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GLOSSARY OF TERMS

Term	Definition
AONB	Area of Outstanding Natural Beauty: A statutory designation by the Countryside Commission. The purpose of the AONB designation is to identify areas of national importance and to promote the conservation and enhancement of natural beauty. This includes protecting its flora, fauna, geological and landscape features.
Beach nourishment	Artificial process of replenishing a beach with material from another source.
Benefits (related to issue)	The service that a feature provides. In other words, why people value or use a feature. For example, a nature reserve, as well as helping to preserve biodiversity and meet national legislation, may also provide a recreation outlet much like a sports centre provides a recreation function.
Berm crest	Ridge of sand or gravel deposited by wave action on the shore just above the normal high water mark.
Brackish water	Freshwater mixed with seawater.
Breaker zone	Area in the sea where the waves break.
Coastal squeeze	The reduction in habitat area that can arise if the natural landward migration of a habitat under sea level rise is prevented by the fixing of the high water mark, e.g. a sea wall.
Defra	Department for Food, Environment and Rural Affairs
Defra Procedural Guidance	The Shoreline Management Plan (SMP) Procedural Guidance produced by Defra to provide a nationally consistent structure for the production of future generation Shoreline Management Plans.
Downdrift	Direction of longshore movement of beach materials.
Ebb-tide	The falling tide, part of the tidal cycle between high water and the next low water.
Ecosystem	Organisation of the biological community and the physical environment in a specific geographical area.
Environmental impact assessment	Detailed studies that predict the effects of a development project on the environment. They also provide plans for mitigation of any significant adverse impacts.
ESA	Environmentally Sensitive Area. A non-statutory designation for an area where special land management payments are available through agreement with Defra to provide farming practices which are beneficial to the environment.
Feature	Something tangible that provides a service to society in one form or another or, more simply, benefits certain aspects of society by its very existence. Usually this will be of a specific geographical location and specific to the SMP.
Fetch	Area of water where waves are generated by the wind.
Flood-tide	Rising tide, part of the tidal cycle between low water and the next high water.
Foreshore	Zone between the high water and low water marks.
Geomorphology/ Morphology	The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.
Groyne	Shore protection structure built perpendicular to the shore; designed to trap sediment.
Heritage Coast	A non-statutory designation by the Countryside Commission for coasts of scenic quality, their largely undeveloped nature and their special wildlife and historic interest. Local authorities assist with the management of Heritage Coasts often with Heritage Coast officers.
LNR	Local Nature Reserves. A statutory designation for sites established by local authorities in consultation with Natural England (formerly English Nature). These

Term	Definition
	sites are generally of local significance and also provide important opportunities for public enjoyment, recreation and interpretation.
Management Area (MA)	A collection of Policy Units that are interdependent and should therefore be managed collectively.
MDSF	Modelling and Decision Support Framework. Mapping linked computer tool used in the evaluation of assets at risk from flooding or erosion.
Mean sea level	Average height of the sea surface over a 19-year period.
MHW	Mean High Water. The average of all high waters observed over a sufficiently long period.
MLW	Mean Low Water. The average of all low waters observed over a sufficiently long period.
NNR	National Nature Reserves. A statutory designation by Natural England (formerly English Nature). These represent some of the most important natural and semi-natural ecosystems in Great Britain and are managed to protect the conservation value of the habitats that occur on these sites.
Objective	A desired state to be achieved in the future. An objective is set, through consultation with key parties, to encourage the resolution of the issue or range of issues.
Offshore zone	Extends from the low water mark to a water depth of about 15 m (49 ft) and is permanently covered with water.
Policy	In this context, “policy” refers to the generic shoreline management options (No Active Intervention, Hold the Existing Line of Defence, Managed Realignment, Retreat or Advance the Existing Line of Defence, and Hold the Retired Line).
Policy Development Zone (PDZ)	A length of coastline defined for the purpose of assessing all issues and interactions to examine and develop management scenarios. These zones are only used in the procedure of developing policy. Policy Units and Management Areas are then used for the Final definition of the policies and the management of the coast.
Policy Scenario	A combination of policies selected against the various feature/benefit objectives for the whole SMP frontage.
Policy Units	Sections of coastline for which a certain coastal defence management policy has been defined. These are then grouped into Management Areas for management purposes.
PV	Present Value. The value of a stream of benefits or costs when discounted back to the present day. For this SMP the discount factors used are the latest provided by Defra for assessment of schemes, i.e. 3.5% for years 0-30, 3.0% for years 31-75, and 2.5% thereafter.
Ramsar	Designated under the, “Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat.” 1971. The objective of this designation is to prevent the progressive encroachment into, and the loss of wetlands.
RIGS	Regionally Important Geological/Geomorphological Sites. A non-statutory designation identified by locally developed criteria and are currently the most important places for geology and geomorphology outside statutorily protected land such as SSSI’s. This is.
SAC	Special Area of Conservation. This designation aims to protect habitats or species of European importance and can include Marine Areas. SACs are designated under the EC Habitats Directive (92/43EEC) and will form part of the Natura 2000 site network. All SACs sites are also protect as SSSI, except those in the marine

Term	Definition
	environment below the Mean Low Water (MLW).
SAM	Scheduled Ancient Monuments. A statutory designation under the Ancient Monuments and Archaeological Areas Act 1979. This Act, building on legislation dating back to 1882, provides for nationally important archaeological sites to be statutorily protected as Scheduled Ancient Monuments.
Setback	Prescribed distance landward of a coastal feature (e.g. the line of existing defences).
SLA	Special Landscape Area. A non-statutory designation for an area usually identified by local authorities as having a strategic landscape importance.
SMA	Sensitive Marine Area. A non-statutory designation for nationally important locations around the coast that require a cautious and detailed approach to management. They are identified by Natural England (formerly English Nature) for their important benthic populations, spawning or nursery areas for fish, fragile intertidal communities, or breeding, feeding, and roosting areas for birds and sea mammals.
SMP	Shoreline Management Plan. A non-statutory plan, which provides a large-scale assessment of the risks associated with coastal processes and presents a policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner.
SNCI	Site of Nature Conservation Importance. A non-statutory designation defined by the Wildlife Trusts and Local Authorities as sites of local nature conservation interest. These form an integral part in the development of planning policies relating to nature conservations issues.
SPA	Special Protection Area. A statutory designation for internationally important sites, being set up to establish a network of protected areas of birds.
SSSI	Sites of Special Scientific Interest. A statutory designation notified by Natural England (formerly English Nature), representing some of the best examples of Britain's natural features including flora, fauna, and geology.
Storm surge	A rise in the sea surface on an open coast, resulting from a storm.
Swell	Waves that have travelled out of the area in which they were generated.
Tidal prism	The volume of water within the estuary between the level of high and low tide, typically taken for mean spring tides.
Tide	Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.
Transgression	The landward movement of the shoreline in response to a rise in relative sea level.
Updrift	Direction opposite to the predominant movement of longshore transport.
VMCA	Voluntary Marine Conservation Areas. A statutory designation to protect the marine conservation importance of a site and to provide a focus for liaison, co-operation and education for a sustainable marine environment.
Water table	The upper surface of groundwater; below this level, the soil is saturated with water.
Wave direction	Direction from which a wave approaches.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.

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ABPMer prepared the Estuary Assessment (refer Appendix I).

Jan Brooke provided valuable assistance regarding the Water Framework Directive and how it could be taken into account in the SMP (refer Appendix F).

CONTENTS

APPENDICES

1 INTRODUCTION

1.1 The Shoreline Management Plan

A Shoreline Management Plan (SMP) provides a large-scale assessment of the risks associated with coastal evolution and presents a policy framework to address these risks to people and the developed, historic and natural environment in a sustainable manner. In doing so, an SMP is a high-level document that forms an important part of the Department for Environment, Food and Rural Affairs (Defra) strategy for flood and coastal defence (Defra, 2001). The plan provides both broad scale assessment of these risks but also quite specific advice to operating authorities in their management of defences. Through this and through the identification of issues covering a wide spectrum of coastal interests, the SMP supports the Government's aims, as set out in Defra's strategy "Making Space for Water" (Defra 2005):

- To reduce the threat of flooding and coastal erosion to people and their property; and
- To deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles.

This SMP2 document, developed on behalf of The North East Coastal Authorities Group (NECAG), sets out the results of the first revision to the original Shoreline Management Plans for the area of coast extending from the River Tyne south to Flamborough Head. This SMP2 collates information from the three original SMPs (SMP1) for sub-cells 1b, 1c and 1d.

1.1.1 Principles

The SMP is a non-statutory policy document for coastal defence management planning. It takes account of other existing planning initiatives and legislative requirements, and is intended to inform wider strategic planning. It does not set policy for anything other than coastal defence management. However, from this perspective, it aims to provide the context to, and consequence of management decisions in other sectors of coastal management.

The SMP promotes management policies for a coastline into the 22nd Century that achieve long-term objectives without committing to unsustainable defence. It is, however, recognised that due to present day objectives and acceptance, wholesale changes to existing management practices may not be appropriate in the very short-term. Consequently, the SMP provides a timeline for objectives, policy and management changes; i.e. a 'route map' for decision makers to move from the present situation towards the future.

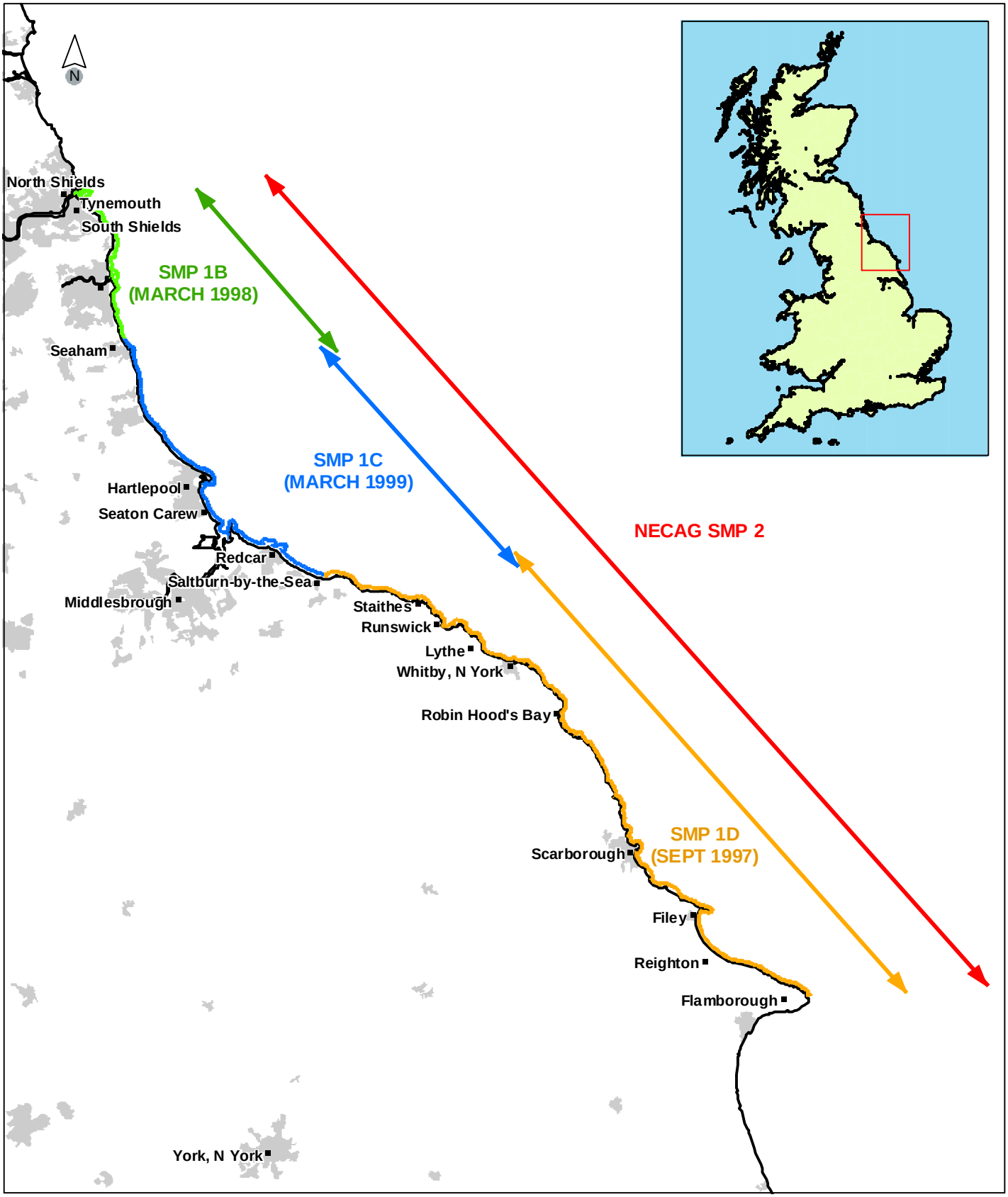
The original SMPs for this area were completed in 1998, 1999, and 1997 working from north to south along the coast. Since that time more detailed

strategy studies have been undertaken over large sections of the coastline and these, together with academic research and monitoring by the Coast Protection Authorities, have improved our understanding of how the coast behaves. In addition many lessons have been learnt with respect to how the SMP should be conducted and indeed how we should be viewing the management of the shoreline. Defra (2001, 2003) undertook a review of the results from SMP1 considering their strengths and weaknesses. This has led to revised guidance. Some of this guidance is targeted at achieving greater consistency in the assessments and presentation of the plans, but there are more fundamental issues that have been identified, which this and other SMP2s must address.

One significant issue is the inappropriateness of certain policies which, when tested in more detail with a view to being implemented, may be found to be unacceptable or impossible to justify; either in terms of economics or from a perspective of what communities need from the coast. It is, therefore, important that the SMP must be realistic given known legislation and constraints; not promising what cannot be delivered but neither delivering in the broader perspective that which fails against the values of the coastal zone. There will be no value in a long-term plan which has policies that are driven by short-term politics or works that prove to be to the detriment of the area when considered several years in the future.

Equally, the plan must also remain flexible enough to adapt to changes in legislation, politics and social attitudes. The plan, therefore, considers objectives, policy setting and management requirements for 3 main epochs; from the present day, medium-term and long-term, corresponding broadly to time periods of 0 to 20 years, 20 to 50 years and 50 to 100 years respectively. There is a need to have a long-term sustainable vision, which may change with time, but should be used to demonstrate that defence decisions made today are not detrimental to achievement of that vision.

The plan covers an area both of significant environmental value, but also having a strong history of human settlement and present use. These uses and interests are not inherently opposed. In reality it is the natural attraction combined with the historical coastal use which gives this area of the coast its distinct and considerable value to man in the present day. While individual core objectives or aims may, therefore, be set, and indeed are set, with respect to each specific aspect of the area, the aim of the SMP2 must be to develop policy where, as far as possible, these specific objectives are not set in conflict. The underlying principle for the development of the plan has been to consider the specific circumstance of the differing sections of the coast and through this understanding, attempt to deliver greatest benefit to the totality of coastal communities in an area.



Key:

Source:
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Title:
Extent of Study Area

Project:
SMP2 River Tyne to Flamborough Head

Client:
North East Coastal Authorities Group

Date:
March 2006

Scale:
1:650,000

Figure:
1.1

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1.1.2 Objectives

The objectives of the SMP process (as distinct from the objectives for management of the coast) are as follows:

- To provide an understanding of the coast, its behaviour and its values.
- To define, in general terms, the risks to people and to the developed, natural and historic environment within the SMP area over the next century.
- To identify the likely consequence of different management approaches and from this;
- To identify the preferred policies for managing those risks or creating opportunity for sustainable management.
- To examine the consequences of implementing the preferred policies in terms of the objectives for management.
- To set out procedures for monitoring the effectiveness of the SMP policies.
- To inform others so that future land use and development of the shoreline can take due account of the risks and preferred SMP policies.
- To comply with international and national nature conservation legislation and biodiversity obligations.

1.1.3 Policies

The generic shoreline management policies considered are those defined by Defra; they are represented by the statements:

- **No active intervention**: a decision not to invest in providing or maintaining defences.
- **Hold the line**: maintain or change the level of protection provided by defences. This would include work or operations carried out in front of the existing defences or where, while maintaining existing defences, policies involve operations to the back of defences (such as secondary flood defences) as an essential part of maintaining the current defence system.
- **Advance the line**: build new defences seaward of the existing defence line where significant land reclamation is considered.
- **Managed realignment**: by allowing the shoreline to move backwards or forwards with management to limit or control change.

In addition, generally as components of an overall managed realignment policy developing over the period of the SMP, two further policies are identified to help clarify management policy covering the different epochs covered by the full period of the SMP.

- **Retreat**: allowing the shoreline to move landward to a position where a natural or managed defence line may be established.

- **Hold the line on a retreated alignment**: maintaining a defence line set back from the existing line of defence.

(Note: all the above policies will need to be supported by strategic monitoring and must, when implemented, take due account of existing Health and Safety legislation.)

This defines the level of detail required by the plan. However, in developing these generic policies there is also a basic requirement to state the intent of the policy such that it is the intent, not the definitions given above, that drive future management.

1.2 Structure of the SMP

The preferred plan and policies presented in this SMP are the result of collating information from numerous studies and the assessments of how the coast may perform. There is, therefore, a need to draw these threads together to provide clarity for different readerships. To this end, the documentation to communicate and support the plan is provided in a number of parts. At the broadest level these are divided into two; the Shoreline Management Plan itself, and a series of supporting appendices. In addition, information is collated in a database linked to a geographical information system (GIS), allowing information to be taken forward in implementing the plan.

1.2.1 Shoreline Management Plan Report Structure

This document provides the plan for the future and the policies required for this plan to be implemented. This is intended for general readership and is the main tool for communicating the intention of future management. Whilst the justification for decisions is presented, it does not provide all of the information behind the recommendations, this being contained in other documents. The plan is presented in seven parts:

Section 1 gives details on the principles, aims, structure and background to the development of the plan.

Section 2 provides details of how the SMP meets the requirements of a Strategic Environmental Assessment (SEA).

Section 3 presents the basis for development of the Plan, providing a broad overview of the Plan area, describing the concepts of sustainable policy and providing an understanding of the constraints and limitations on adopting certain policies.

Section 4 It has been frequently stated that there is as much value in the thought process of developing the SMP as there is in the actual policies themselves. This section, therefore, aims to lead the

reader through this process. The section starts with a discussion of large segments of the coast (called Policy Development Zones; PDZ). Within these zones the coast is described and the way in which the coast might behave, if present management is continued into the future or if no further defence work was undertaken, explained. This is then discussed in relation to the objectives for management and the individual policies for sections of the coast derived (Policy Units; PU). These units are finally grouped in to areas of management (Management Areas; MA), pulling together policy units which have a basic interdependency. For each Management Area statements are prepared setting out a summary of the intent, the necessary actions over different time scales, and the impacts of the preferred policies. Starting from an initial 12 Policy Development Zones, the coast is defined by 99 Policy Units which are drawn together as 33 Management Areas.

Section 5 brings together the overall plan, highlighting important issues in relation to the future management of the coast.

Section 6 provides a very brief summary of policies. It is appreciated that many readers will focus upon the local conclusions of the SMP. However, it is important to recognise that the SMP is produced for the coast as a whole, considering issues beyond specific locations. Therefore, this summary should be read in the context of the wider-scale issues and policy implications, as reported and developed in Section 4 and supported by information in the Appendices.

Section 7 Following consultation on the draft plan, an action plan is developed, providing a programme for future activities which are required to progress the Plan between now and its next review in 5 to 10 years time. A summary of this action plan for each Management Area is presented in Section 4 within the Management Area statements.

1.2.2 The Supporting Appendices

The accompanying documents provide all of the information required to support the plan. This is to ensure that there is clarity in the decision-making process and that the rationale behind the policies being promoted is both transparent and auditable. This information is largely of a technical nature and is provided in ten Appendices:

A. SMP Development: This reports the history of development of the SMP, describing more fully the plan and policy decision-making process.

B. Stakeholder Engagement: Details of the stakeholder involvement process are provided here, together with information arising from the consultation process.
C. Baseline Process Understanding: Includes baseline process report, defence assessment, No Active Intervention (NAI) and With Present Management (WPM) assessments and summarises data used in assessments.
D. Natural and Built Environment Baseline (Thematic Review): This report identifies the environmental features (human, natural, historical and landscape) in terms of their significance and how these need to be accommodated by the SMP.
E. Issues and Objective Evaluation: Provides information on the issues and objectives identified as part of the Plan development, including appraisal of their importance.
F. Water Framework Directive Assessment: This report provides an overview of how the WFD has been considered in the preparation of the SMP.
G. Scenario Testing: Presents the policy assessment and appraisal of objective achievement for the No Active Intervention scenario and the Preferred Plan.
H. Economic Appraisal: Presents the economic analysis undertaken in support of the Preferred Plan
I. Estauray Assessment: Examines the need or extent to which estuaries are included within the SMP2 process. Provides a record of the bibliographic and metadata information.
J. Sets out the support information for an Appropriate Assessment of the Shoreline Management Plan.
K. The Metadatabase, GIS and Bibliographic Database is provided to the operating authorities on CD.

1.2.3 GIS and Databases

The SMP2 provides a future management framework. It is accepted that our understanding of the coast can be improved, addressing the many areas of uncertainty that we are presently confronted with. There will also be changing circumstance not only as the coast evolves but as our use of the coast changes. During the development of the SMP, information on issues, on processes and our assumptions with respect to different aspects, such as the condition of defences or erosion rates, have been recorded.

This information is held within databases linked through to a Geographical Information System (GIS). This system is provided in association with the actual plan so that, as new information emerges, this may be used to update the management system. The intent is two-fold. First, that information is recorded and may be compared with our existing knowledge such that better informed management decisions can be made as management of the coast continues. Secondly, that at such a time that the SMP requires review, hard won information is readily available to this review process.

One important feature of this information is in the responses and issues which were raised during the consultation process. This data is recorded in the issues, features and objective database used for developing and appraising policy. Management of this information will help those managing the coast in the future to identify issues at a local scale, ensuring that views can be readily identified during the actual implementation of the Plan. The degree of effort all consulted have put in to developing the Plan is fully appreciated. The storage of issues information should help ensure that people's concerns are recognised in the future.

1.3 The Plan Development Process

1.3.1 The Need for Revision

The original SMP1s for the area were completed during 1998 for sub-cell 1b, 1999 for sub-cell 1c and 1997 for sub-cell 1d. It has always been recognised that part of the shoreline management plan process is that plans should be reviewed on a regular basis. The review undertaken through SMP2 has been part of this process.

Very much initiated by the findings of the SMP1, a considerable effort has been put in place over the last five years to ensure that we have been in a better position to make judgements with respect to the coast. There have also been changes in legislation and guidance. In this first revision, therefore, the development of the Plan has been able to draw upon and has had to take account of:

- Latest studies and modelling undertaken since the last SMP such as that provided by Futurecoast.
- Issues identified by most recent defence planning (i.e. the several coastal defence strategy plans which have now been produced to cover most of the SMP area between the River Tyne and Flamborough Head).
- Changes in legislation (e.g. the EU Directives, the emerging guidance with respect to the Water Framework Directive).
- Changes in national flood and coastal defence planning requirements (e.g. the need to consider 100 year timescales in future planning, modifications to economic evaluation criteria etc.).
- The emerging thinking on Integrated Coastal Zone Management.

The period between the development of SMP1 and SMP2 has, therefore, been one of quite rapid change. With the manner in which the SMP2 has now been organised and the further understanding that has been developed, shoreline management has to be seen as an ongoing process providing a platform for more local decision making, it is anticipated that subsequent reviews may be undertaken in 10 years time. This timescale would ultimately be driven by the scale in change on the coast itself.

