluding Contributions)**

| Outcome Measure | North | South | Total |
|---|---|---|---|
| **OM1 Economic Benefit** | | | |
| PV Benefits (£k) | 94,520 | 82,120 | 176,640 |
| PV Damages (£k) | 0 | 0 | 0 |
| Whole-Life PV Costs (£k) | 7,520 | 10,510 | 18,030 |
| **OM2 Households at risk (nr)** | 487 | 0 | 487 |
| **OM2b Households moving Risk Bands (Nr)** | 0 | 0 | 0 |
| **OM3 Households at risk in Deprived Areas (Nr)** | 0 | 0 | 0 |
| **OM4 Improved condition of SSSI (ha)** | 0 | 0 | 0 |
| **OM5 BAP Habitat (ha)** | 0 | 0 | 0 |
| **Outcome Measure Prioritisation Score** | 4.04 | 2.11 | |

**Table 7.4: Outcome Measure Scores (Including Contributions)**

| Outcome Measure | North | South | Total |
|---|---|---|---|
| **OM1 Economic Benefit** | | | |
| PV Benefits (£k) | 94,520 | 82,120 | 176,640 |
| PV Damages (£k) | 0 | 0 | 0 |
| Whole-Life PV Costs (£k) | 6,520 | 4,010 | 10,530 |
| **OM2 Households at risk (nr)** | 487 | 0 | 487 |
| **OM2b Households moving Risk Bands (Nr)** | 0 | 0 | 0 |
| **OM3 Households at risk in Deprived Areas (Nr)** | 0 | 0 | 0 |
| **OM4 Improved condition of SSSI (ha)** | 0 | 0 | 0 |
| **OM5 BAP Habitat (ha)** | 0 | 0 | 0 |
| **Outcome Measure Prioritisation Score** | 4.67 | 5.53 | |

7.1.9 The options have been re-assessed against revised Climate Change guidance and under the new Flood & Coastal Resilience Partnership Funding. The scheme options and relative priorities of the schemes do not change. The results of the impact of funding can be found in Appendix Q.

## 7.2 Procurement Strategy

7.2.1 After consultation with the EA Area Coastal Engineer due to significant health and safety issues and potential failure of the assets within MA13.1A (within the Northern Management Unit, a Project Appraisal Report (carried out under an approved FRM7) has been undertaken in parallel with the development of the Strategy. This work was awarded under a variation of the Strategy contract (in accordance with HBC contract rules).

7.2.2 The PAR for MA13.1A was completed and presented at PAB on the 9th December 2011 and gained approval. Works are designed and supervised by Hartlepool Borough Council and the appointed contractor is Hall Construction. Works commenced on-site in April 2011 and are due for completion within the allocated funding in December 2011.

7.2.3 All Project Appraisal Reports will be procured under competition in accordance with Hartlepool Borough Council Constitution and Standing Orders relating to procurement. All physical works will be subject to formal legal assessments with key beneficiaries for agreed contributions prior to final approval and budget allocation from the EA. These works once approved will also be procured in accordance with HBC constitution and Standing Orders relating to procurement.

## 7.3 Delivery Risks

### High Level Risk Register

7.3.1 A high level risk schedule has been developed on the basis of the FCDPAG3 supplement on Optimism Bias. This has identified the risks to the implementation of the Strategy and was used to determine the level of optimism bias applied within the benefit-cost analysis. Refer to Appendix H for the Risk Register.

7.3.2 A further risk to delivery is the level of contributions from beneficiaries. At present significant beneficiaries have been identified and informed of the strategy, its purpose and the process through which it has been developed. They have also been informed that contributions to the strategy would be sought, however the level of contributions to the implementation strategy have not been agreed. Discussions on potential contributions have been progressed and are being taken forwards at Director Level between the Council and all potential contributors. Contributions should be fixed during the PAR process and a decision on funding can be taken dependant on the level of contributions received.

7.3.3 The options have been re-assessed against revised Climate Change guidance and under the new Flood & Coastal Resilience Partnership Funding. The scheme options and relative priorities of the schemes do not change. The results of the impact of funding can be found in Appendix Q.

### Safety Plan

7.3.4 CDM Responsibilities will be addressed during the PAR or detailed design stage for individual options.

7.3.5 A Public Safety Risk Assessment will be established prior to construction.

**Appendix A Project Appraisal Report Data Sheet**

Entries required in clear boxes, as appropriate.