1.3.2 Review and Development Procedure

Since the production of SMP1, the North East Coastal Authorities Group (NECAG) has always been a broadly based body acting to co-ordinate management of the coast. This group comprises representatives from Scarborough Borough Council (Lead Authority), Redcar & Cleveland Borough Council, South Tyneside Municipal Borough Council, East Riding of Yorkshire Council, Easington District Council, Hartlepool Borough Council, Sunderland City Council, English Nature, Environment Agency and Defra. In addition to these parties, the SMP2 Project Management Group (PMG) has also included the North York Moors National Park Authority, the National Trust, the Local Government Association and Royal Haskoning.

The SMP development process has sought involvement from over 400 organisations or individuals, with principal periods of consultation being conducted during December 2004 and April 2005, with consultation on the draft Plan being undertaken over the period between July and September 2006.

The main activities in producing the SMP have been:

- development and analysis of issues and objectives for various locations, assets and themes
- thematic reviews, reporting upon human, historic and natural environmental features and issues, evaluating these to determine relative values of the coast
- analysis of coastal processes and coastal evolution for baseline cases of not defending and continuing to defend as at present
- agreement of objectives with the NECAG and through public consultation, and from this determining possible policy scenarios
- development of policy scenarios which consider different approaches to future shoreline management
- examination of the coastal evolution in response to these scenarios and assessment of the implications for the human, historic and natural environment
- determination of the preferred plan and policies through review with the PMG, prior to compiling the SMP draft document
- consultation on the proposed plan and policies
- consideration of responses and finalising the SMP
- dissemination of the findings and policy contained within the Plan.

2 ENVIRONMENTAL ASSESSMENT AND APPROPRIATE ASSESSMENT

2.1 Environmental Assessment

2.1.1 Background

Directive 2001/42/EC of the European Parliament and of the Council, and the associated Environmental Assessment of Plans and Programmes Regulations 2004, requires that a Strategic Environmental Assessment (SEA) be carried out by certain plans and programmes that are required by legislative, regulatory or administrative provisions. The Directive is intended to ensure that environmental considerations (both good and bad) are taken into account alongside other economic and social considerations in the development of relevant plans and programmes. Whilst it has been determined that SMPs are not required by legislative, regulatory or administrative provisions, they do set a framework for future development and have much in common with the kind of plans and programmes for which the Directive is designed. Therefore, Defra has recommended that environmental appraisal of the SMPs be undertaken in line with the approach of the Directive.

This section identifies how the River Tyne to Flamborough Head SMP achieves the requirements of the 2004 Regulations. The text is sub-divided into sections representing the key requirements of the Regulations, and identifies the sections of the SMP documentation in which the relevant information is presented.

2.1.2 The Appraisal Process

A Shoreline Management Plan (SMP) provides a large-scale assessment of the risks associated with coastal evolution and presents a policy framework to address these risks to people and the developed, historic and natural environment in a sustainable manner. The SMP is a non-statutory, policy document for coastal defence management planning. It takes account of other existing planning initiatives and legislative requirements, and is intended to inform wider strategic planning. It does not set policy for anything other than coastal defence management.

Full details on the background to the SMP and the appraisal process are set out in Sections 1 and 3, with the exact details of the procedure followed in development of the Plan set out in Appendix A.

2.1.3 Stakeholder Engagement

Stakeholders have been involved in the SMP appraisal process, through regular consultation with a broad range of people involved and with an interest in the coast and with the Project Management Group (PMG). This is one of the key changes from the first SMP. This involvement has:

- been undertaken throughout development of the SMP:
- given people and organisations an opportunity to comment on the environmental appraisal of options; and
- allowed representations made by the organisations, communities and the public to be taken into account in the selection of policy options.

The Coastal Group includes representatives from interests including local authorities, nature conservation, industry and heritage. This group has met periodically throughout the SMP development process to input information and review outputs as the study progressed. The PMG comprises a representative from each of the local authorities, National Trust, English Nature and the Environment Agency, attending with a remit to agree the various stages of the SMP as it progresses. Again, this group has met throughout the plan development.

In this way, the views of those whom the SMP policies will affect are involved in its development, ensuring that all relevant issues are considered, and all interests represented. The interests of landowners and residents have been represented through the involvement of the Local Authorities, and the views of all have been sought through the consultation process on the draft recommended policies. Responses from this have been considered in the development of the plan.

Full details of all stages of stakeholder engagement undertaken during development of the draft Plan are presented in Appendix B. This includes the copies of briefing materials.

2.1.4 The Existing Environment

The coastline covered by this plan has a rich diversity in its physical form, human usage and natural environment. This includes dramatic cliffs, vast lowlands of the river valleys, large urban areas fringing the coast, extensive areas of agricultural land, and many areas designated and protected for their heritage, landscape, geological and biological value. This combination of assets creates a coastline of great value, with a tourism economy of regional importance.

The current state of the environment is described in the “Thematic Review”, presented in Appendix D to this report. This identifies the key features of the natural and human environment of the coastline, including commentary on the characteristics, status, relevant designations, and commentary related to the importance of the features and the “benefits” they provide to the wider community. The benefit assessment is provided in support of the definition of objectives. The approach to this assessment is set out in Section 3.

In addition to the review of natural and human environment, the extent and nature of existing coastal defence structures and management practices are presented in the "Defence Assessment" in Appendix C.

This is supplemented by the 'Baseline Processes Understanding' report, in Appendix C, which identifies the contemporary physical form of the coastline and the processes operating upon it.

2.1.5 Environmental Objectives

An integral part of the SMP development process has been the identification of issues and definition of objectives for future management of the shoreline. This was based upon an understanding of the existing environment, the aspirations of Stakeholders, and an understanding of the likely evolution of the shoreline under the hypothetical scenario of "No Active Intervention" (Appendix C), which identifies the likely physical evolution of the coast without any future defence management and hence potential risks to shoreline features.

These objectives include all relevant plans, policies etc. associated with the existing management framework, including all identified opportunities for environmental enhancements.

The definition and appraisal of objectives has formed the focus of engagement with stakeholders during development of the SMP (as identified in Appendix B). The full list of issues and objectives defined for this SMP is presented in Appendix E, which is supplemented by background information provided in the Thematic Studies (Appendix D).

Appendix G includes consideration of how the objective, and hence the 'environment', would be affected under the 'No Active Intervention' scenario, also their achievement under the policy options considered feasible for that frontage, with consideration of international and national designations and obligations and biodiversity. Section 5 provides draws together the overall potential environmental effects of the preferred policies.

2.1.6 Identification and Review of Possible Policy Scenarios

The function of the SMP is to consider the coast as a whole from the perspective of defence management. Having undertaken detailed analysis of its physical behaviour and, through consultation, taken into account the wide and varied interests and objectives for coastal management, a high level analysis was carried out as to primary characteristics of different sections of the coast. Overall the coast is strongly dominated by its underlying geology. Within this imposed structure, it has become evident that no one aspect of the coast, its physical behaviour, its natural or built environment dominates. There is a complex interdependence between different values.

It was, therefore, considered inappropriate that any simple rigid procedure of option appraisal over individual sections of the coast could be undertaken in deriving policy. The continuity of balancing interactions could only be maintained through a scenario approach to analysis. Inevitably, the full 170km of coastline had to be broken down into zones within which such an holistic approach could be adopted. Within these zones, the way in which the coast would develop and the impact this would have in respect of different specific objectives was considered for the No Active Intervention and With Present Management scenarios. This highlighted areas of concern, of benefit and of potential conflict or regret. The objective led scenario approach was then extended, through discussion, to consider how different areas within a zone might be managed to create additional benefit or avoid damage to the overall environment. From this policies, based on those defined in Section 1, have been derived, for individual frontages, in a logical coherent manner, to provide an overall scenario that best delivers national and local objectives. While not necessarily discussed in detail, this approach naturally excludes specific policy options which are not technically realistic or would lead to truly unsustainable approaches to defence, or would run counter to progressing the values identified for an area.

Inherent within this process has been the examination of how different policy scenarios would dictate or be influenced by future evolution of the shoreline, from which the environmental impacts can be identified. The whole process of scenario appraisal and subsequent definition of proposed policies is presented in Section 4. The process has been openly driven by the incorporation and consideration of all detailed objectives reported in Appendix E. A comparison of how well policies address these objectives, compared to how they might be addressed by a general policy of no active intervention is provided in the appraisal tables of Appendix G.

2.1.7 Environmental Effects of the Preferred Plan

The rationale for development of the preferred plan within each policy development zone is reported in Section 4, including a summary policy statement for each Management Area. Within each PDZ discussion, the environmental implications of the various scenarios have been recorded.

A summary of how the preferred plan might perform with respect to different themes, for the whole SMP area, is presented in Section 5.

Within the Management Area Summary Statements in Section 4, further detail of the implications of the preferred plan for all of the internationally, nationally, regionally or locally designated environmental areas are presented, identifying any mitigation measures that would be required in order to implement the policy. This is further supported through undertaking an Appropriate Assessment of the Plan, the support information is provided in Appendix J with a brief overview below in Section 2.2.

2.1.8 Monitoring Requirements

In developing the Plan it is apparent that there are areas of uncertainty that remain critical to implementation of shoreline management. This applies, however, in two ways.

At a local level, monitoring is seen as essential in addressing quite specific issues. The need for this is identified for each management area and should largely be the responsibility of the operating authorities or coastal managers within that area. This not only would then provide information necessary to inform the on-going development of the plan but also provides essential contact between the development of the coast at this local level and decisions being made.

In addition, there are seen to be important linkages, potentially in terms of collating information on impacts, but also in establishing a broader level of understanding and hence prediction of behaviour of different aspects of the coast as a whole, which need to be aggregated over the SMP frontage, at an SMP scale. In Finalising the Plan, these are brought together in the development of the main action plan, introducing the overall coherence for monitoring the whole area, which is most appropriately carried out as a coastal group function, sensibly delegated to one central organisation. The approach to and requirement for monitoring is discussed in Section 7 .

Detailed monitoring and definition of mitigation requirements would be undertaken as part of on-going management and development of strategy studies, together with collation through the Coastal Group.

2.2 Appropriate Assessment

2.2.1 Background

The need for an 'Appropriate Assessment' arises under the requirements of the EC Habitats Directive (92/43/EEC) and its implementation in the UK under the Conservation (Natural Habitats &c.) Regulations 1994. Under Regulation 48(1). an Appropriate Assessment is required for a plan or project, which either alone or in combination with other plans or projects, is likely to have a significant effect on an International site and is not directly connected with the management of the site. A International site is either a Special Area of Conservation (SAC) or a Special Protection Area (SPA), where it has been agreed that it is a Site of Community Importance (SCI). Additionally, in the application of the Habitats Regulations, sites designated under the Ramsar convention need to be considered. As such, Ramsar sites are included within the international sites to which Appropriate Assessment provisions (Regulation 48) apply.

Appropriate Assessment is a decision by the 'Competent Authority' (in this case the local authorities within the SMP plan area), as to whether the proposed plan or project would have an adverse effect on the integrity of any International sites. Section 6 of Planning Policy Statement 9 Biodiversity and Geological Conservation (PPS9) (ODPM, 2006) provides guidance on this matter. An adverse effect on integrity is likely to be one that prevents the site from maintaining the same contribution to favourable status for the relevant feature(s), as it did when the site was designated.

The favourable conservation status of the site is defined through the site's conservation objectives and it is against these objectives that the effects of the plan or project must be assessed. Regulation 48(2) requires that a person applying to carry out a plan or project, which requires Appropriate Assessment, shall provide information to the Competent Authority as may be reasonably required for the purposes of the assessment.

2.2.2 Appropriate Assessment in the land use plan context

On the 20th October 2005, the EU ruled that the UK had not transposed the Habitats Directive into law in the proper manner. Land use plans were incorrectly described under the UK Habitats Regulations, as not requiring an Appropriate Assessment to determine the impacts of the plan on sites designated under the Habitats and Birds Directives.

At present, the Office of the Department for Communities and Local Government (DCLG) has produced draft guidance on how to determine the need for an Appropriate Assessment for a given plan and the provision of an assessment if one is considered to be required. In addition to this, the UK Habitats Regulations are being amended. Natural England have provided an internal draft document relating to the provision of Appropriate Assessments for Regional Spatial Strategies and Sub-Regional Strategies. These two documents: “Planning for the Protection of International Sites: Appropriate Assessment” (DCLG, 2006) and “The Assessment of Regional Spatial Strategies under the Provisions of the Habitats Regulations – Draft Guidance” (English Nature, 2006), currently provide the most cohesive source of guidance relating to the provision of Appropriate Assessments for land use plans. These documents relate explicitly to land use plans, however, given that SMPs have the potential to influence the development of land, this guidance has been applied to SMP policy. In this respect, there are clear parallels between Regional Spatial Strategies and SMPs, and the relevant elements of guidance relating to RSSs have therefore been adapted here for SMP use. Accordingly, these documents have been used as a guide in establishing the scope of the Appropriate Assessment for the River Tyne to Flamborough Head SMP2.

The Appropriate Assessment is simply a mechanism to establish the actual scale and implications of impacts and to provide a determination on whether

a course of action is acceptable or unacceptable, in terms of its effects on the integrity of International sites.

2.2.3 Requirement for an Appropriate Assessment for the SMP2

The primary task in applying the Habitats Regulaltions to the SMP relates to the need to establish whether an Appropriate Assessment is required. As stated above, this relates to the task of establishing whether the plan would be likely to have a significant effect on an international site, either alone or in combination with other plans and projects. On the basis of the policies within the SMP, and the presence of a range of International sites within the plan area, it could not be concluded that there would not be likely significant effect of SMP policy on such sites. SMP policy has been provided at a Management Area level and the policies nested within this, have a clear potential to directly effect International sites. In this context, it was a simple task to determine that the SMP had the potential to have a likely significant effect, and on the basis of a preliminary initial assessment, it became obvious that an Appropriate Assessment for the plan was therefore required. The need for an Appropriate Assessment was therefore considered necessary 'alone' and did not require recourse to determine the effects of the plan in combination with other plans and projects, at that stage. It should be stressed however, that in developing the policies of the SMP, full regard was given to the need to ensure that the integrity of the International sites in the plan area was considered in policy development. Although an Appropriate Assessment was not provided at the policy formulation stage, the assessment of impacts on International sites was a primary consideration in the development of policy and the definition of Management Area boundaries.

The exercise, to provide an Appropriate Assessment for the SMP, provides the opportunity to determine whether the impacts of the SMP would have an effect on the integrity of International sites, by means of a specific assessment exercise. This assessment represents the first attempt at providing an Appropriate Assessment for an SMP nationally, and as such, the document is seeking to pioneer a robust approach undertaken to an appropriate level. The full details of the Appropriate Assessment are provided in Appendix K.

3 BASIS FOR DEVELOPMENT OF THE PLAN

3.1 Historical and Current Perspective

3.1.1 Physical Structure

A detailed discussion of the Geology and Coastal processes is presented in Appendix C.

Geology
To the north, between the Tyne and Crimdon (to the north of Hartlepool) there is the series of Magnesian Limestone Cliffs varying in height and overlain to various degrees and in varying depths by Late Devensian glacial till (overlying much of the hard geology of the SMP coastline). To the south of the Hartlepool headland starts the Triassic sandstones and mudstones extending down to and submerging under the estuarial deposits of the Tees. Emerging from the Tees valley, underlying Redcar, building and changing through the cliffs around Whitby, Ravenscar, Scarborough through to Filey Brig and continuing generally beneath the glacial deposits of the Vale of Pickering are the various shales, limestones, sandstones and ironstones of the Lower, Middle and Upper Jurassic Period. Finally at the southern extent of the SMP area is the massive hard Chalk Headland and shore platforms of Flamborough Head. This changing geology, cut by the major rivers of the Tyne, the Wear, the Tees and the Esk and incised by smaller denes and valleys, and embayed through the differential erosion between harder and more erosive sections of rock and till, dominates the landscape and the geomorphological evolution of the whole frontage. Indeed, although there are other important factors, the development, both physically and in terms of use, values and interest of the NECAG SMP2 coastline is strongly linked and influenced by its underlying geology.

Human and Other Factors
Not withstanding this, other factors have also influenced the physical development of the shoreline. Man's influence in some areas is now quite strong, with construction of defences and typically at a larger scale by structures such as breakwaters. Similarly, over at least the last 200 to 300 years, man's exploitation of the economic geology, in terms of quarrying, mining or deposition of waste has had a significant influence. This impact, although locally quite substantial, tends still to be limited in extent by the natural geology determining the overall shape of the coast.

Erosion of the shoreline is influenced by many factors, most obviously, and particularly over the softer coast, by the geomorphology and exposure to wave and tidal action. Other factors include general weathering, chemical and bio-chemical deterioration and ground water. While much if not most of the coastline is subject to this long term erosion or is under some pressure from erosion to the hard geological structure, in general terms the erosion is slow in comparison to other areas of the English coastline.

Coastal Change

Along some of the more resilient sections of coast the best estimates of erosion are less than 0.1m (less than 10m at current rates over the next of 100 year period being considered as a the basis for the SMP2). Typically this is true of many the major geomorphological structures such as Flamborough Head, the general area of the North York Moor, the Hartlepool Headland, the southern headlands of the Durham coast (particularly just to the south of Seaham) and the overall headland associated with Souter Point. In detail, however, there is considerably greater variation. It is estimated that areas of the Souter and Trow headland may have an historical erosion rate of 0.2 to 0.3m/yr, local headlands south of Sunderland down to Seaham may be eroding at similar rates with even greater rates (up to possibly 0.8m/yr) where the Magnesian Limestone is lower or weaker or where there is greater exposure of the softer till[1]. Similarly between the headlands south of Seaham, erosion of the cliffs, once fully emerged from the deposits of colliery wastes, may recommence with an erosion rate of 0.3m to 0.5m/yr along frontages. In other sections of the coast, such as areas of Whitby and Scarborough; partly as a result of coastal erosion but also due to underlying instability of the coastal slope, there are significant landslips making larger areas of the hinterland more vulnerable. Such highly variable episodic rates also apply south of Scarborough. In terms of coastal processes, this variation in erosion has to be set within the context of the geomorphological control imposed by the harder rock headlands, influencing the shape and exposure of sections of the coast and influencing sediment movement along the shore. The natural evolution of the coast as a whole tends, therefore, to be relatively slow and, in terms of coastal processes, substantially constrained by the hard geology.

Confidence and Uncertainty

At the broader scale there is, from the data collated as part of the SMP process, a good level of confidence in overall physical evolution of the SMP frontage. However, given the relatively slow rate of natural evolution, further obscured in several areas by the large scale of change brought about by past activities (such as the deposition of colliery waste during much of the 20th Century to the Durham coastline or the earlier mining and quarrying activity, particularly to the foreshore, of jet and ironstone in the Whitby area) obscuring the slower natural changes, there is still uncertainty in extrapolating accurately specific rates of erosion at a local level. Equally, despite efforts to better understand the behaviour of the softer till coast line, there is still considerable uncertainty associated with the specific degree of slippage or instabilities that may arise. Indeed in some areas, such as the lengths between Sunderland and Seaham the very location of harder headlands has changed over time.

[1] Further details are provided in Appendix C.

In terms of a general perspective of the SMP area, therefore, frontages under distinct pressure tend to be of a local nature; but over the broader area there is the requirement for the longer term perspective of 100 years given by the SMP from which to consider significant larger, longer scale change. Further uncertainty exists, both in terms of definition of and in terms of physical response to climate change.

Conclusions
At the broader scale of the SMP coastline and not withstanding these areas of uncertainty (which relate more to the timescale of evolution than the underlying process of erosion), the conclusions which may be drawn are that there is little overall change anticipated to the basic geomorphology of the coastline (i.e the underlying shape of the coast will be dictated by the hard geology and slowly eroding control features), but that within this, there will be a continued process of erosion over much of the coast, placing pressure on more local areas. The fundamental aim of the SMP is to consider how management of the coast, specifically its defence policy, may be best taken forward to reduce risk from flooding and coastal erosion against this background.

3.1.2 Coastal Processes and Process Linkage

Over much of the coast, specific studies (strategy studies), considering aspects of coastal processes have been undertaken; largely since the development of the initial SMP1. This has provided a good overall definition of wave climate, tidal flows and water levels, and sediment movement.

Despite some variation from north to south, the typical pattern of wave climate offshore records a dominant wave approach from the north and north east, with significant but reduced frequency of exposure from directions south of east. The general pattern of drift anticipated based on this overall wave climate acting over the nearshore area is from north to south. There is a relatively strong pattern of drift in this nearshore area along the Tyneside and Durham coastlines, potentially reducing along the more east/west shoulder of frontage created by the North York Moor land mass. There is less certainty associated with movement in the nearshore zone between Whitby and Scarborough but with stronger evidence that the influence of, initially, Filey Brigg and then the stronger influence of Flamborough Head interrupt the consistent flow of nearshore sediment further south out of the SMP area. At Flamborough it has been determined that there is some movement of offshore material to the south but that some return of material is possible around Flamborough Head.

At this broad scale, both in analysis of sediment movement from the previous SMPs and in consideration of the overall shape of the coast in relation to bathymetric contours, there are four main areas of prominence:

- The Souter Headland (Lizard Point to Souter Point) forming a shoulder of land south of the Tyne valley. Some offshore drift to the south is indicated through this area.
- The Hartlepool Headland forcing a reorientation of the offshore contours coming in from the north but more significantly defining the northern control to the sediment sink of the Tees Valley. Again there is an indicated offshore continuation of drift from the north past the headland.
- The shoulder of land comprising Old Nab (*Staithes)* to Saltwick Nab (*Whitby*), with the compression of offshore contours against the hard land mass, forming the southern limit of the Tees Valley sediment sink. Due to the nearshore depths of the sea bed and the uncertainty as to the composition of the sea bed in this area, the nature and extent of sediment linkage from north or west to east and south is uncertain. There are, however, records of sand patches potentially identified as having accumulated in large tidal eddies, suggesting movement in the nearshore area[2].
- Flamborough Head, forming the southern end of the SMP frontage and allowing the development of Filey Bay. This provides a significant control over sediment drift, although still allowing some movement as recorded earlier.

Closer to the shore and, at this local scale, more specifically related to the shoreline drift, a different pattern of both processes and control emerges. At the shoreline the offshore wave climate is modified by the nearshore bathymetry tending to draw the wave to approach more normal to the existing shoreline orientation. In addition, the more prominent local features of the coast, both natural and man-made, provide shelter, tending to modify the wave direction and result in changes to the actual wave climate able to work on sediment.

This local impact is very evident. Working from north to south along the coast it may be seen that the background control provided by the Souter headland and the slight depression of the coast created by the Tyne Valley, coupled with the shelter provided by the major harbour structures at the mouth of the river to the dominant north-easterly offshore wave climate, have created an environment where the general sediment drift has tended to be to the north. This has resulted in an accumulation of sediment against the South Pier, adjusting the coast to create a relatively stable foreshore and bay. This more local interaction between the forces acting on the shore, the local control points and the subsequent redistribution of sediment may be demonstrated over much of the coastline.

[2] This information was identified during consultation on the draft SMP. While supporting the general conclusions of a continuity of sediment in the nearshore area, further examination of this information is recommended as part of the overall monitoring plan.

To the south of the Souter Headland the coast has settled into the Whitburn valley. The area is controlled by the outcropping Parson's Rock and the heavily reinforced delta of the River Wear. South of Sunderland the coast is far less naturally constrained but even so has been shown to be strongly influenced by the natural harder headlands of Saltern Rocks, Pincushion and the Featherbed Rocks, and further south the more dominant Chourdon Point and Shippersea headlands. (Seaham Harbour, while locally significant, imposes less overall control because of its closer association with natural headlands.)

Over the southern Durham coastline, although still disguised to a large extent by the heavy but transitory mantle and southerly drift of colliery waste, many of the bays are shown to be fundamentally in equilibrium with the net wave direction. This length culminates in an area of sediment accumulation where the Hartlepool Headland has, at this more local level, held material to form the dunes of Hart Warren within the valley of the Crimdon Beck.

The Hartlepool Headland has further influenced and controls movement sediment with the Tees Bay. Within this control, and controlled to its south-eastern end by Hunt Cliff and beyond this the shoulder of land over the North York Moors, the Tees acts as a sediment sink. Sediment drift tends to circulate in a northerly direction behind the shelter of the Hartlepool Headland, the headland's influence being reinforced by the extension of the Heugh Breakwater. The influence of the Long Scar pulls forward the coastline, tending to retain material in Hartlepool Bay and anchoring the north end of the Seaton Sands; the main control to the Seaton Sands being provided by the North Gare Breakwater. To the east of the Tees, the South Gare and the Coatham Rocks contain the relatively stable Coatham Sands and, while it has been shown that sediment tends to move across the Redcar Frontage, the Coatham Rocks act in conjunction with Huntcliff to contain the developing bay between Redcar and Saltburn.

In terms of direct shoreline linkage, the bays of Skinningrove, Runswick and Whitby are strongly contained, although in each case, there are very certainly important interactions of sediment within each bay, and possibly between bays and the offshore zone. From Whitby through to Filey Brigg, while there is more potential for southerly sediment drift over the frontage, as in the case of the south Durham coast, this is restricted by the relatively deeply cut bays (Maw Wyke Hole, Robin Hoods Bay, Hayburn Wyke, Cloughton Wyke, Scalby, North and South Scarborough and Cayton) and limited by the actual supply from the cliff line. As noted earlier the accumulation of sand patches does suggest that in the nearshore area, as opposed to that at the actual shoreline, sediment drift does occur potentially due to tidal streams.

Finally at Filey, the shape of the bay is dominated by the influence of the Brigg and Flamborough and has been progressively cut between these two headlands to the extent that there is now a good indication that the overall shape is near equilibrium. Although there is some slow erosion of the Brigg,

the main change is in the continuing erosion of the cliff line as a result of the variation in wave exposure and cliff instability. As previously discussed, and applying to most sections of the coast, there will be a longer term trend of erosion, increasing with climate change and sea level rise.

To the southern end of Filey Bay, Thornwick, North Landing, and Selwick Bay are local features with little effective process association with other frontages.

3.1.3 Sediment Supply

There is some form of sediment supply from the nearshore area to shoreline generally over the whole length of the frontage. This is more evident in some areas than others. The likely transfer between the nearshore and the shore at Sunderland, north of Hartlepool, the Tees Bay, Whitby and Scarborough are examples of this. In other areas such as over much of the rocky coastline between Whitby and Scarborough, such transfer is far less obvious, although the presence of sand patches in the nearshore area does indicate some movement. At Filey, while there is clearly significant movement between the shore and the nearshore area, this nearshore area is relatively independent of the broader offshore processes, making this in effect a delicately balanced closed system.

In such areas sediment supply from the cliffs has been identified as being important, and in several areas this cliff supply is seen as providing necessary supply to sustain the local bay beaches. However, there is nowhere that really provides an SMP scale supply from erosion of the land, feeding the whole or substantial sections of the coast. Indeed, over much of the coastline, both due to the relatively slow erosion of the main rock cliffs and the composition of the cliffs, the coastline as a whole is not seen as providing a substantial supply of beach materials to the shoreline.

3.1.4 The Purpose of the SMP in Relation to the Physical Structure and Processes

The aim of the SMP is to ensure that proper account is taken of the impact or interaction between areas, such that management in one area does not have a detrimental impact elsewhere. Typically this implies the need to consider the reliance of defences or erosion rate and cliff stability on secure beach levels. From this; and from the broader picture of the sediment supply (potentially from the nearshore and offshore areas and from erosion of the land), there is the need to consider the potential sediment pathways, the possible interruption of those pathways and the potential for erosion or retention of sediment. At the same time the SMP has to provide flood and erosion risk policy guidance to a level of information that may feed practically into local planning and management of specific defence lengths. In developing this, therefore, the SMP has to maintain a perspective at a broad level while still addressing local interactions. In terms of the physical processes, the NECAG SMP coastline exhibits a relatively limited, but still

potentially important, linkage across much of the length, within the nearshore area. At the shoreline this general linkage is far more constrained. Therefore, at the same time as taking the high level picture of interaction over the whole coast, many of the more immediately practical issues relate, in some areas, such as the Tees, to quite large but still discrete frontages, and in other areas to very short frontages and local bays.

3.1.5 Natural and Cultural Heritage

Appendix D (Thematic Review) provides a detailed definition of the natural heritage, landscape, historic environment and land use. The following paragraphs draw this together in a general appreciation of the values of the area.

Geology

The SMP shoreline is highly diverse in terms of its natural and cultural heritage; those aspects of the coastline that give an essential and important quality and backdrop to the current use and appreciation of the area. With respect to geology, this has already been discussed (Section 3.1.1) in terms of the physical structure. However, the NECAG frontage exhibits an array of both hard and soft geological exposures significant for research, in understanding the very long term perspective of change, for education, in awakening and developing an appreciation of this change, and for sheer enjoyment of the varied landscape, habitats, flora and fauna. In addition to this general varied collection of interest, reflecting the diversity over the whole coast, are the more specific sites, focussing on such aspects as palaeontology, with some of the best exposures of fossils such as around Robin Hoods Bay. These specific qualities are recognised in the extensive range of designations at international, national, regional and local levels.

The geology also underpins a significant element of the cultural heritage. Many of the heritage designations associated with the coast reflect man's exploitation of the natural resources, giving a broad range of understanding to the human development of the area. Such activities cover the surface mining of jet and ironstone in the Whitby area, the more recent mining of coal associated with the Durham coast or the still active extraction of Potash at Boulby. These activities map the historic human settlement of the area as well as providing an important cultural context associated with the development of settlements such as Hartlepool, Seaham, Sunderland and South Tyneside.

Heritage

As significant as this economic based archaeology, is the longer term history of settlements, more often providing a continuous process of association between humans and the coast. This association is demonstrated in the find of a Neolithic axe head on the foreshore of the Hartlepool Headland, to the more obvious heritage of the Souter Lighthouse or the 20th Century military coastal defence at Trow Point. This maritime heritage is celebrated in the

museum area in Hartlepool but is still alive in such villages and towns as Staithes, Whitby, Filey and even Scarborough. The importance of this living heritage is recognised in the aim of the North York Moors National Park Authority to sustain the vitality and community of the coastal villages.

In addition to the important cultural and educational context, the varied assemblage of heritage interest supports a significant tourism industry, supporting in turn the sustainability of the cultural values.

Natural Environment

A substantial proportion of the coast is covered by internationally important designated areas of natural heritage. There are 4 SACs; including much of the Durham coastline, Beast Cliff south of Whitby and Flamborough Head. There are a further 3 SPAs, with the Northumbria Coast SPA, covering intermittently the discrete section of rocky shore from the Tyne to the Tees, the Teesmouth and Cleveland Coast SPA and Flamborough Head and Bempton Cliffs SPA. In addition certain areas are designated as Ramsar sites. As significantly, these sites are part of a matrix of national, regional and local sites (Sites of Special Scientific Interest (*SSSI)*, National Nature Reserves *(NNR),* Sites of Importance for Nature Conservation *(SINC)* and Regionally Important Geological Sites *(RIGS)* forming a near continuous definition of value over the whole SMP frontage; supported by more general designations of Heritage Coast, the National Park and wildlife corridors.

Despite the obvious legal imperatives set out in relation to national and international sites, from the perspective of what the SMP attempts to deliver, it is this interactive mosaic of interest and value which the SMP not only aims to protect but also enhance. This overarching principle is enshrined in the targets for bio-diversity and in the emerging application of the principles of the Water Framework Directive.

Conclusion

For all aspects of heritage; while with respect to specific designation it may be possible to rank the significance of different elements, in considering SMP policy at a local and strategic level there has to be a recognition of the need to conserve very specific aspects of heritage in the context of how it contributes to the overall value of a local area. This is both with respect to specific heritage themes as well as in the cross-cutting benefit to the region. In developing policy and policy scenarios, therefore, there needs to be an awareness of the potential total interrelationship between the different elements. As in consideration of the linkage created by the physical processes, the development of the SMP has to be carried out at a specific level but maintaining this broader awareness of legal imperatives and international significance.

3.1.6 Human (Socio-Economic) Environment and Activity

Significant sections of the coast are heavily developed, providing important areas to live and work but also providing substantial economic wealth to the whole region and the nation. The main settlements on the SMP frontage are:

- South Tyneside; the main centre being set back from the coast but reliant upon the coast for an important recreational and amenity area. This area increasingly links through to the regeneration of the River Tyne corridor.
- Sunderland; where the northern section of the city's coastline is again seen as a major asset to the whole town, both as an amenity zone and an area for tourism. Equally important to the City is the Port of Sunderland and the regeneration plans being developed for the area of the port and harbour. To the south of Sunderland the area of Hendon is seen as an area for greater opportunity associated with the use of the shore, providing an essential recreational and amenity area to this southern part of the city.
- Easington; has seen important regeneration of the sea front and town centre supporting efforts to revitalise the whole area. Associated with this is the development of the Port, the construction of the coastal link road and the development to the northern section of the town frontage. The northern promenade is seen as an important aspect of the town.
- Hartlepool; the town's frontage is divided into two main areas, that of the headland with its substantial residential areas and the more commercial town centre to the south of the Headland. The Headland is also important for its heritage value to the town. The Victoria Dock area is planned for redevelopment linking from the headland through to the centre of the town, the marina and the recently developed tourism centre. To the south of Hartlepool is the town of Seaton Carew, an important settlement in its own right but built around its sea front and extensive sandy beaches.
- Teesmouth; this area is the industrial core of the region, important as a port but also for its various industrial plants. This area is of vital importance to employment in the area.
- Redcar, Marske and Saltburn; the largest of these settlements is Redcar but all have important sea fronts, supporting the tourism of the area but also providing a recreational amenity to the local populations. In particular at Redcar the sea front has considerable commercial value associated with these activities.
- Whitby; is an important traditional sea-side town as well as having a thriving central, working harbour area. Whitby is an important holiday destination supporting tourism within the wider area of the National Park.
- Scarborough; the sea front at Scarborough was developed during the Victorian period and supports superb architectural features from that time as well as important heritage features from earlier settlements. The two main beach areas function in very different ways, complementing each other. Between the two beaches the Harbour is important as a working harbour but also as a centre of activity for the town.

- Filey; the main town is on the cliff above the sea front promenade but even so the sea front acts as an important focus for the town, supporting a valuable tourist industry.

Between these main centres are the smaller villages such as Skinningrove, Staithes and Robin Hoods Bay, all adding to an essential vitality of the coastal environment. These villages and the larger towns both provide the important commercial and economic justification for management of the coast but also contribute, as reflected in the objectives of the North York Moors National Park Authority, to the overall value and appreciation of the area.

Conclusion
An important role of the SMP is to examine how these various communities can be sustained in the context of an eroding coast. Equally important, however, is to reflect what it is about each centre that is important, so that in maintaining defence to an area, or in considering the need for change in defence policy, the values of the coastal frontages are equally maintained.

3.2 Sustainable Policy

3.2.1 Natural Processes

The geological exposures of the coast, certainly over the northern section of the frontage, are clear evidence of how sea levels in the area have changed. Over the last 2,000 years, this change has been quite minimal (averaging less than a millimetre per year). However, we are now entering a period of accelerating sea level rise that will impose greater pressure on the coast to erode and could in some areas; particularly where the shoreline is dependent on natural protection provided by beach material, result in significant change. There is also the potential for changes in sediment supply. This problem has been exacerbated at some locations in the last century due to human intervention reducing the contemporary sediment supply from cliff erosion by the construction of coastal defences and harbour arms. Although attention is focussed upon the shoreline position, this process also has the potential to produce a deepening of the seabed at any particular point. This is a feature that has been potentially identified within a number of areas on the coast where there is evidence of the low water contour moving closer to the shoreline. We have to plan for this change. In general terms we have to expect greater energy against the coast and against defences coupled with a potential reduction of sediment along sections of the shoreline. If we choose to continue to defend our shorelines in the same locations that we do at present, then the size of the defences may need to increase. We need, therefore, to be looking to create width where this is possible, either through setting back defences or through modifying the approach we take. Equally we need to be recognising the importance of the geological control that exists to the coast, working with this to sustain the shape of the coast and thus to retain and maximise the use we make of the sediments which are available.

As discussed earlier, over much of the coast, there is quite limited overall movement of sediment at the shoreline. This is not primarily seen as a coast where action in one area has major impact elsewhere. More locally the transfer of sediment along the shore can be significant. In considering the sustainability of managing areas of the coast we have to understand the significance of these impacts such that we are able to maximise the use of material without creating problems elsewhere. A sustainable shoreline sediment system is one that is allowed to behave as naturally as possible, without significant further intervention.

3.2.2 Economic Sustainability

One of the difficulties facing us, as a nation, is the cost of continuing to protect shorelines to the extent that we do at present. Many of the defences that exist today have been the result of reactive management with often limited understanding (or perhaps knowledge) of the long-term consequences, including financial commitment. Studies over the past few years have established that the cost of maintaining all existing defences is already likely to be significantly more than present expenditure levels. In simple terms this means that either more money needs to be invested in coastal defence, defence expenditure has to be prioritised, or funding has to come from other sources based on the benefit they bring. Whilst the first option would clearly be the preference of those living on or owning land along the coast, this has to be put into context of how the general UK taxpayer wishes to see their money used. Given that the cost to provide defences that are both effective and stable currently averages between £2million and £5million per kilometre, the number of privately owned properties that can be protected for this investment has to be weighed up against how else that money can be used, for example education, health and other social benefits. Furthermore, because of the climate changes being predicted, which will accelerate the natural changes already taking place, these recent studies have also established that the equivalent cost of providing a defence will increase during the next century, possibly in some areas to between 2 and 4 times the present cost. Consequently those areas where the UK taxpayer is prepared to continue to fund defence may well become even more selective and the threshold at which an area is economically defendable could well shift. Whilst it is not known how attitudes might change, it is not unreasonable to assume that future policy-makers will be more inclined to resist investing considerable sums in protecting property in high risk areas, such as the coast, if there are substantially cheaper options, such as constructing new properties further inland. It is extremely important that the long-term policies in the SMP recognise these future issues and reflect likely future constraints. Failure to do so within this Plan would not ensure future protection; rather it would give a false impression of a future shoreline management scenario which could not be justified and would fail to be implemented once funding was sought. The implications of these national financial constraints are that protection is most likely to be focussed upon larger conurbations and towns,

where the highest level of benefit is achieved for the investment made, i.e. more properties can be protected per million pound of investment. The consequence is that more rural communities are more likely to be affected by changing financial constraints, but from a national funding perspective, i.e. best use of the taxpayer's money, this makes economic sense.

However, sustainability cannot only be judged on the effort necessary to defend areas. There has also to be consideration of what values, what heritage may be passed on to future generations. This is not just in the bricks and mortar that is being defended but is the character and vitality of the coastal communities. There has, therefore, to be a sensible balance achieved between those areas where the increasing pressure from the changing shoreline will make defence unacceptable in reality and those where defences can be maintained but at increased cost. The SMP has to consider this in terms of:

- What is the value that is being defended, whether this is in terms of a viable community or merely from the economic perspective of a hard asset.
- Whether defences themselves are causing a further deterioration in conditions which makes their maintenance increasingly difficult.
- How management practice will itself evolve. For example in moving down one course of action will this lead to further defence, and further resource being put into defence.

In this latter case the SMP attempts to identify where there is a need to possibly take earlier action to support existing natural structures or to take advantage of existing width, so as to provide a more sustainable defence system in the future.

In many respects sustainability and the balance which we are attempting to achieve may be considered in terms of how the consequence of our action now will be considered in the future. Either in terms of these consequences or in deciding to defend or not defend, a simple test of sustainability is the degree of regret that might be felt in the future of the decision which is being made now. Will we wish that we had taken a different course of action?

3.2.3 Natural Environment

The forces of nature have created a variety of landforms and habitats along the NECAG coastline. The special quality of the natural habitats and geological/ geomorphological features on this coast is recognised in a number of national and international designations, protected under statutory international and national legislation, as well as regional and local planning policies. There is a legal requirement to consider the implications of any 'plan' or 'project' that may impact on a Special Protection Area (SPA) or Special Area of Conservation (SAC), through the European Union Habitats Directive (Council Directive 92/43/EEC) and Birds Directive (Council Directive

79/409/EEC). The Defra High Level Target for Flood and Coastal Defence (Target 9 – Biodiversity) also requires all local councils and other operating authorities to:

- avoid damage to environmental interest
- ensure no net loss to habitats covered by Biodiversity Action Plans
- seek opportunities for environmental enhancement

A key requirement for the SMP is therefore to promote the maintenance of biodiversity or enhancement, through identifying biodiversity opportunities. Coastal management can have a significant impact on habitats and landforms, both directly and indirectly. In places, coastal defences may be detrimental to nature conservation interests, e.g. producing coastal squeeze, but in other locations defences may protect the interest of a site, e.g. freshwater sites. Coastal habitats may also form the coastal defence, e.g. the sand dune complex to the north and south of Teesmouth. Therefore, coastal management decisions need to be made through consideration of both nature conservation and risk management. Although the conservation of ecological features in a changing environment remains key, in terms of environmental sustainability, future management of the coast needs to allow habitats and features to respond and adjust to change, such as accelerated sea level rise. It is recognised that true coastal habitats cannot always be protected in situ because a large element of their ecological interest derives from their dynamic nature and this is important to ensure the continued functionality of any habitat. Similarly in terms of many of the geological designations many of these rely on fresh exposure of the cliffs. This poses a particular challenge for nature conservation and shifts the emphasis from site 'preservation' to 'conservation'. Therefore, accommodating future change requires flexibility in the assessment of nature conservation issues, possibly looking beyond the designation boundaries to consider wider scale, or longer term, benefits. The SMP also needs to consider opportunities for enhancing biodiversity throughout the SMP area, not just at designated sites.

The natural environment of the SMP coastline, quite apart from its intrinsic value, is acknowledged to be of exceptional importance in tourism and to the very way of life of people living in the area. In looking to sustain this environment, therefore, the SMP has to consider how the natural and built environment co-exist on this dynamic coastline.

3.2.4 Social Justice

A number of stakeholders have raised the issue of 'Social Justice' in relation to an aspiration for coastal protection during the consultation phase on the draft Shoreline Management Plan 2 (SMP2).

Social Justice refers to conceptions of justice applied to an entire society. It is based on the idea of a just society, which gives individuals and groups fair treatment and a just share of the benefits of society. The term 'Social Justice'

itself tends to be used by those who believe that present day society is unjust in some aspect.

In the context of Shoreline Management Planning, social justice has been used by some to justify intervention in terms of proactively managing the coast and, more particularly, an expectation that the public purse should fund defence against erosion, inundation and/or loss of property arising there from.

In terms of the SMP2 it is interpreted that social justice refers to the provision for compensation for property lost to the sea. Firstly that compensation should be paid for total loss of property due to failure to defend against coastal erosion on a hitherto defended coast. This infers a change in the preferred policy over the epochs of the SMP2. Secondly if the policy is to not defend properties at all, then the owners of properties that will be lost, should receive compensation.

In response to these interpretations it must be remembered that the premise upon which coast protection is provided is under permissive powers. Coast Protection Authorities operate under permissive powers to act; there is no statutory right to be protected.

The SMP2 when developing policies takes into account technical, environmental, social and economic factors in line with the Government's strategy for managing floods and coastal erosion. The SMP2 is realistic, uses existing legislation and accounts for likely future Coastal Defence funding. The SMP2 has developed policies based on current legislation.

Management of the coast has to be addressed in relation to the different aims, duties and responsibilities of society and individuals and this is reflected in the existing funding and regulations. There is a requirement on the operating authorities to regulate development on the coast and shoreline to ensure that the actions of individuals or groups of individuals do not cause damage to others or to those features of the coast valued in some way by society. The SMP2 provides an essential role in advising on this, through being able to examine the coast and interactions at a suitably broad scale. In exercising permissive powers, operating authorities are able to undertake works to reduce the risk from flooding and erosion where such action is seen as being to the overall benefit of the nation and society. This is most frequently judged in terms of economic benefits but can also be driven by other factors such as cultural, heritage or environmental issues; but always in relation to the overall community, not specifically in relation to individuals. The SMP2 is an essential tool in considering the overall risk and, judged against the various objectives identified, identifies policy which balances the achievement of these objectives in a sustainable manner. Addressing the risks at an individual level, where there is not seen to be specific national or overall community benefit, remains the responsibility of the individuals, acting always within the regulatory framework discussed above. Even at this level,

the SMP2 provides an important function, setting out the anticipated risk and providing guidance on the coastal processes influencing this. Furthermore, the SMP2 identifies where there are potential constraints in relation to the possible impacts any individual action may have on other sections of the coast.

Within the current legal framework, the SMP2 provides a valuable overview of the various issues which might arise from specific action or inaction in terms of coastal defence and flood and erosion risk management.

The SMP2 has raised the importance of Social Justice and its application to the delivery of long term sustainable solutions for coastal management. Stakeholders' concerns have been brought to Defra's attention. Defra has recognised within the Making Space for Water project SD2: Adaptation toolkit, that Social Justice and Flood and Coastal Erosion Risk Management (FCERM) are now inextricably linked.

3.3 Thematic Review (A review of the different themes is given in Appendix D)

It is evident from section 3.1 above and Appendix D that there is a high degree of diversity over the SMP2 coastline, in terms of the physical processes, natural and cultural heritage and socio economic drivers; and in considering sustainability (section 3.2) that there is significant interaction within each theme and between the different themes or individual sectors of interest. Furthermore, depending on the scale at which the coast is considered there are different interactions. Nominally, for example, it may be appropriate to say that over the whole SMP2 coastline there is a north to south sediment drift. At a high level this might be valid but ignores, at a slightly more detailed level, the fact that the Tees Bay acts primarily as a sediment sink or, at an even more detailed level, that there is a reversal to this sediment drift trend in areas such as Scarborough South Beach or along the northern flank of Flamborough Head. Similarly in terms of transport or coastal footpaths, or indeed the contribution that Scarborough or Sunderland have on the economic welfare to the region, there are many interactions at differing levels of detail.

The aim of the SMP is to provide an assessment of flood and erosion risk at the national level and, associated with this, an indication of the overall level of commitment to defence in these areas. Equally the SMP aims to provide a general assessment of appropriate policy for risk management at a level that will assist direct management of defences in a manner which will support other management objectives for the areas. Clearly to address both levels there needs to be a layered approach to the SMP analysis. To achieve this, despite maintaining a clear awareness of the broader levels of interactions between areas, it is necessary, to allow focus on all issues, to consider sections of the coast in detail and within which individual policy units can then be derived. In taking such an approach consideration has also to be given to the higher level issues, such that the interaction between these is not lost.

The public consultation undertaken at the start of the SMP allowed issues to be identified for individual features within the area. This was used to develop an overall characterisation of the coast, which in turn assisted in agreeing specific objectives for management. Consideration of this overall characteristaion allows the coast to be divided into sections, through which more detailed consideration could be given to the development of policy. This process is discussed in Scetion 3.4.