# GENERAL DETAILS

| | |
|---|---|
| Authority Project Ref. (as in forward plan): | HP07 |
| Project Name (60 characters max.): | Seaton Carew Coastal Strategy |
| Promoting Authority: Defra ref (if known) | N067 |
| Name | Hartlepool Borough Council |
| Emergency Works: | No Yes/No |
| Strategy Plan Reference: | Not Applicable |
| River Basin Management Plan | Not Applicable |
| System Asset Management Plan | Not Applicable |
| Shoreline Management Plan: | Shoreline Management Plan 2 – River Tyne to Flamborough Head |
| Project Type: | Strategy Plan |

Shoreline Management Study/ Preliminary Study/ Strategy Plan/Prelim. Works to Strategy/ Project within Strategy/Stand-alone Project/ Strategy Implementation/Sustain SOS. Coast Protection/Sea Defence/Tidal Flood Defence/Non-Tidal Flood Defence/Flood Warning Tidal/Flood Warning - Fluvial/Special

**CONTRACT DETAILS**

| | |
|---|---|
| Estimated start date of works/study: | N/A |
| Estimated duration in months: | N/A |
| Contract type* | N/A |

(*Direct labour, Framework, Non Framework, Design/Construct )

**COSTS**

| | APPLICATION (£000's) |
|---|---|
| Appraisal: | £ |
| Costs for Agency approval: | £ |
| Total Whole Life Costs (cash): | £ |

For breakdown of costs see Table in Section

**CONTRIBUTIONS**

| | |
|---|---|
| Windfall Contributions: | Not Applicable |
| Deductible Contributions: | Potential contributors have been identified and consulted with a view to securing contributions for the individual schemes. |
| ERDF Grant: | Not Applicable |
| Other Ineligible Items: | Not Applicable |

**LOCATION - to be completed for all projects**

| | |
|---|---|
| EA Region/Area of project site (all projects): | North East Region |
| Name of watercourse (fluvial projects only): | Not Applicable |
| District Council Area of project (all projects): | Hartlepool Borough Council |
| EA Asset Management System Reference: | Not Applicable |
| Grid Reference (all projects): | NZ452530 |

(OS Grid reference of typical mid point of project in form ST064055)

**DESCRIPTION**

| | |
|---|---|
| Specific town/district to benefit: | Seaton Carew, Hartlepool |

Brief project description including essential elements of proposed project/study
(Maximum 3 lines each of 80 characters)

Coastal Strategy Study to develop a sustainable management system for the Seaton Carew Study. Capital and monitoring works have been identified and prioritised based on risk. Preferred options have been technically, economically and environmentally assessed.

**DETAILS**

| | | | |
|---|---|---|---|
| Design standard (chance per year): | Not Applicable | | yrs |
| Existing standard of protection (chance per year) | Varies | | yrs |
| Design life of project: | 100 (Strategy Appraisal Period) | | yrs |
| Fluvial design flow (fluvial projects only): | Not Applicable | | $m^3/s$ |
| Tidal design level (coastal/tidal projects only): | Future 1 in 100 year = 4.6 | | m |
| Length of river bank or shoreline improved: | 9km | | m |
| Number of groynes (coastal projects only): | 0 | | |
| Total length of groynes* (coastal projects only): | Not Applicable | | m |
| Beach Management Project? | No | Yes/No | |
| Water Level Management (Env) Project? | No | Yes/No | |
| Defence type (embankment, walls, storage etc) | Walls, Rock Revetment, Breakwater, Training Wall | | |

* i.e. total length of all groynes added together, ignore any river training groynes

**ADDITIONAL AGREEMENTS:**

| | | | |
|---|---|---|---|
| Maintenance Agreement(s): | Not Applicable | | Not Applicable/Received/Awaited |
| EA Region Consent (LA Projects only): | Not Applicable | | Not Applicable/Received/Awaited |
| Non Statutory Objectors: | No | Yes/No | |
| Date Objections Cleared: | Not Applicable | | |
| Other: | Not Applicable | | Not Applicable/Received/Awaited |

# ENVIRONMENTAL CONSIDERATIONS

| | | |
|---|---|---|
| Natural England (or equivalent) letter: | Received | Not Applicable/Received/Awaited |
| Date received | 26/04/2010 | |

**SITES OF INTERNATIONAL IMPORTANCE**
(Answer Y if project is within, adjacent to or potentially affects the designated site)

| | | |
|---|---|---|
| Special Protection Area (SPA): | Yes | Yes/No |
| Special Area of Conservation (SAC): | No | Yes/No |
| Ramsar Site | Yes | Yes/No |
| World Heritage Site | No | Yes/No |
| Other (Biosphere Reserve etc) | No | Yes/No |

**SITES OF NATIONAL IMPORTANCE** (Answer Y if project is within, adjacent to or potentially affects the designated site)

| | | |
|---|---|---|
| Environmentally Sensitive Area (ESA): | No | Yes/No |
| Site of Special Scientific Interest (SSSI): | Yes | Yes/No |
| National/Regional Landscape Designation: | No | Yes/No |
| National Park/The Broads | No | Yes/No |
| National Nature Reserve | Yes | Yes/No |
| AONB, RSA, RSC, other | No | Yes/No |
| Scheduled Ancient Monument | No | Yes/No |
| Other designated heritage sites | No | Yes/No |