3.4 Development of Policy

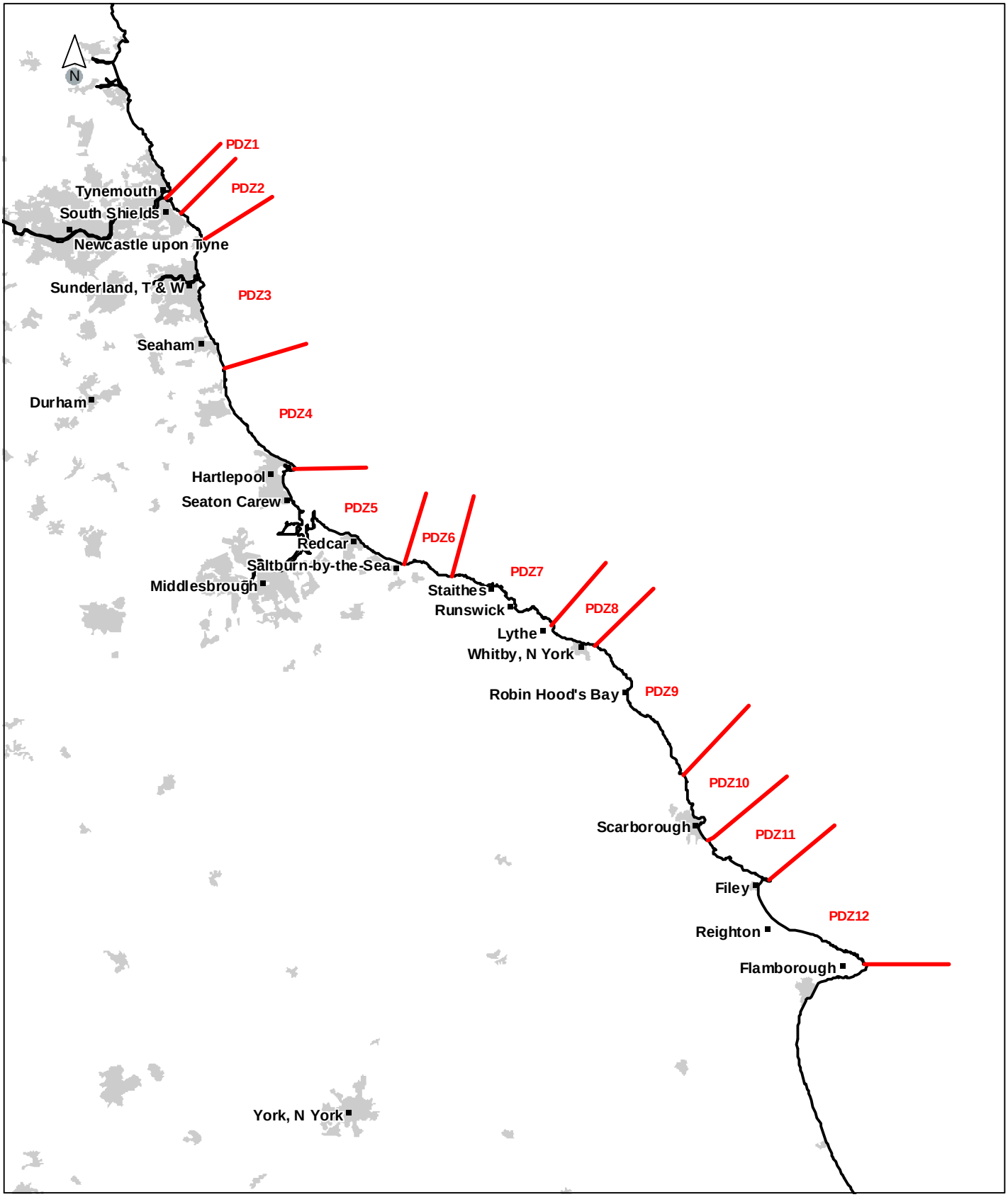
3.4.1 Derivation of Policy Development Zones

There is quite clearly no single issue which dominates the development of policy on the coast. From whichever perspective the coast is viewed, there are always overlapping issues and interests between sections. Purely from the manageability of developing policy in sufficient detail, however, the coast has to be divided. This has been done in such a manner as to minimise the residual linkages between one section of the coast and the adjacent section, but also to ensure that in developing and discussing policy, all major interactions across all themes are able to be considered. Figure 3.1 maps out in broad terms the high level division of the coast. It is within these sections or zones that individual policy units may be developed. This division is not intended to define hard barriers to thought about the coast as a whole but solely a practical means of examining the coast in detail. So as not to be confused with the final policy units, the sections are called, merely as a matter of labelling and convenience, “Policy Development Zones” (PDZ). Within each of these zones are identified the principal management issues which need to be addressed.

3.4.2 Indentification of Policy Units

Within each PDZ different scenarios are considered; always starting with the policy for “No Active Intervention” (NAI) for all locations within the PDZ. This provides the baseline for considering the need or the sense in actively managing the coast. The second scenario is based on the policy developed from SMP1, taking into account further detail or modification which may have been developed during strategy studies undertaken since SMP1. These are termed “Present Management” (i.e that policy which the SMP2 is reviewing[3]) and provides the starting point for considering future management. This Present Management scenario sets out a series of policies for individual lengths of coast within each PDZ. Within any PDZ these individual policies may be different for specific lengths along the shoreline, such that one length may be to “hold the line” (HTL), in a different length the policy may be for

[3] It is recognised that the purpose of the SMP is to review this present management, making recommendations where necessary for these policies to be updated. As such the SMP2, on completion and approval, will define present management for the future.



Key:

Policy Development Zones

Source:
INSERT PATH AND FILENAME HERE

Title:
Policy Development Zones

Project:
SMP2 River Tyne to Flamborough Head

Client:
North East Coastal Authorities Group

Date:
March 2006

Scale:
1:650,000

Figure:
3.1

ROYAL HASKONING

managed realignment (MR) or advancing (A) the line of defence, or may be to take no active intervention. Furthermore, over different time periods, the policies may change from retreat (R) to holding the realigned defence line (HR).

The two initial scenarios are compared and the way in which they allow the coast to develop and the manner in which they meet or fail to meet objectives defined within the SMP2 is considered. For some sections of coast the scenarios may in effect be the same. In other areas one scenario may address certain issues but fail to address others. In this comparison, therefore, there may be the opportunity to introduce adaptation which will move forward to a more sensible approach to long term management. In such cases new scenarios are then considered, looking how best to deliver the objectives of the SMP.

From this approach either the "Present Management" policies are confirmed or new policies developed for individual sections of the shore. A preferred defence policy is then defined for a specific section of the coast. This section of coast is the policy unit. This defines how that section of coast should be managed over the life time of the SMP.

There is appreciation that there may be a need for transition from present management through to the long term policy. This may be a result of a new policy being recommended or it may be in recognition of the way in which the coast is likely to evolve. To allow adaptation there is scope within the SMP for changes in policy over time. Policy for each unit is therefore defined over time periods; from now to 2025 (short term), from 2025 to 2055 (medium term) and from 2055 to 2105 (long term).

The aim of developing policy for individual units of the coast within the framework of the PDZ is to ensure the broader implications of managing one policy unit with respect to another unit is considered; hence the scenario approach. These implications are discussed in the process of developing policy within Section 4. Inevitably, therefore, there are dependencies between policy units, the intent being to manage groups of policy units to best deliver objectives for management of areas of the coast. This is discussed below.

3.4.3 Management Areas

Policy Development Zones, as described above, are merely a convenient mechanism for ensuring that policy is developed over appropriate lengths of the coast to ensure interactions are taken into account. Policy units are then sections of the coast for which a specific defence management policy (No active intervention, Hold the Line, Managed Realignment or Advance) are defined. However, as discussed above there may be dependencies between Policy Units (to justify a policy of retreat in one area may be on the assumption that an adjacent section of coast is held). Having defined these

policies, therefore, it is equally important to group policy units where there is this dependency. Such groups of policy units are defined as “Management Areas”. It is within these management areas that the overall intent of management of the coast can best be described.

The definition of the management area is only at the end of the policy development process. A statement can then be produced providing the understanding of why a specific area of the coast is to be managed in this way and how individual policies work to deliver that intent.

3.5 PDZ Analysis

The analysis and discussion for each zone aims to provide an understanding of the issues and nature of the area in such a manner which is logical and rigorous but also in a manner that may refered to and understood by both coastal managers and people who use or live on the coast. This analysis is undertaken in Scetion 4 and for each zone a standard approach, in line with the SMP guidance, has been taken. This has been set out in three sections:

- Description,
- Physical Characteristics
- Management.

These are explained below.

DESCRIPTION

Physical

This section merely describes where things are and what they are, in terms of: the underlying physical nature of the coast, the existing defences and, where appropriate, their overall condition, together with the use being made of specific areas. This section aims to set the scene, starting to pull together the overall picture. More detail on the physical processes is provided in Appendix C.

Environment

In association with the physical description, this draws on the thematic review (Appendix D) and the consultation (Appendix B) in identifying the different issues and interests associated with the specific zone. Again the aim of this is to provide an overall appreciation of the way in which elements of how the coast is valued come together.

Key Principles

There are common principles addressing basic issues over the whole length of coastline.

Key Objectives

The final element in this first section is a list of key objectives quite specific to the zone. These objectives and principles attempt to summarise the overall aim derived from the more detailed list of objectives in Appendix E.

PHYSICAL CHACTERISTICS

Basic Parameters

These provide direct information on wave climate and water level within each zone, together with a synopsis of rates of erosion for different sections of the coast within the zone.

Existing Processes

A brief description of how the coast is behaving is provided, aiming to explain exposure conditions and where the coast is attempting to change. From this

may be understood where there may be pressure developing in relation to the use of the coast and an initial appreciation of what may or may not be sustainable in the long term.

Unconstrained Evolution
Although recognised to be a totally theoretical scenario where there has been or is still major modification of the coast, this section briefly examines what would happen if all man's influence were suddenly removed. The aim of this is to provide a better understanding of how we are influencing the coastal behaviour and therefore the stresses and broader scale impact that are introduced. This assists in assessing first how the coast might wish to change but also in defining the limits of interaction which the SMP should be considering.

MANAGEMENT
Current Management
Current management is summarised in terms of the policies developed during SMP1 and with respect to subsequent strategy studies.

Scenarios
The section provides a more detailed description and assessment of the two base line scenarios for the whole zone. This starts with the No Active Intervention Scenario and then considers the current management scenario (With Present Management). In many cases strategies have only looked over a period of 50 years. The SMP2 extends the implication and intent of the current management policy over the full 100 years and comments, where appropriate, on the further implications of this beyond this period of time. The aim of the No Active Intervention, is to identify what is at risk if defences were not maintained. In a similar way With Present Management aims is to examine how the coast may develop, identifying where there are benefits in this management approach and where there may be issues arising in the future. Associated with each scenario is a brief summary of the key risks based on the MDSF and strategy findings. This provides a headline assessment of how each scenario achieves the key objectives set out in section one above.

Discussion and Detailed Development of Policies
This sub-section uses the two baseline scenarios to consider specific issues in more detail, looking at both the long term implications of the current policies and stepping back from the more local strategy development areas to consider any impacts on the coast as a whole. The discussion also considers any detailed proposals put forward in strategies and comments on these from the broader perspective. Where the current policy is felt not fully to address some of the issues being identified, further scenarios are developed. Typically this has been found to be a variation within one of the baseline scenarios, rather than a scenario with such wide reaching impacts that the influence of management affects area outside the development zone being considered. From this discussion and from the analysis of different

approaches and their consequences, recommendations are made for the SMP policy. This principally starts with where management would take the coast in the long term, working back to how policy should therefore be adapted over the short and medium term periods.

Management Areas
Policy units are grouped as management units, providing coherent intent as to the management and dependencies over the area.

3.6 Management Area Policy Statements

The policy units and management areas are developed in the analaysis described above. A summary or statement is presented for each management area. This is set out in the following manner.

SUMMARY OF POLICY
The format for this summary is based on the Policy Unit summary suggested by the procedural guidance. However, because of the nature of the coast and in particular in many cases because distinct policy units have an association and cannot really be managed independently; the policy summaries have been developed by management area. A brief overview of the preferred plan recommendations is presented together with an overview of implementation for the short and medium term, followed by the long term intent. Finally the specific policies are identified.

CHANGES FROM PRESENT MANAGEMENT
The essential changes from current management are highlighted.

IMPLICATIONS
For each management area a summary is provided of the potential impacts these policies will have in terms of the various specific themes and in term of residual risk and risk reduction.

Built Environemnt
Assessments are provided covering the impact on the built environment, together with a summary of the economics, the impact on the heritage and amenity. This is followed by an assessment with respect to issues relating to the Water Framework Directive. In this last aspect, the aim is to identify whether there may be significant impacts that will require further consideration as the emerging WFD guidance comes into force or where at a more local scale the principles set out in the WFD need to be considered.

Environmental Assessment
The management area statement also includes an assement of potential impacts on the natural environment. Where the area includes internationally designated sites, a summary based on the Appropriate Assessment (Appendix J) is included. This is followed by a table assessing the impacts on other designated areas.

MANAGEMENT AREA ACTION PLAN

The management area statement concludes with an action plan relevant to the specific area. (These actions are drawn together for the whole of the NECAG SMP2 coastline in Section 7, together with an explanation of the requirement for monitoring.)

4 APPRAISAL OF OPTIONS AND RATIONALE FOR PREFERRED PLAN

Within this section is the analysis leading to the preferred plan. The basis for this has been set out in Section 3 of the report.

The analysis is undertaken covering Policy Development Zones (PDZ), as described in Section 3. Following the analysis, the Policy Units (PU) are grouped together as Management Areas (MA) and individual statements of policy are provided for each Management Area.

4.1 PDZ 1 River Tyne to Frenchman's Bay

4.1.1 Policy Development Analysis

DESCRIPTION

Physical

The zone covers a length of some 3km comprising three principal elements:

Littlehaven is within shelter of the main Tynemouth piers and comprises a section of sand beach between the South Groyne and the main South Pier. An old seawall acts to divide the beach, protruding out at an angle beyond the normal line of high water. Behind the beach is a narrow low lying area, occupied by the local coastal road, with the land rising quite steeply behind. The area between the defence and the road forms a promenade with car parks and recreational areas.

Herd Sand, locally known as Sandhaven beach, is a continuation of the relatively low lying coastal frontage, separated from Littlehaven by the South Pier. The frontage is a generally broad sweep of sand formed against the southern side of the main South Pier and curving around into the lee of Trow Point. Relatively high dunes have formed at the northern end with lower dunes formed just to the north of Trow Point. Over the central section of the frontage the beach narrows with some pressure against the light reveted coastal defences. The area behind the beach is relatively low lying occupied by generally recreational development and the main A183 coastal road. The land rises to the southern end and further back into the main urban area of South Tyneside. Examination of the historical records for the area show this section of the coast to have been reclaimed from the sea. The area was formally saltmarsh. Much of the promenade and the area of Gypsies Green are constructed on made ground.

The final southerly section is Trow Quarry. The main quarry, behind Trow Point, has been in filled as a level grassed area, with the quarried rock face set back some 250m, reducing to a mere 50m at the southern end, where the rock headland between Trow Lea and Frenchman's Bay has been maintained. The seaward face of the infilled area forms two small bays, divided by the eroding rock outcrop of Target Rock. Much of the foreshore is a rock platform, with a narrow sand beach only present immediately south of Trow Point.

Environment

The whole area provides a focus for recreational and tourism activities associated with the main urban area of South Tyneside. These activities include traditional family beach use, watersports, more formal facilities (such as the Sports Ground, formal park areas, and boating lake) with the southern area providing less formal open ground and general recreational area. These activities are supported by a promenade, water sports facilities (including a lifeguard station), amusement park, shops, restaurants and, at the northern end, an hotel and conference centre. There are several car parks along the frontage. Herd Sands is designated bathing waters. The area also acts as the start point to the Durham Coastal Path. There are plans for new development both behind Littlehaven and Herd Sands. These aim to develop the already important tourism potential for the area. Within this, therefore, the hotel to the northern end of Littlehaven and features such as the fairground, immediately south of South Pier, are important existing assets. Similarly, the car parks and maintaining a high quality promenade are considered to be vital for the future development of the area. The Gypsies Green Stadium is to be redeveloped, with subsequent redevelopment of areas between the stadium and South Pier.

The existing hard infrastructure includes a local coastal road to the rear of Littlehaven and the main coastal road behind Herd Sands. There are also local commercial areas to the root of the main South Pier. This area is immediately behind the fairground.

The area of Herd Sands and Trow Quarry are included within the Durham Coast SSSI, designated for its geology, geomorphology, vegetation (both dunes and paramaritime magnesian limestone), ornithology and invertebrates. The South Pier, including areas of the dunes, is part of the Northumbria Coast SPA/ Ramsar area, as is the area of Trow Quarry. Trow Quarry is also designated as SAC.

The northern section of the zone acts as an integral part of the Port of Tyne, with quays, a jetty and commercial areas immediately inside the mouth of the river. The South Groyne and South Pier are

important navigation structures providing shelter to the Port entrance, training the navigation channel and retaining an important spending beach at the mouth of the river, allowing waves within the harbour mouth to be dissipated.

There are discrete heritage structures including the gun platform on Trow Point. The South Pier Lighthouse is a listed structure with association with the development of the Port of Tyne.

Trow Quarry infill has been shown to contain pollutants, including asbestos and potentially hospital waste. While there is little evidence of significant pollution, continued erosion of the frontage exposes potentially harmful materials posing a threat to those using the coast.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To maintain the existing values and opportunity for development of recreation and tourism.
- To prevent disruption to the nationally important Port of Tyne
- To minimise pollution.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:25yr	1:50yr	1:100yr	1:200yr
-2.15	2.15	2.85	3.04	3.17	3.23	3.34	3.41

Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 2.85m below Ordnance Datum.

Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between.

Source (extreme water levels): Babtie, 1998. Shoreline Management Plan, River Tyne to Seaham Harbour. Sub cell 1b. NB. Values for 200 yr ARI are interpolated between 100 yr and 250 yr values.

Wave climate

Return Period (1:X years)	Wave Height Hs (m)
0.10	4.24
1	6.08
10	7.92
20	8.48
1000	11.61

Source: Babtie, 1998. Shoreline Management Plan, River Tyne to Seaham Harbour. Sub cell 1b. OUTRAY used to determine inshore wave data at 10 m contour.

Baseline Erosion Rates

Littlehaven	Local readjustment, with major erosion following loss of the South Groyne.
Herd Sands	0.2m/yr
Trow Point	0.2m/yr, but potentially less.
Trow Quarry	0.2m/yr, subject to control imposed by headlands.

All the above rates are based on existing evidence and are likely to increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

The main shape of the coast is held by and is dependent on the South Groyne, the main South Pier, Trow Point and, effectively as an extension of this, the southern rock headland at the start of Frenchman's Bay. Within this final section of Trow Quarry, the infilled areas are also held by Target Rock, which is visibly eroding. Sediment drift is limited, with each frontage in basic equilibrium, although over Herd Sands there is a tendency for material to be moved north over the northern section and south behind Trow Point causing a degree of divergence over the central section. This drift is, however, variable, with beach levels being restored to the centre on occasions.

Unconstrained:

In the absence of the main man made control features the coast would retreat rapidly, allowing the mouth of the Tyne to widen. Material from this erosion would tend to feed into the Tyne. Trow Point will continue to erode slowly but this will allow more rapid erosion to the softer frontages to north and south.

To the north of Trow Point this unconstrained area of erosion could be as much as 100m to 200m establishing a bay controlled by the higher ground behind the existing location of the main South Pier. To the south the width of erosion would be held by the more local hard features but would tend to remove material back to the line of the quarried face just north of the Frenchman's Bay headland. There is a possibility that Trow Point would be outflanked. This might result in increased general drift to the south with an increased loss of material at the southern end of Herd Sands.

MANAGEMENT

Present Management.

SMP1	Policy
The zone is covered in part by Management Unit B1 and extends into B2(Trow Quarry).	Hold the Line Do Nothing
Littlehaven to South Pier Coastal Management Study	
The strategy aims to re-establish the failing defence to the bay with a recommendation to rebuild the Harbour Drive wall.	Hold the line
Trow Quarry	
Initial investigations have been undertaken and an outline examination carried out into the feasibility of protecting this frontage. A detailed study of options is now underway.	Presently under review in more detailed assessments

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

Even without maintenance, the South Groyne is likely to remain an influence on the coast over the next fifty years, retaining the Littlehaven Beach. In the longer term, failure of this structure would result in erosion of this corner, with material being lost from the beach and erosion increasing pressure for retreat of the whole length of Littlehaven. The defence along Harbour Drive would have already failed and, while the remains of the wall and the fill contained by the wall would tend to be more resistant, this area would similarly erode back to the rising ground behind, with subsequent loss of much of the dune at the root of the main South Pier. There would be significant volumes of material deposited in the main Tyne channel. In addition the beach would stop acting as a spending beach, increasing wave action over the main entrance to the channel. The pattern of erosion would be limited by the presence of the main South Pier, which; while falling into disrepair, would remain over the next 100 years as a major control feature of the coast.

The presence of the South Pier would still provide shelter to the coast to the south, still resulting in material tending to be pushed in to its lee. Similarly Trow Point would still act as the southern control point to Herd Sands. Between these two points the beach would tend to roll back with increased pressure and (as the revetment to the centre of the bay fails) erosion of the centre of the bay. The infill area of Trow Quarry would continue to erode as in the unconstrained case. The rate of erosion would critically depend on the rates of erosion of Trow Point and Target Rock.

There is the potential for erosion to start outflanking Trow Point cutting into the infill of the Quarry, as this continues there would tend to be a loss of sand from the southern end of Herd sands, imposing greater pressure on the defence at this end.

MDSF Evaluation (Appendix H)	*Assets lost over the time period of the SMP.*	*PValue Damages*
Erosion	in excess of 22 residential and commercial properties (Recreational facilities not included.)	£361,000
Flooding	1 commercial property	£962,000
Other information	Loss of car parking and fairground. Disruption to transport. Management cost of potential contamination.	
Assessment of key objectives	• There would be loss of significant recreational facilities and opportunity. • Significant disruption to the operation of the Port of Tyne. • Loss of dunes to Littlehaven but potential improvement to the SSSI with the retreat and natural dune development to the south of Herd Sands. • Loss of some of the recreational area of the quarry but associated more natural development of the internationally designated areas. • Significant potential for pollution of the foreshore, possibly to Herd Sands and to the south.	

With Present Management (Scenario 2):

The South Groyne and main South Pier, together with the influence of Trow Point, would maintain the general shape of the coastline. Within this, defences would be maintained to Littlehaven and along the full length of Herd Sands. The present management policy for Trow Quarry was for no active intervention based on the SMP1, but this has been the subject of on-going investigation and development of an appropriate management approach aimed at managing the risk associated with exposed fill. The overriding aim, emerging from studies to present (2006) is that significant pollution of the foreshore and beaches would be unacceptable. The options for management are ultimately between removal of fill materials and providing protection to the eroding face of the in fill. There is still recognised to be uncertainty associated with erosion rates that cannot be fully resolved without longer term monitoring. However, it is also recognised that a policy of no active intervention in the short term will not address the immediate problems. In assessing this scenario it is assumed that the emerging approach from the detailed examination is for short term management of erosion through protection but still within a longer term approach for managed re-alignment.. Confirmation of this policy depends on full consideration of the economic, technical and environmental aspects of the management approach.

Within Littlehaven the overall configuration of the bay would be maintained although the hard defence to the centre would have an increasingly significant impact as the beaches to either side roll back. There would be increasing pressure on this central section with a long term need to increase the level of the defence in line with both its increased exposure and rising sea level. In effect the defence would split the bay in two, reducing access to the beaches and, in the centre creating a barrier between land use and that of the foreshore. The policy for the frontage is being reviewed in detail but it is the Council's current policy to consider managed realignment of the frontage.

Over the northern section of Herd Sands the current defence line is nominally the dunes but with a retired line of defence formed by a low promenade around the area of commercial development, including the amusement park. Between this retired defence and the face of the dunes is an area used for recreation. There would be some roll back of these northern dunes tending to cause steepening as their back face comes under increasing constraint due to the promenade and development behind. This would be more seriously constrained by attempting to retain area of formal recreational activity. This would make the dunes more vulnerable to breach and to the impact of humans. It is unlikely that the dunes condition would become critical over the 100 year period of the SMP if the full width up to the existing hard line of defence were available. Further constraining this width by hard defence of the recreation area could, however, damage their ecological integrity and their value as a natural defence. The foreshore and front face of the dunes is designated as an SSSI.

Further south on Herd Sands, there is some pressure on the defence in the area of the Lifeguard station. Over the next twenty years there will be increasing pressure and the length of defence under regular attack will increase. By 2050 it would be anticipated that the defences will have had to be substantially upgraded in terms of their strength, toe depth and crest level. Within the period of the SMP it would be expected that this point would form a major division of Herd Sands. With the diminishing influence of Trow Point it is possible that the length of strengthened defence would need to extend over some 700m of the frontage to protect the existing promenade.

Within the area of Trow Quarry, as stated above, present management is to locally identify and remove material as it becomes exposed on the front face of the eroding infill. This is seen as being only a very short term management approach. The existing policy is therefore for improved defence with a longer term policy of managed realignment.

MDSF Evaluation	*PValue Damages*
Erosion	*No erosion damages identified*
Flooding	*No flood damages identified.*
Other information	Management cost of potential contamination. Possible loss of Gun emplacement to Trow Point.
Assessment of Key objectives	• Maintains existing recreational and tourism facilities to the area but with a loss of beach area and potentially affecting water sports at southern end of the frontage. • Prevents significant disruption to operation of the Port of Tyne • Maintains overall structure of environmentally designated habitats but reduces specific ecological integrity, constraining future development of dunes and SSSI. • Maintains general cultural values of the area.

• reduces immediate risks of pollution. • Increases reliance on defences.

DISCUSSION AND DETAILED POLICY DEVELOPMENT

There are several issues developing from management of the frontage. What may be appreciated is that the main harbour structures do provide a beneficial influence on the frontage both in terms of meeting a key objective to prevent disruption to the operation of the Port of Tyne but also in providing a basic structure of control around which the ecological, economic and socio-economic interests may be developed. Realistically, these structures are considered of national importance in their navigational role and would remain. Within this constraint on the development of the area, therefore, it is the more local policy for defence where potential issues arise; in particular the frontage between the South Groyne and the main South Pier (Little Haven), Herd Sand and the Trow Quarry. These are discussed on the basis that the Groyne and the Pier are maintained.

Littlehaven

The recent strategy study considers the frontage over a period of 60 years, rather than the 100 years of the SMP. The main problems are the excessive overtopping which can cause damage to the car park and potentially result in risk to people using the frontage, coupled to the poor condition of the Harbour Drive wall, which is being undermined and is likely to fail over the next 5 to 10 years. The strategy concluded that the value of the car park justifies re-construction of the wall to a higher standard. The study indicates that if the wall were not in place the bay would retreat a further 90m in the centre. This would create a more sustainable beach without erosion threatening the main local road to the rear. This assumes that there would be a degree of roll back of the dunes to either side without increased threat to assets on the frontage.

From the longer perspective of the SMP there is concern that construction of a new defence on the existing line would be subject to increasing pressure over the 100 years. With a basic sea level rise (4mm/yr) this could result in a need to increase crest levels by some 0.8m to maintain the standard of defence proposed by the strategy. In addition, increased exposure of the wall could result in increased erosion and wave reflection as well as progressively increasing the shedding of wave action to either side tending to cause increased erosion to the beach on either side. This may cause a longer term loss of what is recognised to be relic beach (there is little evidence of supply to the bay). Over the longer period there may therefore be a need to further extend the protection or to add additional rock armour protection to the wall. Ultimately the policy to hold the specific line of the defence would impose a continuing and increasing dependence on defence, with loss to the general ecological integrity of the area. Under different more extreme UKCIP sea level scenarios such a policy would become increasingly unsustainable with a need for a more inflexible approach to risk management. The option presented in the strategy, while economically justified, fails to meet the minimum priority score to warrant coast protection grant under the existing government policy.

No active intervention is likely to result in a general deterioration of the area as the wall fails and rubble fill is exposed and, therefore, to maintain the principle for good ecological potential, works would probably have to be undertaken remove the existing sea wall debris and fill. Although this problem would be at a relatively local scale, it would be counter to the principles of the Water Framework Directive (WFD). At present

there is no guidance as to funding to comply with emerging legislation aimed at delivery of the WFD.

Specific defence policy for this frontage cannot be determined solely on the basis of risk to the existing assets. The frontage as a whole is an important component of the amenity and recreation of the zone and this has been confirmed in consultation with the planning authority. The essential elements for future development of the frontage have been identified as the need to maintain a high quality promenade with scope for minor recreational support facilities. In addition, the importance of car parking space along the whole zone has been identified.

In terms of sustainable defence, to allow the frontage to retreat to a more natural profile would be the preferred policy. This, however, ignores the potential for future enhancement. Recognising this, the intent of a preferred policy is to relax the line of defence to a more sustainable line consistent with an integrated development plan aimed at deriving a balanced enhancement of both the natural and human environment. The key principles for such a policy should be to retreat the line of the existing hard defence to comply more compatibly with the concave shape of the bay, retaining material on site to raise land levels behind above predicted flood levels. While it may be possible to maintain the wall over the next 20 years through significant works, it is important that planning of the area should accept a need for retreat beyond this period. The Council has declared its intentions to investigate realignment and this is now subject to a strategy study. The immediate policy is for managed realignment, with the longer term aim to hold the line on a more sustainable line.

Herd Sands

At present Herd Sands remains relatively stable. There is some variation in beach levels across the frontage, with occasional erosion both to the dunes and lowering of the beach adjacent to the lifeguard station. These areas can rebuild, although at the southerly point levels can lower to the point where they expose the vulnerability of the light revetment at this point. There are, on more severe storms, occasions when waves and sand are driven over the frontage causing local flooding to the sea front.

There is little indication of significant sediment supply to the frontage (what there may be, will come from the offshore area) and the bay to a degree may be seen as a closed system. Control of the beach is provided by the main South Pier and by Trow Point. With increases in sea level and to a lesser extent attrition of general beach material (due primarily to wind blown loss), the upper shoreline will tend to roll back.

To the northern end of the beach this will tend to move the dunes landward. Any resistance to this movement, or any lack of width within which the dunes may move, will tend to cause oversteepening and the potential both for blowouts and breaching. This will be made worse by continued trampling. In either case the dunes will no longer form a competent defence to the recreational and commercial area behind and there would be significant anticipated loss over the long term. While there may be scope for soft management; such as fencing and boardwalks, this would provide short to medium term amelioration. Physically holding the line through construction of hard defences would be expensive and would require increasing long term commitment to this form of defence. Given the anticipated long term nature of the problem the more sustainable and preferred policy for the frontage would be to maximise the area for future dune development. It is anticipated that there would be a need to retreat use of the area

immediately behind the dunes over the next fifty years. In effect, by taking this action the preferred policy allows use to be made of the natural defence system in holding the line initially with a longer term policy of retreat over the second part of the SMP century. This policy would impact on the use of the recreational area. The rate of change on this northern frontage is uncertain and monitoring would be required to inform planning decisions. The intent would be to enhance the integrity of the dunes, thus continuing to provide natural width to the retired defence at the back of the dune.

Further south the problem is more immediate. Over possibly the next twenty years there is likely to be a substantially increased pressure on the defence centred on the Lifeguard station. As discussed in the general assessment of the zone, to hold the line at this position will in effect be committing to a need for increasingly more substantial defence, over a longer length of the beach. This would have significant impact on beach use, water sports and the nature conservation, as well as being progressively more difficult to justify. Furthermore, to the southern end of the frontage the continued erosion of Trow Point creates the possibility of outflanking of the Point and potential exposure of the in fill to Trow Quarry, as well as potentially resulting in further loss of sediment to Herd Sands. Trow Point is eroding but relatively slowly; potentially in the order of 0.1m/yr (erosion rates used in examining potential retreat are based on a more general assessment of the rock frontage to the south).

There is, therefore, the potential for consolidating the control at this location while potentially avoid more major works to the north, in management of the southern end of Herd Sands. For this reason a preferred policy at Trow Point would be for no active intervention at present but with a longer term policy of reinforcing the point in the future as required by a detailed examination of management to the southern area of Herd Sands. Critical to this would be the need to monitor the actual erosion rates at Trow Point and along the Herd Sand frontage.

As the pressure increases on the light revetment and erosion continues to Trow point, there needs to be detailed consideration as how these two sections may be managed to alleviate the distinct problems. Typically this would be seen as the need to reinforce the northern side of the point, re-establishing the point as a control to the beach and considering managed realignment along the southern end of Herd Sands.

The policy may require relocation of the lifeguard station and possible loss of car parking as well as the potential loss of one commercial building. Any realignment is most unlikely to affect the Gypsies Green Stadium and could, as part of an overall realignment, involve moving the line of defence forward locally to better manage beach movement. This would need to be integrated with future re-generation of the area. The overall intent of the SMP policy would be to maintain defence of the overall area, to sustain the small dune area to the south of the sands, but to do so in a manner more sympathetic to coastal processes than would be achieved through increasing reinforcement of the existing linear defences.

It is not believed that at present, or over the next twenty years, work will necessarily be required to maintain the influence of Trow Point. However, depending on the timescale for redevelopment in the area there may be a need to examine the management approach in detail before the end of the residual life of the existing revetment. The policies for these to areas need to reflect this.

At present there is little if any economic justification for maintaining the defence of this southern frontage. The intent of the managed realignment would be principally in terms of the development in the area. This needs to be recognised in terms of funding. It is unlikely that funding would be supported by grant under the Coast Protection Act. The development of the area behind needs to be assured of defence against erosion and flood risk, without imposing an expectation of a continuing and increasing investment in maintaining defences. For this reason, the detailed approach to defence need to be developed alongside future development plans.

Trow Point is also a significant feature in management of the Trow Quarry. This is discussed below.

Trow Quarry

With the presence of Trow Point to the north and the headland left in place by quarrying to the south (Frenchman's Bay headland), Trow Quarry is seen as a relatively discrete section of the coast in terms of general drift of natural material. Eroded pollution, from the infill area does, however, pose a degree of threat to the coast to the north and south as well as to users of the local foreshore. Current management of the frontage involves regular inspection and an on-going programme of dealing with hazardous material as it becomes exposed.

Under emerging regulation to meet the requirements of the Water Framework Directive it is uncertain whether the scale of impact on the coastal water body would be significant. Even so, regardless of whether the aim of the area is to meet good ecological status (GES) or good ecological potential (GEP) it would be anticipated that, given the designations associated with the frontage (SSSI, SPA, SAC, Ramsar); quite apart from the potential threat to the public, current measures, in effect limited management of the problem is only appropriate over the very short term.

South Tyneside Council have commissioned a detailed study and appraisal of the issue. Therefore, the role of the SMP2, at this time, must be to provide high level guidance within which this detailed study takes place. As results emerge from this more detailed work, the implementation of the recommended SMP2 policy will need to be reviewed.

Before discussing possible longer term management scenarios, the critical uncertainties in assessing the way the frontage behaves need to be considered.

The frontage is controlled by the relatively hard points at either end, with a further control feature, Target Rock, between. Target Rock divides the frontage creating two bays, Graham's Sand; immediately south of Trow Point, and Target bay; between Target Rock and Frenchman's Headland. The character of the two bays is substantially different.

The Graham's Sands bay is set back some 80m to 90m in the lee of Trow Point and while still eroding, the in-fill is at a relatively mild slope with a degree of natural protection provided by rock and debris from the in-fill. There is a relatively wide intertidal foreshore comprising rock platform and areas of sand, with larger sediments such as cobbles and boulders close to the base of the coastal slope. During more major storms the face of the in-fill will continue to erode. This rate of erosion and the degree to which the face of the bay will erode back is limited primarily by Trow Point with initially Target Rock, and in the absence of Target Rock the shoulder of the quarry face behind Target

Rock providing an anchor point to the bay. Depending on the erosion rate of Trow Point (and the possible outflanking of Trow Point) the erosion within the bay is limited.

Target bay is set much further forward, with a narrower intertidal width. The degree of control imposed by Target Rock on the bay shape is, therefore, at present much less. The infill is being eroded more severely and even if there were no further erosion to Target Rock, it seems probable that without substantial protection the in-fill would erode back to the old quarry face.

The level (robustness) of protection required to resist erosion at present in Graham's Sand Bay is seen as being significantly less than that required at present in Target Bay. Although this would need to be confirmed through more detailed study.

Critical to the behaviour of both bays is the future erosion of the headlands. Detailed information on this, available to the SMP2 is quite limited. In terms of overall assessment, the SMP2 has taken a rate of 0.2m/yr based on a typical rate for the general nature of material along this section of the coast. From more detailed inspection of the area it is assessed that this rate is possibly high with respect to Trow Point, but may even be low with respect to sections of Target Rock. It would appear that the Frenchman's Headland may be more akin to Trow Point than to Target Rock.

Scenarios may now be built up based on the uncertainty associated with these erosion rates and from this the possible areas of critical choice that then need to be made in respect of potential management policy.

Scenario (a)
Description: That Trow Point and Frenchman's Headland erode slowly but that Target Rock continues to erode at a more rapid rate. **Rationale:** Graham's Sands would remain relatively unaffected by significant erosion over the next 20 years, with slightly increased erosion pressure as sea level rises. Trow Point would maintain a significant degree of control within this bay. There would be increased pressure on the southern length of the bay as Target Rock cuts back, eventually over the 100 year period control at the southern end of Graham's Sand bay would transfer to the shoulder of the quarry, limiting further erosion of the bay. As Target Rock cuts back, this would increase the rate of erosion of Target Bay, with this frontage eroding back to the quarry face behind. **Implications:** If a policy of no active intervention was adopted then there would be a precautionary need to excavate in-fill over some 250m of Graham's Sand Bay to a width varying from some 15m at the northern end to a width of 60m (back to the shoulder of the quarry face). Within Target Bay material would need to be excavated back over the full width of infill over again a length of some 250m. This would involve significant excavation with the associated high levels of cost and risk to the environment. In terms of protection, with Trow Point maintaining its control, it is probable that protection to the northern bay would constitute merely an improvement to the natural protection already in place. Some more robust work might be required in the area of Target Rock. If this were designed such that it could be tied into the shoulder of the quarry, the overall stability of this northern frontage could be maintained even over the longer term, avoiding the need for excavation of in-fill in the future, and irrespective of management of Target Bay. This level of management could be reviewed over the next 20 to 50 years. Within Target Bay, protection would have to be significantly more robust, providing for the eventual loss of Target Rock and the additional pressure on the then exposed corner at the north of this Bay. In effect this section of the overall frontage would require a major prominent rock revetment, rather than a back defence to a naturally shaped bay. Works undertaken in the near future would dictate the management of this section over the next 100 years. It is unrealistic to expect subsequent review to reverse this approach to management over the next 50 years, given the level of expenditure that would have been put in place. **Critical choice:** Working within the conditions stated for this scenario, a protection approach for the northern bay would allow adaptation in a review in 20 to 50 years. In the case of the southern bay there would need to be a commitment to either excavation now or a policy for protection. This latter choice would depend on a more detailed comparison of cost and potential environmental damage as a result of excavation and the alternative significant cost of providing protection.

Scenario (b)
Description: That headlands erode at some 0.2m/yr initially increasing with sea level rise (i.e the general premise of SMP2).
Rationale: Graham's Sand would still remain relatively unaffected by significant erosion over the next 20 years, but would come under considerably greater pressure from then on, due to the combined impact of sea level rise and the more extensive erosion of Trow Point, with increased erosion pressure as sea level rises. Erosion could be of the order of 50m over the whole frontage with also the threat of Trow Point being outflanked. As Target Rock cuts back, this would increase the rate of erosion of Target Bay, with this frontage eroding back to the quarry face behind. Erosion of Frenchman's Headland would place further pressure on this southern bay with exposure of the in-fill from the south.

Implications: If a policy of no active intervention was adopted then there would be a precautionary need to excavate in-fill over some 250m of Graham's Sand Bay to a width of some 50m to 60m. Within Target Bay material would need to be excavated back over the full width of infill over again a length of some 250m. This would involve significant excavation with the associated high levels of cost and risk to the environment.

In terms of protection, Trow Point would continue to provide a controlling influence over the next 20 years. It, therefore, remains probable that protection to the northern bay would constitute merely an improvement to the natural protection already in place over that period of time. Beyond 20 years more robust defence would need to be put in place. The initial level of management would need to be reviewed over the next 20 years.

Protection to the southern bay would be as described in scenario (a).

Critical choice: Working within the conditions stated for this scenario, a protection approach for the northern bay would still allow adaptation in a review in 20 years. In the case of the southern bay there would still need to be a commitment to either excavation now or a policy for protection. This latter choice would depend on a more detailed comparison of cost and potential environmental damage as a result of excavation and the alternative significant cost of providing protection.

It is recognised that further detailed examination is required and is being undertaken; specifically in terms of the potential environmental damage associated with either form of management, the level of defence that would actually be required, and the associated cost of this, the costs of excavation of material and aspects such as the nature of material behind Target Rock.

One factor that might influence this examination is the fact that it would be extremely improbable that the rear area to the main extent of Trow Quarry will be affected by erosion over the foreseeable future. Given that this is infill, potentially of the same nature as that to the front of the area, this area might be considered as an appropriate area for further infill, reducing the need for extensive removal of material from the general site. This view is expressed solely with respect to risk from erosion and it is recognised that there are significant other issues which would then need to be addressed.

What becomes evident from the consideration of the scenarios is the critical rates of erosion of Trow Point, most specifically in relation to the northern bay. This is one aspect that more detailed examination of the problem cannot resolve at this time; the information is not available at present and can only be obtained through appropriate monitoring. In scenario (a) it is estimated that the Trow Point will continue to provide substantial control to the northern bay over the next 20 to 50 years, in scenario (b) this is reduced to 20 years. From this it is considered that the policy for this section should be to initially hold the line (subject to the detailed studies confirmation of the level of protection that would be required). Monitoring of the erosion rates at Trow Point would be an essential element of this policy, such that the approach could be reviewed in 20 years; this period of time being necessary to allow monitoring data to be collected. This short term policy, and potentially a policy that could be sustained over the next 100 years depending on erosion rates, would avoid unnecessary excavation of material.

In terms of the southern bay, this similarly depends on further information as to the condition and rate of erosion of Target Rock. The long term decision is ultimately the balance between the need to excavate material or to defend against erosion. Both present issues related to funding and potential impact. This balance has to consider what is warranted based on an assessment of risk and the proportionality of action necessary to reduce the risk. This will need to be examined both in relation to the funding implications and potential impacts, based on further information not available at present. As such this long term policy cannot be fully resolved at this stage.

There are immediate risks of pollution in the short term due to the increasing difficulty and risk associated with local management inspections. Following discussion, on-going through the more detailed strategy study, the policy in the short term is to manage this immediate risk by Hold the Line. The intent of this hold the line approach would be to provide adequate protection such that the risk is managed in the short term; while further information is obtained through monitoring. The implementation of this hold the line policy should be appropriate to the immediate risk, limiting the scale of intervention such that it would minimise constraint on the future assessment of options. The preferred policy for the frontage in the medium to long term would be for continued management, with an aspiration for managed realignment, to allow semi-natural behaviour of the coast to continue. This future policy will be informed by the detailed study taking place now and through the detailed monitoring required over the coming years.

MANAGEMENT AREAS

The policy development zone naturally splits into three management areas; those of:

- Littlehaven
- Herd Sands
- Trow Quarry

The division between Littlehaven and Herd Sands is created by the presence of South Pier; a structure essential for the continued use of the Port of Tyne and which, in any regard, would remain as a control feature to both areas over the period of the SMP2.

The division between Herd Sands and Trow Quarry is provided by Trow Point. This is a major control point both to the north and south and the management or erosion of this feature is critical to both. To the north it is assumed that, regardless of the rate of erosion of the natural headland, the sustainable management of Herd Sands would depend on maintaining the control of processes at this point (i.e. if the point erodes quite rapidly, there would be a need to reinforce the north face of this natural feature). To the south the erosion rate of the headland is critical in determining the long term policy for Trow Quarry.

Policy statements or summaries are therefore presented by management areas in the following sheets.