**OTHER ENVIRONMENTAL CONSIDERATIONS**

| | | |
|---|---|---|
| Listed structure consent | N/A | Not Applicable/Received/Awaited |
| Water Level Management Plan Prepared? | No | Yes/No |
| FEPA licence required? | N/A | Not Applicable/Received/Awaited |
| Statutory Planning Approval Required | N/A | Yes/No/Not Applicable |

**COMPATIBILITY WITH OTHER PLANS**

| | | |
|---|---|---|
| Shoreline Management Plan | Yes | Yes/No/Not Applicable |
| River Basin Management Plan | N/A | Yes/No/Not Applicable |
| Catchment Flood Management Plan | Yes | Yes/No/Not Applicable |
| Water Level Management Plan | N/A | Yes/No/Not Applicable |
| Local Environment Agency Plan | N/A | Yes/No/Not Applicable |

**SEA/ENVIRONMENTAL IMPACT ASSESSMENT**

| | | |
|---|---|---|
| SEA | Agency Voluntary | Statutory required/Agency voluntary/not applicable |
| EIA | Not Applicable | Yes (schedule 1); Yes (schedule 2); SI1217; not applicable |
| SEA/EIA status | Draft Advertised | Scoping report prepared/draft/draft advertised/final |

Other agreements (Not Applicable/Received/Awaited for each)

| Detail | Result |
|---|---|
| Habitats Regulations Assessment (Screening Report) | Received |
| | |
| | |
| | |
| | |

# Costs, benefits & scoring data

(Apportion to this phase if part of a strategy)

**Local authorities only**: For projects done under Coast Protection Act 1949, please separately identify: FRM = Benefits from reduction of asset flooding risk; CERM = Benefits from reduction of asset erosion risk

**Benefit type** (DEF: reduces risk (contributes to Defra SDA 27); CM: capital maintenance; FW: improves flood warning; ST: study; OTH: other projects) DEF

**LAND AREA**

| | | | |
|---|---|---|---|
| Total area of land to benefit: | | 209 | Ha |
| of which present use is: | FRM | CERM | |
| Agricultural: | | 0 | Ha |
| Developed: | | 106 | Ha |
| Environmental/Amenity: | | 103 | Ha |
| Scheduled for development | | 0 | Ha |

**PROPERTY & INFRASTRUCTURE PROTECTED**

| | Number | | Value (£'000s) | |
|---|---|---|---|---|
| | FRM | CERM | FRM | CERM |
| [1]Residential | | 476 | | 82,725 |
| Commercial/industrial | | 16 | | 141,710 |
| Critical Infrastructure | | | | 49,976 |
| Key Civic Sites | | 1 | | 1,000 |
| Other (description below): | | | | |
| Description: | | | | |

**costs and Benefits**

| | | |
|---|---|---|
| [1]Present value of total project whole life costs (£'000s): | | 20,820 |
| Project to meet statutory requirement? | *Y/N* | Y |

| | Value (£'000s) | |
|---|---|---|
| | FRM | CERM |
| Present value of residential benefits: | | 17,177 |
| Present value of commercial/industrial benefits: | | 84,291 |
| Present value of public infrastructure benefits: | | 22,933 |
| Present value of agricultural benefits: | | 0 |
| Present value of environmental/amenity benefits: | | 22,176 |
| [1]Present value of total benefits (FRM & CERM) | 146,688 | |
| Net present value: | 125,798 | |
| Benefit/cost ratio: | 7.03 | |

| | | |
|---|---|---|
| Base date for estimate: | Apr 2010 | |
| PAG Decision Rule stage 3 applied | No | Yes/No |
| PAG Decision Rule stage 4 applied | No | Yes/No |

**OTHER OUTCOME MEASURE SCORING DETAILS**

| | | | |
|---|---|---|---|
| Super Output Area No*: | **E01011 996** | Indicate if deprived: | No Yes/No |

(*as ranked by Indices of Multiple Deprivation)

| | | |
|---|---|---|
| Risk: | H | VH, H or N/A |

| | Wetland | Saltmarsh/ Mudflat | |
|---|---|---|---|
| Net gain of BAP habitat: | 0 | 0 | Ha |
| SSSI protected: | 150 | | Ha |
| Other Habitat: | 290 | | Ha |
| Heritage Sites: | N/A | | "I or II" , "II or other" or "N/A" |

**Exemption Details (if exempt from OM scoring system)**

| | | |
|---|---|---|
| Exempt from Scoring: | **Yes** | Yes/No |

Reason (max 100 chars):