4.1.2 MANAGEMENT AREA POLICY STATEMENTS (MA01- 03)

Location reference:	Littlehaven
Management Area reference:	MA01
Policy Development Zone:	1

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The intent of the plan is to maintain the control imposed by South Groyne and South Pier, thereby maintaining operation of the Port of Tyne. This allows imposes distinct control of the area between this structures allowing local management. The intent within this area is to encourage a more natural development of the bay reducing the reliance on defences. However, within this the intent of the emerging land use plan has to be recognised in maintaining a high quality promenade between South Pier and the hotel at the northern end, maintaining areas for car parking and maintaining access to the beach and the use of the beach. The detailed plan for managing defences needs to be determined in an integrated land use plan for the area.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain the south groyne and south pier Investigate an appropriate realigned position for defence compatible with proposed land use.
Medium term	Maintain the south groyne and south pier Hold the realigned defence.
Long-term	Maintain the south groyne and south pier Hold the rear line of defence.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
1.1	South Groyne	HTL	HTL	HTL	Key control structure
1.2	Littlehaven	MR	HR	HR*	Developed in conjunction with land use plan
1.3	South Pier	HTL	HTL	HTL	Key control structure

Key: HTL - Hold the line, A - Advance the line, R - Retreat, NAI – No active intervention
* HR – Hold the Line on a retreated alignment, MR – Managed realignment

CHANGES FROM PRESENT MANAGEMENT

The SMP2 identifies the increasing pressure on the existing central defence and the consequence of ever greater reliance on this defence in its current position. This will work to the detriment of the area. The defence policy for this frontage has been changed to one of managed realignment but with the intent of holding the line further to the rear.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

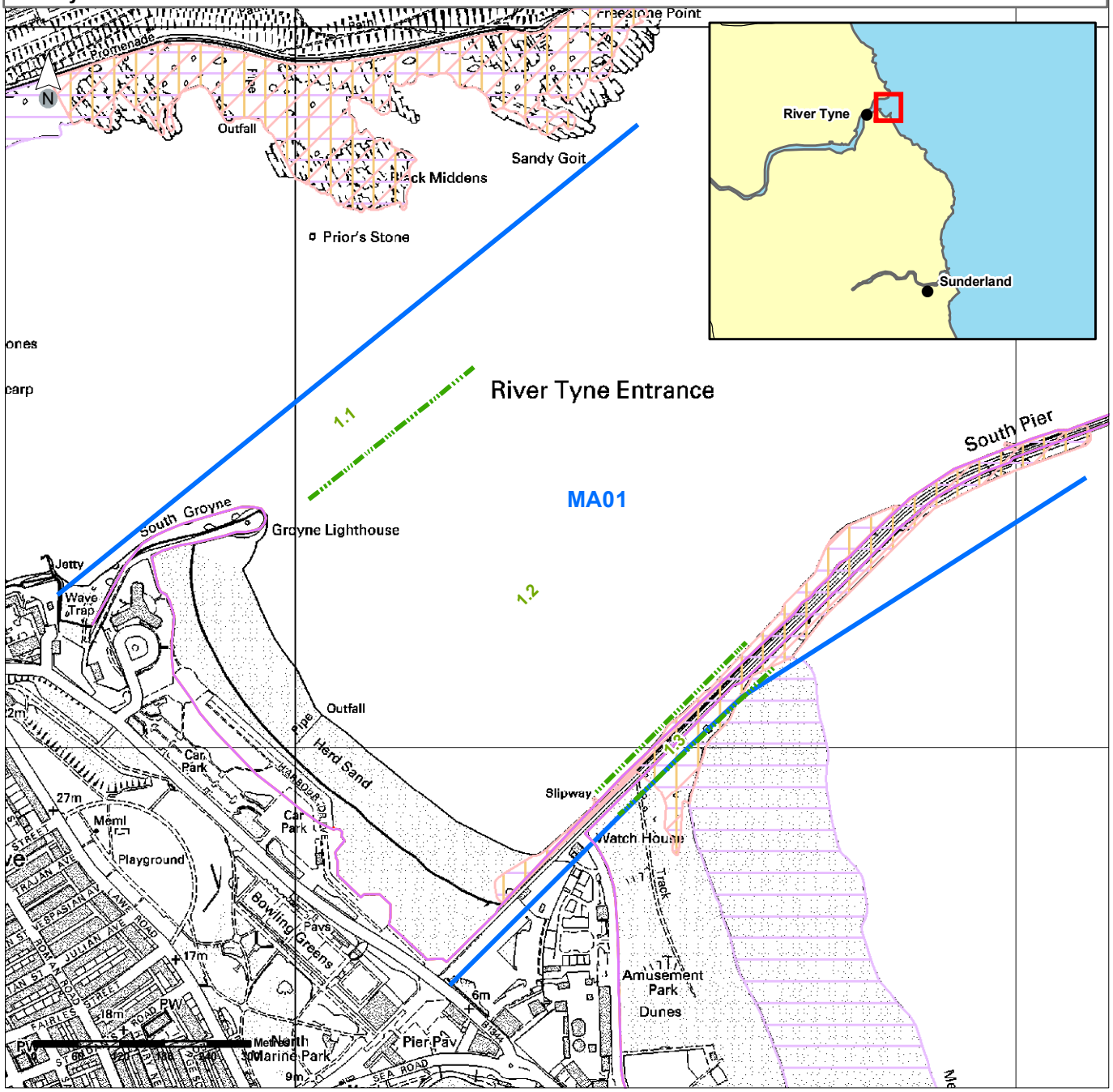
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	1093	422	434	1949
	Preferred Plan Damages £k PV	400	0	0	400
	Benefits £k PV	693	422	434	1549
	Costs of Implementing plan £k PV	487	5	34	526
Costs estimated for retreat of existing line. Description of damage and benefits under preferred plan: • Loss of some car parking area by 2025. • Protects car parking, with reduced overtopping risk. • Protects hotel and properties within the river. • Maintains the road link. Further examination of costs, undertaken concurrent with the development of the SMP2, indicates a possible value of £2,100k. The value would include amenity enhancement.					
Heritage	No loss of heritage structures.				
Amenity	Improved access and amenity of area.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	Yes at a local scale

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA01
Policy Units 1.1-1.3



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Maintain the south groyne and south pier. Investigate an appropriate realigned position for defence compatible with proposed land use.	Maintain the south groyne and south pier. Hold the realigned defence.	Maintain the south groyne and south pier. Hold the rear line of defence.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT - PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, ruddy turnstone, purple sandpiper)	
Sub Feature(s) Boundary and linear features and littoral rock associated with South Pier	**Sensitivity** Habitat loss associated with holding the line of the pier (i.e. sea level rise as a result of climate change)	**Conservation Target** To maintain the site fabric to support purple sandpiper (i.e. roosting habitat associated with the pier structure)
Potential effect of policy	The policy suite supports the natural development of the bay, however, holding the line of the pier (Policy 1.3) does not necessarily ensure that specific habitat utilised by roosting birds (particularly purple sandpiper) will be retained following sea level rise.	
Preventative Measures Ensure that appropriate roosting habitat is incorporated into any future requirement to raise the level of the pier (i.e. boulder habitat)	**Mitigation** None	**Implications for the integrity of the site** Provided that the described preventative measures are incorporated into the future management of the pier, it can be concluded that the proposed policy suite will result in no adverse effects on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA01

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
National	The north of the Tyne Estuary is part of the Northumberland Shore SSSI. South Pier is part of Durham Coast SSSI, designated for Magnesian Limestone and associated vegetation, species rich dune system, invertebrates, nationally important numbers of wintering shore birds and breeding little terns.	No perceived effect. Encourages more natural development of the bay	None proposed
Local	none	N/A	None proposed

ACTION PLAN MANAGEMENT AREA 01

Action	By when	Responsibility	Cost £k
Revise strategy for Littlehaven, with intention to realign defence. *Deteriorating defence and overtopping. Ensure integration with redevelopment. Maintain navigation and water sports*	2007	South Tyneside Council	30
Schemes: • Develop new promenade on realignment	2009	South Tyneside Council	2100

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Herd Sands
Management Area reference:	MA02
Policy Development Zone:	1

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The intent of the plan is to maintain the primary recreational and tourism function of the area, including maintenance of recreational facilities, car parking and water and beach use; recognising the important ecological integrity of the dune systems and the long term natural retreat of the coast line. Key pressures will be for the retreat of the dunes to north and south and the increasing pressure on defence at the southern section of the bay. The plan therefore highlights the need for planning constraint in the area behind the northern dunes and the need to relocate the hard recreational area. Similarly the plan identifies the need to develop defence of the southern frontage in conjunction with the development of the Gypsies Green Stadium. The plan recommends holding the line of the main promenade but with the need to defend the southern end of this in manner compatible with an overall managed realignment of the defence over the south of Herd Sands. The importance of Trow point is highlighted in this and, subject to monitoring erosion of this control, the need to reinforce control at this point.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain the south pier as management area 1. Manage access to dunes. Maintain defences along the frontage.
Medium term	Maintain the south pier as management area 1. management of dunes to north Realign the existing hard defence in front of Gypsies Green and re-establish defence in a more sustainable manner. Maintain control at Trow Point
Long-term	Maintain the south pier as management area 1. management of dunes to north Hold the realigned line of defence. Maintain control at Trow Point

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
2.1	Herd Sands North	HTL	HTL	R	Maintain the integrity of the dune defence
2.2	Herd Sands South	HTL	MR	HR	Retreat to maintain the value of the beach
2.3	Trow Point (north)	R	MR	HR*	Maintain longer term control function

Key: HTL - Hold the line, A - Advance the line, R - Retreat, NAI – No active intervention
* HR – Hold the Line on a retreated alignment, MR – Managed Realignment

CHANGES FROM PRESENT MANAGEMENT

The SMP2 identifies the increasing pressure on the dunes to the north and the existing defence to the south. Defence of either of these could result in loss of beaches. This will work to the detriment of the area. The defence policy for this frontage has been changed to one of management and managed realignment but with the intent of maintaining the defence to the principal assets.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

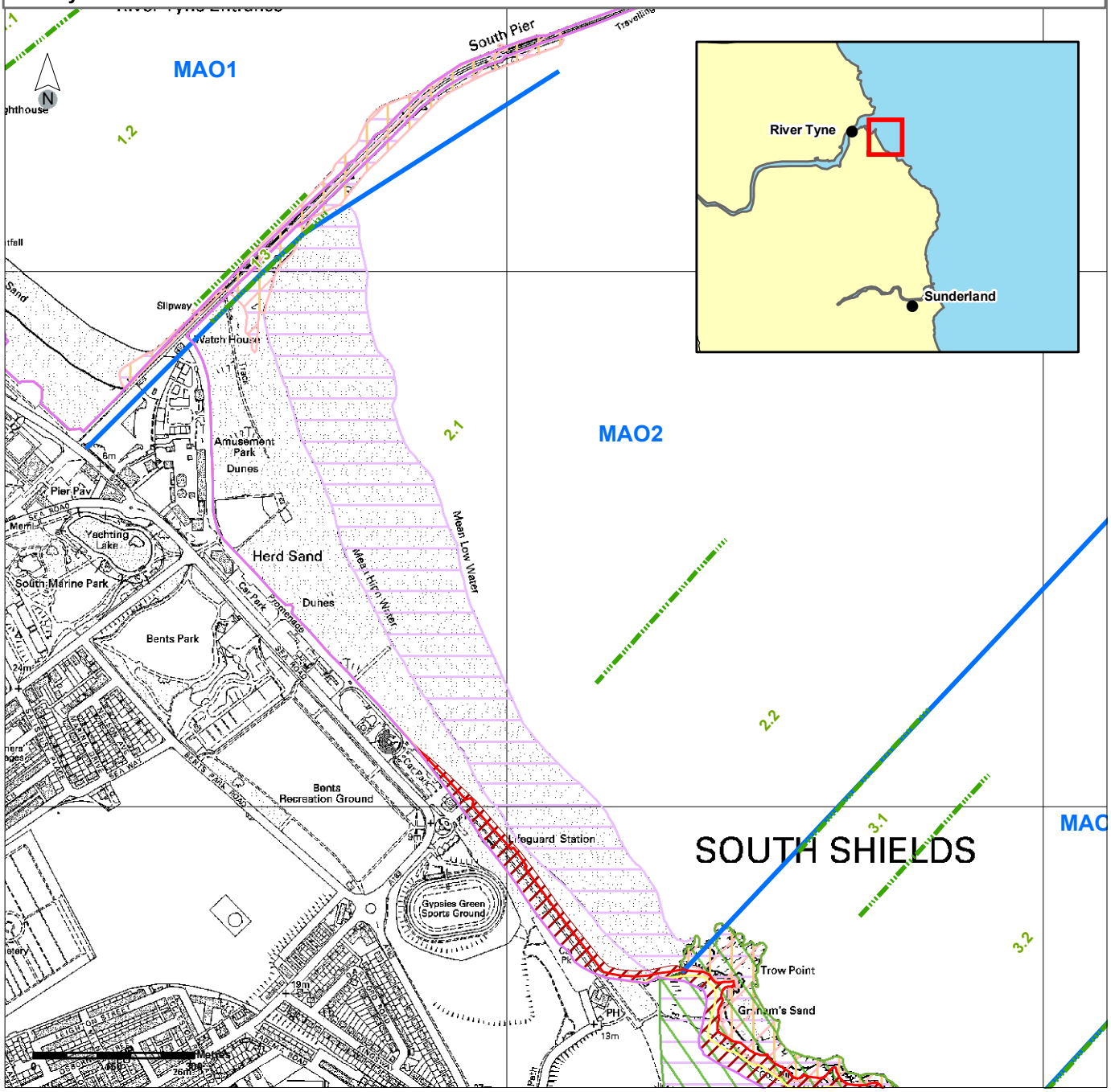
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	0	0	9	9
	Preferred Plan Damages £k PV	0	0	4	4
	Benefits £k PV	0	0	5	5
	Costs of Implementing plan £k PV	10	350	4	364
Costs estimated for retreating the line. Description of damage and benefits under preferred plan: • Relocation of recreational area between 2055 and 2105. • Possible loss of some car parking to southern end but retention of main car parks. • Possible loss of lifeguard station by 2055 • Possible loss of public house at southern end of Bents Recreation Ground by 2055 • Main promenade and assets retained. • Public house to southern end of frontage protected. • Commercial area to south of South Pier retained.					
Heritage	No loss of heritage structures.				
Amenity	• Maintained use of water sports and beach use over the whole frontage. • Recreational and tourism facilities retained.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA02
Policy Units 2.1-2.2



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)		
From Present Day:	Medium - Term:	Long - Term:
Maintain the south pier as management area 1. Manage access to dunes. Maintain defences along the frontage.	Maintain the south pier as management area 1. Management of dunes to north. Realign the existing hard defence in front of Gypsies Green and re-establish defence in a more suitable manner. Maintain at Trow Point.	Maintain the south pier as managment area 1. Management of dunes to north. Hold the realigned line of defence. Maintain control at Trow Point.

Key:
- Predicted Shoreline Mapping*
  - Preferred Plan
  - 20 Years
  - 50 Years
  - 100 Years
  - Management Zones
- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, ruddy turnstone, purple sandpiper)	
Sub Feature(s) Boundary and linear features and littoral rock associated with the Northumbria Coast SPA and Ramsar (i.e. South Pier)	**Sensitivity** This Management Area sits adjacent to an area of the Northumbria Coast SPA and Ramsar site (i.e. the South Pier structure), however, policies for the retention of the South Pier structure (and the conservation features of interest therein) fall within MA01 and as such the policy suite within MA02 already presumes the retention of this structure.	**Conservation Target** To maintain the site fabric to support purple sandpiper (i.e. roosting habitat associated with the pier structure)
Potential effect of policy	This policy suite assumes that the features of conservation interest will be retained as a result of policies described within MA01. As such policies within MA02 are not expected to have any further impact upon the Northumbria Coast SPA and Ramsar.	
Preventative Measures Described within MA01	**Mitigation** None	**Implications for the integrity of the site** No adverse effects are anticipated on the integrity of the European site.

SAC Site Feature	Annex 1 habitat: vegetated sea cliffs of the Atlantic and Baltic coasts	
Sub Feature(s) Neutral lowland grassland	**Sensitivity** Loss of vegetated sea cliff habitat as a result of dune roll back to the north of the site.	**Conservation Target** The overall length and / or area of the cliff habitat of the site is maintained taking into account natural variation.
Potential effect of policy	This policy suite supports the long-term natural development of the dunes. The southern end of this dune habitat borders the vegetated sea cliff interest of Trow Point (Durham Coast SAC) and would be expected to result in the natural loss of a proportion of this habitat.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA02

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
National	Herd Sands is part of the Durham Coast SSSI, containing sand dunes	2.2 potential pollution of foreshore due to landfill of unknown nature if eroded. The managed realignment of defences will be with the intent of provide space for dunes to expand to. Holding the line in the long term will result in squeeze once again.	As the medium term is likely to see increase in space available for dunes no mitigation is proposed. However, the long term view will require consideration of environmental interests within managed realignment.
Local	none	N/A	None proposed

ACTION PLAN MANAGEMENT AREA MA02

Action	By when	Responsibility	Cost £k
Establish plan for dune management, including long term plan for recreation area. *Maintain integrity of dunes. Long term roll back. Integration of recreational use*	2007	South Tyneside Council	10
Outline strategy for Herd Sands developed in conjunction with land use plan. *Ensure integration with redevelopment. Maintain function of dunes and use of beach and water sports. Sustainable defence line.*	2012	South Tyneside Council	25
Schemes:			
• Dune management	2008	South Tyneside Council	200
• Initial scheme implementation to the south of Herd Sands	2011	South Tyneside Council	200

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Trow
Management Area reference:	MA03
Policy Development Zone:	1

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The intent of the plan is to manage the potential pollution problem posed by erosion of in fill to Trow Quarry. This is subject of a more detailed on going appraisal study. Findings of the SMP2 indicate that protection of the frontage is likely to be necessary in the short term but in the longer term management implementation will depend on the actual erosion rates of Trow Point in particular. This policy, in this area would allow information to be obtained on these erosion rates over a manageable time period. The aspiration is that in the medium to long term there would be a policy of managed realignement but this approach to management would need to be confirmed by the detailed study.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain and upgrade the natural protection to the frontage.
Medium term	Review management with a presumption of active realignment.
Long-term	Managed realignment of the whole frontage.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025.	**2055**	**2105**	**Comment**
3.1	Trow Point (south)	R	MR	HR*	As required for management area MA2
3.2	Trow Quarry	HLT	MR	MR	Subject to detailed appraisal.

Key: HTL - Hold the line, A - Advance the line, R - Retreat, NAI – No active intervention
* HR – Hold the Line on a retreated alignment, MR – Managed Realignment

CHANGES FROM PRESENT MANAGEMENT

The policy changes from that in SMP1 to Managed realignment. Initially, allowing time for further monitoring of erosion rates and development the long term approach, the policy of Hold the line is recommended; in line with the emerging strategy. This recognises the increasing difficulty of management of the inspection and removal approach currently being undertaken. This short term policy for Hold the Line is within the longer term context for managed realignment of the frontage.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

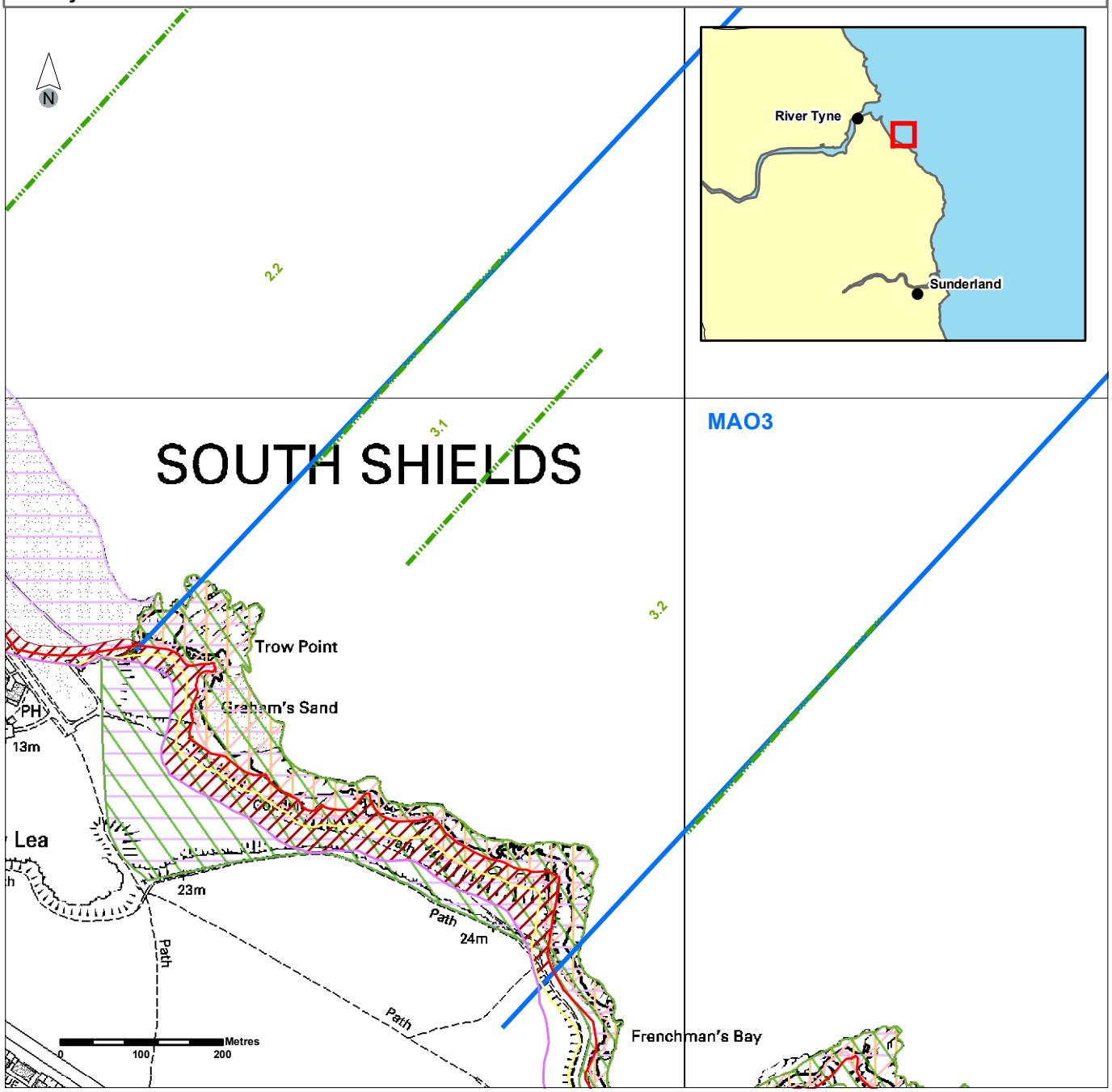
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	Deferred pending the outcome of the detailed appraisal.			
	Preferred Plan Damages £k PV				
	Benefits £k PV				
	Costs of Implementing plan £k PV				
Description of damage and benefits under preferred plan: • Cost and potential impact of excavation.					
Heritage	• Potential loss of gun emplacement.				
Amenity	• Reduction of amenity area				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	Yes, potentially at a local scale
Impact of geomorphology and hydrodynamics	Yes, potentially at a local scale.

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA03
Policy Units 3.1-3.2



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Maintain and upgrade the natural protection to the frontage.	Review management with a presumption of active realignment.	Managed retreat of the whole frontage.

Key:

- Predicted Shoreline Mapping*
  - Preferred Plan
    - 20 Years
    - 50 Years
    - 100 Years
  - Mangement Zones
- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, ruddy turnstone, purple sandpiper)	
Sub Feature(s) Littoral rock (exposed cobble and boulder habitat between Trow Point and Frenchman's Bay)	**Sensitivity** Loss of habitat, particularly roosting habitat for purple sandpiper, i.e cobble and boulder beaches	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores with associated boulder and cobble beaches.
Potential effect of policy	This policy suite supports the long-term natural retreat of the frontage and also the natural roll back of the cobble beaches. The policy does however advocate a short term hold the line policy, the impacts of which will need to be fully considered at the strategy stage.	
Preventative Measures To provide a assessment of the HTL policy at the strategy stage within this area.	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

SAC Site Feature	Annex 1 habitat: vegetated sea cliffs of the Atlantic and Baltic coasts	
Sub Feature(s) Neutral lowland grassland (between Trow Point and Frenchman's Bay)	**Sensitivity** Loss of vegetated sea cliff habitat as a result of natural erosion	**Conservation Target** The overall length and / or area of the cliff habitat of the site is maintained taking into account natural variation.
Potential effect of policy	This policy suite supports the long-term natural retreat of the cliffs.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA03

	Description of Designation	Effect of Preferred Plan	Measures to offset Effects /impacts Compensation/Mitigation/Alternative Solution
National	Trow is part of the Durham Coast SSSI, geological importance.	3.2 Potential pollution of foreshore due to landfill. In the medium term the implementation of HTL on a localised basis to avoid contamination of the foreshore could impact features of the SAC and SSSI.	The long term option of managed realignment should be pursued as the preferred option. This will be examined in more detail in the dedicated coastal strategy investigation.
Local	none	N/A	None proposed

ACTION PLAN MANAGEMENT AREA MA03

Action	By when	Responsibility	Cost £k
Design development. Establish specific design criteria and undertake design. *Develop an appropriate immediate action to address potential contamination. Development of long term realignment*	on-going	South Tyneside Council	150
Schemes: • Short term defence	2008	South Tyneside Council	1600

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.2 PDZ 2 Frenchman's Bay to Souter Point

4.2.1 Policy Development Analysis

DESCRIPTION

Physical

Overall the zone may be seen as a massive magnesian limestone headland with a generally thin capping of Pelaw Clay and extending nearly 5km. from the local headland to the south of Trow Quarry to the narrow local headland of Souter Point. The shape of the headland changes in orientation from an alignment facing to the northeast, at the northern end, to a coastline facing virtually east as it runs down to Souter Point. The critical change in orientation occurs at Lizard Point. Within this overall headland and resulting from differential erosion of the basically hard material, several small bays have developed. In effect, the coastline may be subdivided for description into the following areas:

Frenchman's Bay Headland, with its relatively high cliff line, exposed rock foreshore and the broad (300m to 400m wide) open area of the Leas. Within the shallow bays there is sand overlying the rock foreshore area. Where the coast is locally more deeply indented there is small areas of dry sand beach.

Marsden Bay is a deeper cut and longer bay (nearly 1.5km.) with rock platforms to north and south, but a generally sand foreshore beneath steep Magnesian Limestone cliffs. There are two areas of man-made defence; to the northern end to the former lifeguard station and in the centre of the bay to the Grotto Café and beach access. While generally to the northern end of the bay there is some 60m of open land to the crest of the cliff, behind which is the main coastal road, at the southern section of the bay this width is much less, being at minimum only of the order of 15m to the road. There are several car parks over the length of the bay. On the foreshore there are several stacks, highlighting the differential erosion of sections of harder and softer rock. The most prominent of these is the Marsden Rock, which tends to have protected the cliff to the rear from erosion. There are areas where shingle or sand form a backshore beach at the toe of the cliff.

The Lizard Point Headland comprises generally hard rock cliffs with small bays and an open area of land above. Souter Lighthouse is situated on the headland at Lizard Point, set back some 90m from the cliff. There is also a car park to the north of the Lighthouse close to the cliff line.

The Old Harbour Quarry to the south of Lizard Point comprises relatively low cliffs, quite deeply indented and caved in areas, with small pocket beaches. The cliff line acts as thin barrier in front of a now infilled and landscaped quarry area, extending back to the main coastal road. Locally caving of the cliff has reduced the width of solid rock barrier to as little as 2m, although more generally the barrier of natural rock is of the order of 20m. In places defence works have already been undertaken to resist local erosion.

Whitburn Point is a more consistent rock cliff frontage, although still caved, with a relatively deep capping of glacial till but with a relatively uniform rock platform to the foreshore. Above the cliff is some 150m width of open ground, backed by housing.

Souter Bay is a wider, longer length of beach frontage, some 80m in width, with a raised beach behind. The sediments are held by Souter Point. The old cliff line to the rear of the beach is set at a less steep angle. Above the cliff is the open area occupied by the MOD firing range.

Environment

With the exception of Souter Bay, a short section behind the Grotto Café, the foreshore of Marsden Bay and the southern MOD land, the zone, the cliffs and open land to the rear is within the ownership of the National Trust. This very largely sets the character of the area, extending even beyond this National Trust land. The overall focus is on its inherent natural landscape and its importance as an area for casual recreation. Supporting this are the natural conservation designations as part of the Durham Coast SAC; designated for its vegetated and exposed magnesian limestone cliffs and grassland, the Northumbria Coast SPA around Frenchman's Bay; an area also defined as a Ramsar site, and the Trow Point to Whitburn Steel SSSI and the Durham Coast SSSI. Bio-diversity opportunities have been identified in the area of Souter Bay, although these relate to land management associated with the MOD firing range.

The beach of Marsden Bay currently remains a designated bathing beach, though the bay's use for this purpose has declined in the last two decades. Access to the beach is important. There is currently a life guard station to the northern area, which once provided a safety facility for users of the beach. Access along the crest of the cliff line is part of the longer coastal path. Beach access is from Marsden Steps at the north of the bay and behind the Grotto Café. Car parking is another important feature providing access facilities for use of the area.

The coastal road provides both local access and is the main coastal road, linking between South Shields and Sunderland.

The limekilns to the southern section of Marsden Bay, together with the Souter Lighthouse and its associated properties are discrete heritage features.

Harbour Quarry poses some risk of contaminated material being released to the coastal system. At present this relates to general risk of mining waste being released and potentially reducing the attractiveness of Marsden Beach and the beaches to the south. The specific nature of potential contamination has not been identified.

In terms of other infrastructure, there are several outfalls along the frontage most notably at the northern end of Marsden Bay.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To maintain the existing recreational value and opportunity, particularly access both to the area and to the beaches and open areas.
- To maintain the cultural heritage features.
- To maintain the important regional transport link
- To minimise pollution.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:25yr	1:50yr	1:100yr	1:200yr
-2.12	2.18	2.88	3.08	3.21	3.27	3.38	3.44

Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 2.85m below Ordnance Datum.

Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between.

Source (extreme water levels): Babtie, 1998. Shoreline Management Plan, River Tyne to Seaham Harbour. Sub cell 1b. NB. Values for 200 yr ARI are interpolated between 100 yr and 250 yr values.

Wave climate

Return Period (1:X years)	Wave Height Hs (m)
0.10	4.24
1	6.08
10	7.92
20	8.48
50	9.21
100	9.76
1000	11.61

Source: Babtie, 1998. Shoreline Management Plan, River Tyne to Seaham Harbour. Sub cell 1b. OUTRAY used to determine inshore wave data at 10 m contour.

Baseline Erosion Rates

Frenchman's Bay section	0.1 to 0.2 m/yr
Marsden Bay	0.1 to 0.2m/yr, being held to a degree by defences
Lizard Point	0.1m/yr possibly less
Souter Bay	0.2m/yr reducing against the hard cliffs

All the above rates are based on existing evidence and are likely to increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

The whole zone acts as a headland. Relatively high rates of sediment drift to the south are reported in the SMP1 but more detailed assessment of this strongly suggests that there is little supply or drift from or close to the cliff line. What drift there is would tend to be to the south but this is very largely contained by the numerous headlands. This has allowed the development of small swash aligned bays. In general the main bays north of Lizard Point are of insufficient depth to allow growth of stable backshore beach in front of the cliffs. Under severe wave action material can, therefore, be taken offshore from the bays. Consultees report significant fluctuation in beach levels from one year to the next. The evidence, however, is that material does tend to return. South of Lizard Point, many of the bays are smaller and relatively more deeply indented. This has allowed more stable beaches to develop. In the case of Souter Bay, the raised beach and the backshore beach is held by Souter Point. The angle of the backshore of the bay demonstrates the potential drift to the south being held by Souter Point.

There is some evidence that the overall nearshore slope is steepening. This is based on very limited information. If it were the case then there would be a concern that the beaches and the back cliffs would become more exposed, reducing the ability of bays to retain material and increasing rates of

erosion of the cliff line. A similar affect may result from anticipated sea level rise (i.e an initial loss of sediments within bays, followed by increased pressure on the cliffs).

Cliff failure along the frontage tends to be by undercutting followed by relatively larger sporadic collapse of upper sections. This is most evident just north of Lizard Point, with areas of large boulders on the foreshore.

Unconstrained:
There is little intervention at the toe of the cliff, with only small sections of defence in Marsden Bay and intermittent concrete infill to the area of Harbour Quarry. What is seen from the landscape is very much the pattern for an unconstrained future. That of a coastline which will continue to erode.

Critical to the long term evolution will be difference in erosion rates between bays and headlands. Greater erosion within bays could allow more stable beaches to develop. This might be anticipated more to the south of Lizard Point where there is clearly softer drift material exposed at the back of individual bays. If, however, erosion of headlands continues apace with the bayed cliffs, there is likely to be a general loss of sediment from beaches.

Consistent long term monitoring of the erosion rates is not available and the rates applied in the SMP2 are uncertain. Similarly, the assessment of both the scale and impact of sea level rise continues to be an issue. Despite this, what remains certain is that the unconstrained coast will continue to erode. It has been assumed that over the period of the SMP erosion to the north of Lizard Point erosion may be up to 50m. To the south erosion may be of the order of 25m.

MANAGEMENT

Present Management

SMP1 The zone is covered by Management Units B2, B3 and B4.	Policy Do Nothing
Whitburn Coastal Strategy Study The strategy sub divides the coast in to eleven management units. In all but two the policy is to do nothing. At the north of Marsden Bay, at the former lifeguard station and at Harbour Quarry the policy is limited intervention..	Overall policy, Do Nothing, with local intervention.

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

The shape of the coast is dictated by the geology. Only locally within Marsden Bay and to a limited extent in front of Harbour Quarry are there man made defences. These defences might be expected to have an influence locally over the next 20 to 50 years but as they fail or become outflanked they will not fundamentally alter the overall evolution of the frontage.

Based on assumptions of sea level rise, erosion to the north of Lizard Point will be in the order of 4m, 20m and 50m over the next 20, 50 and 100year period respectively. This erosion, in terms of retreat of the cliff top is likely to be episodic (sudden failures of several metres locally). Associated with this is a potential loss of beaches within the bays. To the south of Lizard Point the corresponding erosion will be in the order of 2m, 10m and 25m. Here there would be less loss of beach material.

The larger scale impacts of this process would be the loss of the main coastal road, potentially over the next 20 years, the loss of car parks and, at Harbour Quarry, the release of mining waste. The main heritage features of regional and national importance; the Lime Kilns and Lighthouse would not be physically affected. Access, particularly to the Lime Kilns could be disrupted.

In addition, there would be a substantial loss of the general recreational area, including the current route of the coastal path and quite possibly the beaches to the north. The overall nature of the zone would, however, be maintained.

At a more local level the lifeguard station would be lost, although the changing character of Marsden Beach means that this former safety feature is no longer required. The Grotto Café and the associated access point to the shore would also be lost. Local defence to Harbour Quarry, within the caves, will be outflanked.

MDSF Evaluation	*Assets lost over the time period of the SMP.*	*PValue Damages*
Erosion	None	0
Flooding	No flood risk	0
Other Information	Loss of the Grotto Café (private) Loss of the main road Potential loss to fishing interests evaluated in strategy	
Assessment of key objectives	• Maintains the character of the area although possibly creating a more natural and remote feel to the area of Marsden Bay. • There may be a loss of beach use in Marsden Bay but beach use would still be available to the south of Lizard Point. • The key aspects of the natural heritage would be generally enhanced despite loss of grass lands. There would be potential damage due to pollution. • Key cultural heritage would be maintained. • The main transport link would be disrupted. • There would be potentially serious pollution to the local beaches and beaches to the south. • There would be no commitment to continued defence.	

With Present Management (Scenario 2):

In general the processes described in Scenario 1 would still apply. Only three areas of difference are noted. The strategy recommends general maintenance of the defence to the

access point at the north end of Marsden Bay (the location of the former Life Guard station) and to the defences associated with the Grotto Café. Although, in the latter case, this is seen as a private consideration based on the continued value of the asset, the strategy does acknowledge that the Grotto defences do also provide protection to the public access to the centre of the beach. These actions would not have a significant impact on the longer term trends of erosion and, as suggested by the strategy, are really dictated by short to medium term needs. There would, in the long term be a loss of the main coastal road and car parks, with similar impacts to those described in Scenario 1.

At a more strategic level, the strategy also recommends action to partially infill the caves in front of Harbour Quarry. This initially limited action would stop loss of quarry infill from being fed into the coastal system. It is argued in the strategy that economic damages to the local beaches and to the fishing interests justify such action. Over a longer term (60 years to 100years and beyond; an SMP perspective), this policy of defence at Harbour Quarry would imply continued intervention, deferring a choice as to the ultimate management of the risk. For the sake of this Scenario it is, therefore, assumed that the long term policy would be to defend.

The current width of the natural barrier separating the infill from the foreshore (excluding the local caving), is estimated to be of the order of 20m. Based on the erosion assumption, this barrier would provide protection over the next 75 to 100 years. Further local support would be required during the period leading up to the more general loss of the natural barrier. Following the logic of this policy, the long term result would be a gradual encasement of much of this area of coastline. This in turn would result in an inability of the coast to adapt to the pressures of erosion and is likely to result in the loss of beaches and in effect a separation of the recreational land above the quarry from shoreline use.

Further south, erosion would continue. There would be an associated loss of open land, together with the loss of the coastal path. There would also be some loss to the area, but possibly not the actual facilities of the rifle range.

MDSF Evaluation	*Assets lost over the time period of the SMP.* *PValue Damages*
Erosion *Flooding*	*None* *No flood risk*
Other information	Loss of the Grotto Café (private). Loss of the main road. Economic loss identified by strategy in connection with impact on tourism and fisheries.
Assessment of Key objectives	• Maintains the character of the area although possibly creating a more natural and remote feel to the area of Marsden Bay. • There may be a loss of beach use in Marsden Bay and to the south of Lizard Point. • To the north the key aspects of the natural heritage would be generally enhanced despite loss of grass lands. There could be significant loss in terms of natural cliff exposure and transitional habitat over the quarry area. • Key cultural heritage would be maintained. • The main transport link would be disrupted. • The threat of pollution would be contained. • There would be an increased commitment to continued defence.

DISCUSSION AND DETAILED POLICY DEVELOPMENT

Consideration of the two baseline scenarios highlights the need to make choices at two very different scales. Quite rightly this is reflected in the number of subdivisions that have had to be made in looking at detailed strategies for defence. From a policy (SMP) perspective it is more sensible to examine the nature of these choices relating to the essential issues rather than examine each of these sub-divisions at a strategy level of detail. The key issues are:

- At a broad level there are three issues: the general loss of recreational area and the coastal path, the disruption to the transport link and the potential pollution from Harbour Quarry.
- Within this, at a quite local level is the continued management of existing defences within Marsden Bay.

Taking first the former, the policy of the principle land owner, The National Trust, is to accept natural change and to manage as far as possible the use of the frontage within the constraints of this policy. As such, a non-intervention policy would be preferred. Indeed, within these objectives and considering the major cost involved with any long term major intervention, this can be the only sensible option. To defend the frontage on a large scale, such as was discussed by one consultee, would result in a long term squeeze of the foreshore, destroying much of the value placed on the frontage. The corollary of this would be to progressively retreat the line of the coastal path, the redesign of car parking balanced with an accepted loss of the general overall area of land for recreational purpose. Such a policy would be compatible with the objectives associated with nature conservation, providing a resilient environment within which the habitats may develop. This overall policy would provide the best opportunity for maintaining the natural beaches and the current association between beach use and the recreational use of the land to the rear. Key local issues would be maintaining safe access between cliff top and the foreshore and safety to those using the beaches. It would be anticipated that the more general beach use would transfer to the shore south of Lizard Point, subject to the policy for management of the Harbour Quarry (discussed below).

Accepting the overall land lost to recreational use, in effect, heightens the value of the land then still available for this purpose. This impacts on the possible options for road realignment.

The primary area of concern with respect to the loss of the road is at the southern end of Marsden Bay. Two management options are possible:

i) Protection to toe of cliff. The estimated cost of this work would be an initial expenditure of £2.5M by year twenty and a subsequent expenditure of some £4M between years 50 and 100, providing a revetment over a length of some 800m.

ii) Road realignment. The strategy suggests setting the road back in front of the Lime Kilns, at an estimated cost of £700,000. While such action would restore the main transport link along the coast within a zone likely to be unaffected over the next 100 years, it would potentially occupy valuable recreation space, in effect closing down the informal recreational link along the frontage. Further consideration should therefore be given to this realignment, potentially improving the road (Lizard Lane) to the rear of the Marsden Quarries. This alternative route would impact on the residential properties to the hinterland.

The issue at Harbour Quarry has both local and more strategic implications. The strategy has identified potential damages amounting to £1.2M/year from loss of tourism and £1M/year associated with the shell fishing activities. This is based on a major discharge of material from the quarry. Immediate works to alleviate such damage are estimated as being of the order of £240,000, requiring concrete barriers constructed within the caves. A principle assumption being made in the strategy is that exposure of the quarry infill material would result in major flux of material to the coastal system. Work further south on the coast has shown, however, the capacity of the coast and coastal usage to absorb more diffuse pollutants. Critical to this would be establishing the specific nature of the infill and, as seen in the case of Trow Quarry, the absence of specifically harmful materials.

While the current strategy offers an appropriate short term solution to the immediate risk, adoption of this approach in the longer term would result either in a long term general commitment to defence of much of the frontage, as the main body of the cliffs erode, or an increasingly fragile natural defence and hence a more catastrophic failure of the natural rock barrier; exposing the coastal system to a glut of eroded infill. In the short term, therefore, the proposed strategy is preferred in managing a very real risk; the longer term policy would be one of managed retreat, based on further investigation of the risk; the nature and extent of the infill and its likely extent of erosion given local failure of the natural barrier. Depending on these factors long term management might be a combination of excavation and acceptance of a natural diffusion on the infill material. Associated with this would be a need for management and redesign of the landscaped area and maintenance of access to the developing areas of beach.

The short term policy should be seen as part of the development of the long term policy of no active intervention (in terms of defence). Investigation of the nature of infill is critical in this. If, as currently indicated, the in-fill is inert, then the intent of the short term policy of maintaining, or even improving defences at critical locations, should be seen as management of the diffusion of material into the coastal zone in such a way as to minimise impact. This may, subject to further investigation, mean removal of the local defences in a controlled manner. The programme for management would then be:

- To investigate the nature and extent of the infill.
- To identify where there is risk of exposure.
- To assess the impact should these exposures become critical and make a strategic assessment of whether defences are maintained, improved or abandoned.

Associated with this would be a need for an assessment of how to manage the hinterland. The Council intends to investigate the nature of material and the risks they pose to coastal waters. The policy for the frontage would be reviewed in light of these further investigations.

With respect to the more local issues, management of the area of the former Life Guard Station would depend on the developing use of the eroding frontage. At present the strategy indicates that continued defence of the steps / access is sustainable over the medium term. Such action would not run contrary to a long term policy of retreat. The continued defence of the Grotto Café is linked to its viability as a commercial asset. While it must be anticipated that there will be a continuing loss of beach in front of the defence, its private maintenance would not significantly run counter to a general policy of retreat.

South of Harbour Quarry the only sensible policy is for non-intervention. At Souter Bay, there would be development of different transitional habitat as recommended by the English

Nature's report on opportunities for bio-diversity and local management of the frontage to enhance this would be acceptable within this general policy. In the longer term, however, there needs to be recognition that the raised beach area will erode and there will, therefore be a reduction in this low level habitat as the coast cuts back to the rising coastal slope. As suggested in the report, the long term management of the area has to be in discussion with the MOD. Development of this management plan falls outside the remit of the SMP2.

MANAGEMENT AREAS

From the above there are four policy units defined, reflecting in detail the differences in issues being faced. These policy units may be grouped dividing the policy development zone into two management areas; these are:

- Lizard Point North, including policy units of Frenchman's Bay and Marsden Bay and Lizard Point itself.
- Lizard Point South, including policy units of Harbour Quarry and Souter Bay

In the case of the first area the common factors are the management of the recreational area and the transport and parking issues. In the case of the southern area, the common link between the two policy units is the management of the retreating coastline but with the dominating issue of how Harbour Quarry may best be managed.

Policy statements or summaries are therefore presented by management areas in the following sheets.

4.2.2 MANAGEMENT AREA POLICY STATEMENTS (MA04-05)

Location reference:	Frenchman's Bay to Lizard Point
Management Area reference:	MA04
Policy Development Zone:	2

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall policy for the zone is to allow the coast to erode, accepting a loss of recreational space but maintaining the natural character of the area. There is potential width in the zone to allow realignment of the important coastal road, but consideration should be given to relocating this transport link further in land, thus compensating better for the natural loss to the amenity area. There is a risk of continuing squeeze to the beach within Marsden Bay, with gradual loss of the amenity value of this area. The policy of allowing width for cliff erosion is the most appropriate way in which this threat may be addressed. The local defences at the former Lifeguard Station and the Grotto Café are seen as being of a local nature, not significantly impacting on the overall process of retreat.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Allow maintenance of local defences. Plan realignment or relocation of the main road.
Medium term	Review need for safety provision and access to Marsden Bay Realign or relocate road.
Long-term	No active intervention along the whole frontage, consolidating policy units into one unit.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
4.1	North of Lizard Pt.	R	R	NAI	local protection, road re-alignment, reassess car parking
4.2	Lizard Pt	NAI	NAI	NAI	Re-align car parking
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

The SMP2 concurs with the findings of the strategy study, which recommended a change from SMP1 policy of Do Nothing to one of retreat; recognising the potential locally to maintain defence to the former Lifeguard Station and the Grotto Cafe.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

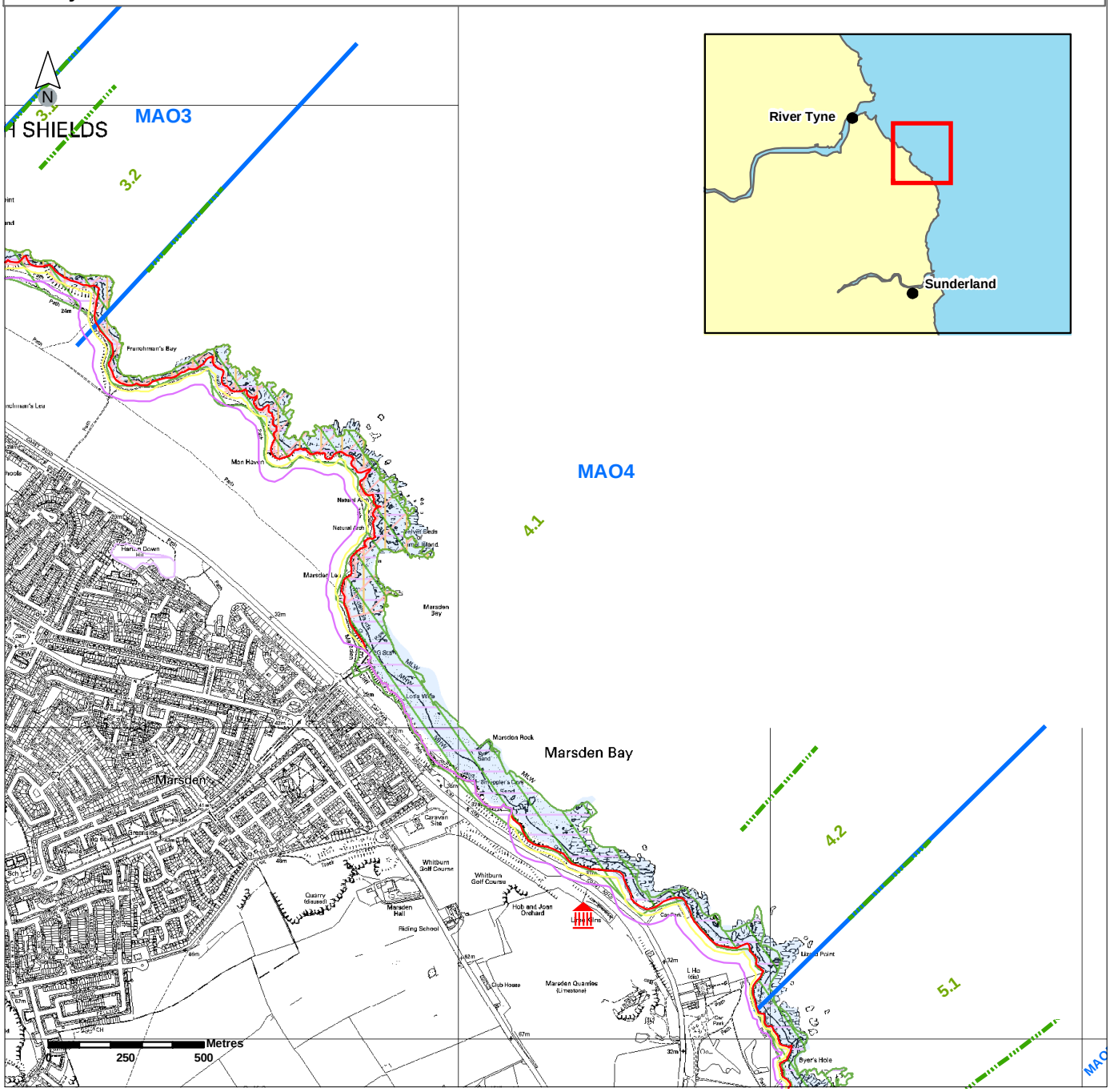
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV		351	0	351
	Preferred Plan Damages £k PV		351	0	351
	Benefits £k PV		0		0
	Costs of Implementing plan £k PV	0	0	0	0
Description of damage and benefits under preferred plan: • Loss of former lifeguard station and Grotto Café by 2025 (subject to private investment. • Loss of car parking along Marsden Bay. • Loss main road by 2025 and need to relocate.					
Heritage	No loss of heritage structures.				
Amenity	Loss of recreational amenity land but sustaining as far as possible use of foreshore .				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA04
Policy Units 4.1-4.2