**Strategy Study**

# Outcome Measure Prioritisation Priority Score

## Stage 1 - Calculate individual scores

| Ref | Description | Project contributions (including adjustments) | | | | Targets | | Individual scores |
|---|---|---|---|---|---|---|---|---|
| **OM1** | Present value of Whole Life Benefits **(£000s)** | 94,250 | | | Divided by | 3,700,000 | Gives OM1 individual score | 0.0255 |
| | | **o1** | | | | **t1** | | **s1** |
| **OM2** | Number of households moved from any flood / coastal erosion probability category to a lower one **(households)** | 487 | Minus o2b | 0 | Divided by | 100,000 | Gives OM2 individual score | 0.0049 |
| | | **o2** | | **o2b** | | **t2** | | **s2** |
| **OM2b** | Number of households moved from the very significant or significant flood probability category to the moderate or low flood probability category; or equivalent coastal erosion probability categories **(households)** | 0 | Minus o3 | 0 | Divided by | 36,000 | Gives OM2b individual score | 0.0000 |
| | | **o2b** | | **o3** | | **t2b** | | **s2b** |
| **OM3** | Number of households in deprived communities at reduced flood risk **(households)** | 0 | | | Divided by | 9,000 | Gives OM3 individual score | 0.0000 |
| | | **o3** | | | | **t3** | | **s3** |
| **OM5** | The number of hectares Biodiversity Action Plan habitat created, net of compensatory habitat **(Hectares)** | 0 | | | Divided by | 800 | Gives OM5 individual score | 0.0000 |
| | | **o5** | | | | **t5** | | **s5** |

## Stage 2 - Calculate overall OM prioritisation score

| | | | | | |
|---|---|---|---|---|---|
| **Score** | Outcome Measure prioritisation score (total of individual scores divided by whole life cost) | **0.0304** | Divided by | **6,520** | Multiplied by 1,000,000 | **4.67** |
| | | **(s1 + s2 + s2b + s3 + s5)** | | **Project whole life costs** | | **OM prioritisation score** |

## Stage 1 - Calculate individual scores

| Ref | Description | Project contributions (including adjustments) | | | Targets | | Individual scores |
|---|---|---|---|---|---|---|---|
| **OM1** | Present value of Whole Life Benefits **(£000s)** | 82,120 | | | Divided by 3,700,000 | Gives OM1 individual score | 0.0222 |
| | | **o1** | | | **t1** | | **s1** |
| **OM2** | Number of households moved from any flood / coastal erosion probability category to a lower one **(households)** | 0 | Minus o2b | 0 | Divided by 100,000 | Gives OM2 individual score | 0.0000 |
| | | **o2** | | **o2b** | **t2** | | **s2** |
| **OM2b** | Number of households moved from the very significant or significant flood probability category to the moderate or low flood probability category; or equivalent coastal erosion probability categories **(households)** | 0 | Minus o3 | 0 | Divided by 36,000 | Gives OM2b individual score | 0.0000 |
| | | **o2b** | | **o3** | **t2b** | | **s2b** |
| **OM3** | Number of households in deprived communities at reduced flood risk **(households)** | 0 | | | Divided by 9,000 | Gives OM3 individual score | 0.0000 |
| | | **o3** | | | **t3** | | **s3** |
| **OM5** | The number of hectares Biodiversity Action Plan habitat created, net of compensatory habitat **(Hectares)** | 0 | | | Divided by 800 | Gives OM5 individual score | 0.0000 |
| | | **o5** | | | **t5** | | **s5** |

## Stage 2 - Calculate overall OM prioritisation score

| | | | | | |
|---|---|---|---|---|---|
| **Score** | Outcome Measure prioritisation score (total of individual scores divided by whole life cost) | **0.0222** | Divided by **4,010** | Multiplied by 1,000,000 | **5.53** |
| | | **(s1 + s2 + s2b + s3 + s5)** | **Project whole life costs** | | **OM prioritisation score** |

## Appendix B List of Reports Produced

| Report | Reference | Date | Appendix |
|---|---|---|---|
| Stage A Condition and Performance Assessment | D121392/TR1 | July 2010 | J |
| Stage B Technical and Environmental Report | D121392/TR2 | July 2010 | K |
| Strategic Environmental Assessment Environmental Report | D121392/ENV1 | July 2010 | L |
| Habitats Regulations Assessment Screening Report | D121392/ENV2 | April 2010 | M |
| Stakeholder Engagement Strategy | D121392/CON1 | April 2010 | N |
| Economic Addendum | D121392/TR3 | Nov 2010 | O |
| Water Framework Directive Assessment | D121392/ENV3 | Nov 2010 | P |