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Allow maintenance of local defences. Plan realignment or relocation of the main road.	Review need for safety provision and access to Marsden Bay Realign or relocate road.	No active intervention along the whole frontage, consolidating policy units into one unit.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT - PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, ruddy turnstone, purple sandpiper)	
Sub Feature(s) Littoral rock (between Frenchman's Bay and Marsden's Bay)	**Sensitivity** Loss of habitat, particularly roosting habitat for purple sandpiper, i.e cobble and boulder beaches	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores with associated boulder and cobble beaches.
Potential effect of policy	This policy suite supports the long-term natural development of the cliffs between Frenchman's Bay and Marsden's Bay and as a result the natural erosion of the cobble/boulder beaches.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

SAC Site Feature	Annex 1 habitat: vegetated sea cliffs of the Atlantic and Baltic coasts	
Sub Feature(s) Neutral lowland grassland (throughout Management Area)	**Sensitivity** Loss of vegetated sea cliff habitat as a result of natural erosion	**Conservation Target** The overall length and / or area of the cliff habitat of the site is maintained taking into account natural variation.
Potential effect of policy	This policy suite supports the long-term natural erosion of the cliffs along the entire Management Area. As a result of this erosion process (supported by the SMP2 policy) it will be necessary to retreat the coastal path. Path retreat may, therefore, lead to a loss of habitat, however, such loss would be outside of the SAC boundary.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA04

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
National	Part of Durham Coast SSSI, Includes Marsden Bay, very important site for coastal geomorphology (Geological Conservation Review Site).	4.2 Potential loss of geological SSSI features due to possible cliff protection works to protect main coast path.	Road re-alignment to avoid the need for cliff protection works.
	none	N/A	As above
Local			

ACTION PLAN FOR MANAGEMENT AREA MA04

Action	By when	Responsibility	Cost £k
	2008	South Tyneside Council	5
Planning Strategy. Development of realignment strategy for road, car parking and access. Including examination of alternative route for road. *Discussion with highway authority. Establish necessary policy within land use plans to allow relocation. Confirm policy approach prior to review of SMP3*	2012	South Tyneside Council	50
Schemes: No coast protection scheme proposed.			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Lizard Point to Souter Point
Management Area reference:	MA05
Policy Development Zone:	2

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The long term intent of the plan is to allow natural retreat of both units, thereby maintaining recreational use of the foreshore and supporting the natural heritage. There is potential pollution relating to Harbour Quarry in-fill. The aim of the plan is to allow natural diffusion of in-fill material (subject to further investigation as to its nature). This will require management of existing local defences in the short term.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain and, subject to further investigation, improve local defences. Investigate managed retreat from a policy of defence.
Medium term	Manage retreat of Harbour Quarry local defences in a manner allowing natural diffusion on quarry in-fill.
Long-term	No active intervention along the whole frontage, consolidating policy units into one unit.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
5.1	Harbour Quarry	HTL	R	R	Investigation of potential pollution
5.2	Harbour Quarry to Souter Point	NAI	NAI	NAI	local management to enhance bio-diversity
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

The strategy sets a policy for continued local defence of Harbour Quarry. While this is accepted as a short term approach in this unit, the medium to long term policy reverts to the SMP1 policy of Hold the Line.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

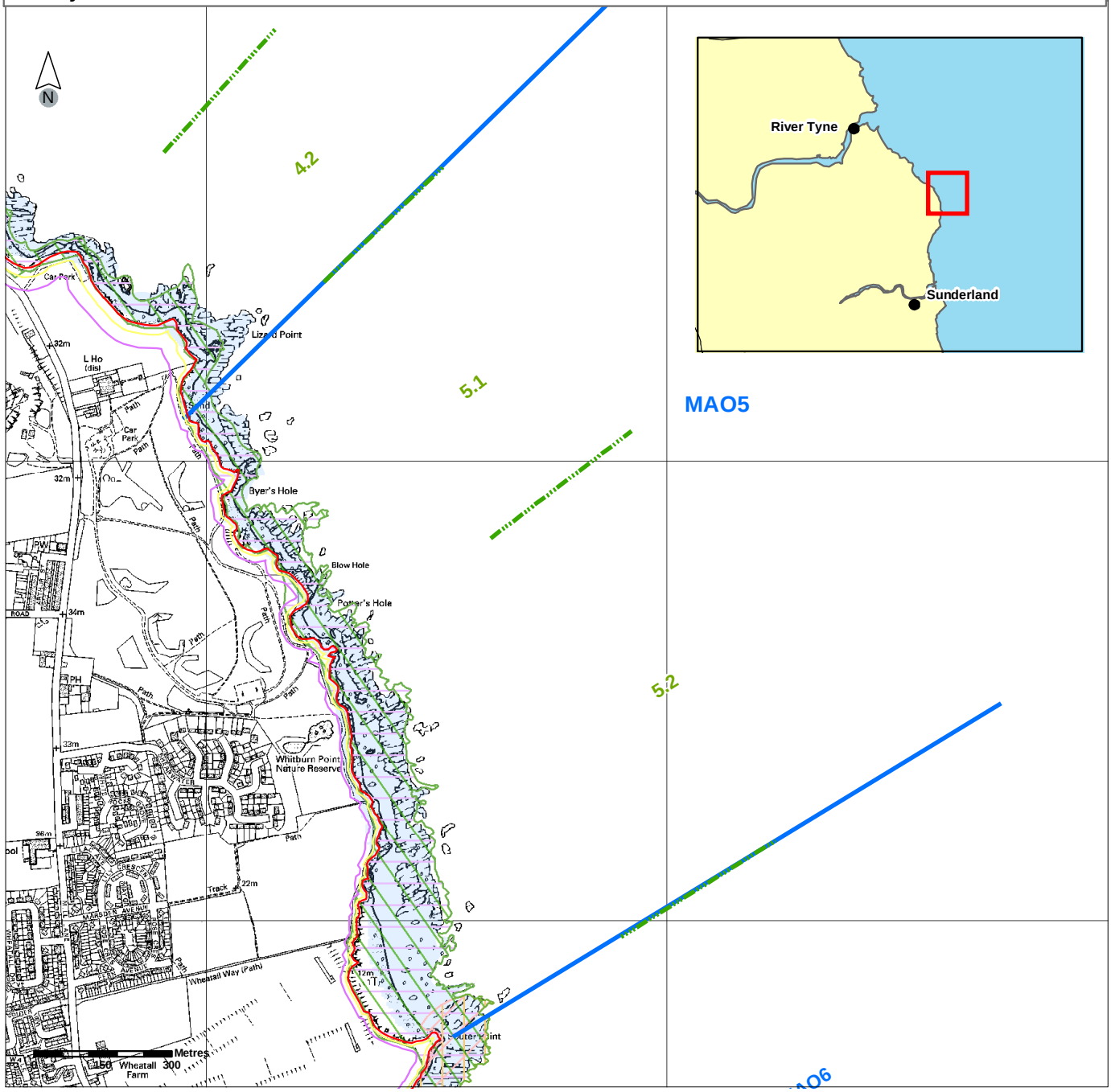
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	deferred pending study of quarry waste			
	Preferred Plan Damages £k PV				
	Benefits £k PV				
	Costs of Implementing plan £k PV	169	0	0	169
Costs based on strategy Description of damage and benefits under preferred plan: • Loss of amenity park area but mitigated by development of a more natural foreshore.					
Heritage	No loss of heritage structures.				
Amenity	Medium term loss of recreational area but long term improvement.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	Yes
Impact of geomorphology and hydrodynamics	Yes

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA05
Policy Units 5.1-5.2



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)		
From Present Day:	Medium - Term:	Long - Term:
Maintain and, subject to further investigation, improve local defences.Investigate managed retreat from a policy of defence.	Manage retreat of Harbour Quarry local defences in a manner allowing natural diffusion on quarry in-fill.	No active intervention along the whole frontage, consolidating policy units into one unit.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, ruddy turnstone, purple sandpiper)	
Sub Feature(s) Littoral rock (at Souter Point)	**Sensitivity** Loss of habitat (exposed littoral rock and boulder habitat); and potential exposure to contaminants	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores with associated boulder and cobble beaches.
Potential effect of policy	This policy suite supports the long-term erosion of the exposed littoral rock and boulder habitat; in addition there is potential exposure to contaminants (associated with the nearby coastal landfill) as a result of long-term erosion of the cliffs. Dependent upon the exact nature of the contaminants this could result in direct impacts upon the SPA interest features (i.e. bird species). At the present time investigations are ongoing to determine the nature of the infill.	
Preventative Measures Managed retreat combined with monitoring to assess the risk of exposure to contaminants and the potential for the coast to absorb any potential effects of diffuse pollution.	**Mitigation** Potential need to review SMP policy, once the extent and nature of the risk associated with infill material has been determined.	**Implications for the integrity of the site** No adverse effects are anticipated on the integrity of the European site provided that: - the risk of exposure from contaminants is fully assessed and monitored; and - appropriate mitigation measures are implemented once the nature of the contaminants and risk of exposure are fully determined.
SAC Site	**Feature** Annex 1 habitat: vegetated sea cliffs of the Atlantic and Baltic coasts	
Sub Feature(s) Neutral lowland grassland (throughout Management Area)	**Sensitivity** Loss of vegetated sea cliff habitat as a result of natural erosion.	**Conservation Target** The overall length and / or area of the cliff habitat of the site is maintained taking into account natural variation.
Potential effect of policy	This policy suite supports the long-term natural erosion of the cliffs along the entire Management Area.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA05

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
National	Part of Durham Coast SSSI (vegetated coastal magnesian limestone cliffs)	5.2 potential pollution of SSSI foreshore features due to leaching of material from coastal landfill. Potential short term impacts to SSSI features if hard defences implemented.	Managed retreat combined with monitoring of sea caves to assess risk and investigate the potential of the coast to absorb diffuse pollution. Impacts short term – strategy for future removal should be devised to enhance SAC in long term.
Local	Whitburn Point Local Nature Reserve	No intervention will result in reduction in extent of LNR.	None proposed

ACTION PLAN FOR MANAGEMENT AREA MA05

Action	By when	Responsibility	Cost £k
Risk assessment, initial surveys and report	2007	South Tyneside Council	5
Investigation. Examine nature and extent of material in Harbour quarry. *Concern over potential pollution and amenity use of land. Urgency relates to continued need for defence of weak spots and potential increasing requirement.*	2009	South Tyneside Council	50
Assess potential impacts and confirm SMP policy.	2010	South Tyneside Council	10
Schemes: Retired defence (subject to investigations and plan)	2025	South Tyneside Council	240

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.3 PDZ 3 Souter Point to Chourdon Point

4.3.1 Policy Development Analysis

DESCRIPTION

Physical

The zone covers a stretch of coast, some 18km in length, running almost north south and comprising, at the large scale, two principal bays:

- Whitburn Bay, formed in the softer Whitburn valley deposits between the two natural control features of the hard Souter Headland and the delta deposits and rock outcrops of the river Wear.
- Ryhope Bay, cut into the softer rock and glacial till cliffs, held again by the Wear delta and the Chourdon Point headland to the south.

The Wear delta deposits of sand and mud banks, overlying rock outcrops, have been reinforced through the construction of the piers and defences of the Port of Sunderland. To the southern end, the works to Seaham Harbour have effectively transferred the control point of this southern bay slightly further north.

Within this broad structure there are secondary control features, with Parsons Rocks subdividing Whitburn Bay and the headlands of Salterfen, Pincushion Rocks and Featherbed Rocks creating further scalloping of Ryhope Bay. In more detail the frontage may be described in five sections:

Souter Point to Parsons Rocks. This section comprises, in the north, low Magnesian limestone cliffs underlying relatively thick deposits of till. There is a wide platform of rock foreshore with bars and banks of relatively large but potentially mobile stones and boulders, most obviously represented by the feature overlying Whitburn Steel. This has been added to by a section of manmade boulder wall. The cliff to the back of the foreshore reduces in level, forming a low sand and shingle dune at the Bents, immediately behind Whitburn Steel. South of here the foreshore is predominantly sand overlying clays and rock, with a narrow strip of upper sand beach backed by seawalls, a promenade and a sloping bank to the main coastal road. In areas, the width between the coastal defence and the road is only of the order of 5m to 10m, but this increases to over 40m just north of Dykelands Road. The upper beach disappears just north of Dykelands Road. A more massive sea wall has been constructed which effectively it cuts across the natural line of the bay to join with the defence line below Roker Cliff Park. There is a progressive lowering of the beach levels against this wall from north to south. The foreshore in front of the cliff park comprises the exposed rock outcrop of Parson's Rocks.

From the Bents through to Parson's Rocks there is near continuous development to the landward side of the road. The only development seaward of the coastal road, apart from various promenade structures, are the Whitburn Bents Fishermen's Cottages and the associated residential properties at Pebble Beach and, further north, the newer housing and school and the developed area of Whitburn itself; set back some 50m to 70m behind the crest of the cliffs.

Parson's Rocks to Roker Pier. The Roker Cliff Park extends nearly 100m out beyond the general line of the coast, with the cliff crest rising to some 15m above the outcrop of rocks to the foreshore. The cliffs remain at this level through to the Wear Estuary; although the character of the cliffs change from a near vertical profile over the northern half of the section to a more gentle coastal slope behind Marine Walk and Roker Pier. The full length of the coast is protected by seawalls, with a promenade running from the north to the south of the Roker Cliff Park and starting again along Marine Walk. Despite the generally sandy foreshore, it is only at the southern end of the section, in the crook of Roker Pier, that an upper beach, well above normal high waters is present.

Sunderland Port. The main harbour entrance is between the sweeping arms of the Roker and New South Pier, which extend out some 800m beyond the principal line of the coast. Within the shelter of these piers, the entrance to the river is defined between the North Pier and the Old South Breakwater. The north dock area is now developed with residential properties and development associated with the North Dock Marina. The seaward face of this development (still within the enclosure of the main piers) has an area of sand beach, backed by a sea wall and rock revetment.

The southern side of the river mouth is occupied by the area of core port activity, with this extending some 1.5 km along either side of the Hudson Dock. At the northern end, within the shelter of the main

pier is a relatively new development of warehousing important to the modernisation of the port. This is protected on its seaward face by revetment and sea walls. There is again an area of sand shingle foreshore trapped in the crook between these defences and the New South Pier.

South of the New South Pier various defences protect an area of old dock lands, now generally open land. This forms an important link through to the area by the river. The old dock lands area, built apparently over intermittent rock outcrops and deposits of the earlier Wear delta, forms a barrier between the sea and the Hudson Dock. The southern limit of this land is held by the North East Pier and the South West Breakwater, with the South Outlet to the docks (now closed) forming a small area of water open to the sea between the piers.

The defence line further south returns in a stepwise manner to the more clearly defined coastline, with further defences at the end of the Hudson Dock (the Cofferdam Barrier), through to the Hendon Foreshore barrier; behind which is a major sewage treatment works. Following from this is the Hendon Tip wall and Hendon Banks Barrier wall, each providing protection to industrial areas linked to the port activities. The land immediately to the rear of the defences is generally level at some 6m Ordnance Datum Newlyn (ODN), with a steeper coastal slope behind.

Over both the length between the New South Pier and the North East Pier and in front of the Hendon Tip and Banks Barrier walls there is a narrow width of drying sand foreshore.

Hendon to Featherbed Rocks. The initial length south of Sunderland comprises a major defence of rock revetment backed by a concrete sea wall and promenade, rising to the rear with a coastal slope. To the crest of this slope is the main railway spur to the docks, with property and commercial areas behind. South of this are natural cliff exposures of magnesian limestone overlain with glacial till. The level of the boundary between the relatively harder limestones and the till varies quite considerably; resulting in different depths and exposure conditions to the till.

The frontage is punctuated by two principal headlands, at Salterfen and Pincushion, but also by more local hard points, as different strengths in the limestone are exposed. At present the cliff line between Hendon and Salterfen is clearly eroding with little vegetation. To the south, between Salterfen and Pincushion, there is a greater punctuation of the coast with narrow sections of harder material locally resisting erosion. The variation and scale of these local hard points is evidenced by the small stacks; particularly around Pincushion.

Towards Seaham, south of Pincushion, the cliff becomes more uniform, but is also more vegetated than further north; indicating less erosion.

The Final length of this section comprises a steep, relatively hard cliff running through to the Featherbed Rocks. This is protected at the toe by a concrete wall and promenade and at the southern end by a rock revetment.

Over much of the frontage is open agricultural land, backed by the railway line and the coastal road. Key settlements are at Hendon, Grangetown and Ryhope; all to the rear of the railway line. At Seaham, the town centre is close behind the road at the crest of the cliff.

Cutting through the cliff line are a series of generally heavily vegetated denes or valleys.

Along the foreshore there is generally a quite wide sand veneer beach foreshore with mean high water reaching up to the toe of the cliff or manmade defences. Only in local areas are there normally dry areas of beach, where a backshore beach is created by material trapped either between local hard points or behind slightly raised areas of rock outcrop or scree on the foreshore. The main foreshore features are currently associated with the principal headlands identified above, but areas of rock or scree further offshore are possibly indicative of former hard points. New areas of outcrop are now being exposed as the general line of the coast retreats.

There are several outfalls along the frontage; two between Salterfen and Pincushion, which have substantial head-works at the toe of the cliff and a further outfall closer to Seaham.

Seaham Harbour to Chourdon Point. Much of the northern part of this section has man-made defences, in terms of the rock revetment around Featherbed Rocks and extending below part of the North Terrace cliffs. This small bay curves in to the lee of the main North Pier to the Harbour. The beach in this bay is a combination of sand and shingle running steeply down to deeper water. There are areas of development, car parking and amenity areas close to the cliff top.

The North Pier and South Pier enclose the Harbour of Seaham, extending seaward some 500m from the natural cliff line. Within this enclosure are various commercial areas associated with the port and along the crest of the coastal slope behind is the new coastal link road, connecting the north and south of the town.

There is a substantial rock revetment extending to south of the harbour, running some 700m to a point below the Edith Street roundabout. Behind this defence are the typical steep limestone cliffs, but also areas of mining waste infill. Above them is the main port entrance and storage area.

South of the revetment the coast is currently undefended through to Chourdon Point, with the steep cliffs of Dawdon Bank and the deeper bay of Blast Beach; still substantially infilled with mining waste. Over much of the frontage there is veneer of sand to the beaches, but with extensive areas of rock outcrop both in the intertidal area and the nearshore area. Even where this is largely obscured at Blast Beach, there are small areas of rock outcrop emerging from beneath the eroding waste material.

Environment

Major sections of the frontage fall within nature conservation designated areas: Ramsar, SPA, SAC and SSSI designations covering the cliffs and foreshore area through from Souter Point to Whitburn Steel and the section between Hendon and Pincushion. Both Parson's Rocks and Featherbed Rocks (including sections of Seaham Harbour) are Ramsar, SPA and SSSI and Blast Beach; within the ownership of the National Trust, is an SAC and SSSI. To a degree linking these areas, certainly as far as Pincushion, and linking to the coast along the Wear Valley, the area has been defined as a Wildlife Corridor. The areas between Salterfen Rocks and Hall Farm Dene and from Nose's Point running south are designated as Heritage Coast; excluding the town of Seaham. There is also a small area of SSSI within the enclosure of Sunderland Harbour, where the southern extent of sand and shingle is important as a tern colony; the presence of this is in part due to the remoteness of the feature, protected from human pressures by the port development of warehouses.

Other environmental features are summarised below.

The northern end of the zone has strong links with the area of the Souter Headland; continuing the focus on informal recreational activity provided by the natural coast. This is enabled by the width between the slowly eroding cliffs and any hard assets to the rear.

Moving south towards Sunderland the area becomes more urban, with both new buildings constructed local to the coast, as well as important cultural features such as the Fishermen's Cottages at the Bents.

The Sunderland City Council Unitary Development Plan identifies the seafront as "an important environmental and recreational amenity serving the City and beyond" and as such defines a Seafront Zone where there is a focus on indoor and outdoor facilities promoting leisure and tourism to the region. Within this Seafront Zone is a Coastal Zone, defined as being seaward of the A183. The intent of this designation is to maintain existing open spaces, retained for passive recreational use. A significant aspect of this value is attributed to beach use and the association of this with the promenade. This generally urban section of the coast includes the commercial and industrial areas of the Port.

The Port area is a complex matrix of use, significance and assets. The Roker Pier is a listed structure of historical significance and the New South Pier is a Scheduled Ancient Monument. The area of the North Pier is considered to be of Potential Archaeological Interest. Clearly the new residential and amenity facilities around North Dock have significant social importance and the port area and operation remains a major contributor to the national, regional and local economies; as well as increasingly providing scope for development of water related activity. An important driver in this area is to maintaining the safe operation and navigation to the Port.

Proposals for regeneration development of the area east of the Hudson Dock are being prepared and look to utilise this relatively remote area in rationalising and improving the quality of waste and recycling management for the City as a whole. The presence of the sewage treatment facility is regionally important to public health within the City.

At the southern end of the port, the Hendon Seafront frontage is seen as a significant opportunity to provide valuable and unique open space to the area of South Sunderland. In addition the area is defined as having significant Archaeological Potential. Not withstanding the national and international

commitments and significance of natural conservation objectives within this section, there is a clear interdependency of social, amenity and culture values, underpinned by the importance of the City and Port to the regional and national economies.

The immediate issues for the coast south of Sunderland is in maintaining its naturalness (as reflected in its designation as an Area of Special Landscape) and, associated with this, maintaining and improving the public access to the coast; both in terms of extending the rights of way of the cliff top path and maintaining access to the beaches, generally through the denes. Potentially in conflict with this is the pressure being placed on agricultural use of the coast, to make maximum use of the reducing land area due the continuing process of erosion.

At Ryhope the former Halliwell Banks Quarry, infilled with waste, is being exposed by this cliff erosion. The composition of the fill and options for addressing this are currently under review. Concerns have been expressed by consultees as to the potential contamination of the beaches.

Further inland is the village of Ryhope, with properties some 300m from the cliff line. Just to the east of Ryhope and running over much of this length of coast is the main coastal railway line between Middlesbrough, through Hartlepool to Sunderland. This railway is of national significance being part of the National Railway Service. Furthermore, consideration is being given to creating a halt at Ryhope as part of the regional public transport plan.

Between Seaham and Ryhope a minor but well used coastal road runs to the seaward side of the railway over much of the length. Potentially more significant is the new Sunderland Southern Radial road cutting to the east of the railway line just to the south of Salterfen Headland and running north, re-crossing the railway line between Grangetown and Hendon. The proposed route of this road, currently under preparation with diversions of the gas and sewerage pipelines; which also run along the coast in this area, is some 60m from the cliff line at Salterfen Dene and some 200m inland of Salterfen Head.

Recent development has extended the town of Seaham northward to the Seaham Hall Dene. This development, together with much of the coastal development to the northern section of the town, is immediately to the landward side of the coastal road running along the crest of the cliffs. The frontage includes the main seafront promenade at the base of the cliffs and this together with the beach is the main coastal recreational area of Seaham. The area close to the harbour has been improved as part of the Seaham regeneration plan, with an integrated approach which has included the new coastal link road and the development of the commercial area to the south of Seaham; all centred around the port area, which still provides a core focus for economic prosperity to the town. Amidst these developments are listed buildings. In a similar way to Sunderland but at a smaller scale the human environmental values of Seaham are closely interdependent.

The area to the south of Seaham through to Chourdon Point returns to a more natural (or at least semi natural) frontage. In addition to the national and international designations for conservation noted at the start of this assessment Seaham is the start for the Durham Coastal Path.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence
- To support the objectives of the Durham Heritage Coast initiatives and maintain the opportunity to extend recreational use generally of the coast.

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To support regeneration of the urban hinterland areas.
- To avoid disruption to the commercial operation of the Port of Sunderland and associated water activity.
- To avoid disruption to the commercial operation of the Port of Seaham.
- To maintain key transport links.
- To minimise contamination.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:25yr	1:50yr	1:100yr	1:200yr
-1.92	2.48	3.18	3.29	3.42	3.48	3.59	3.66

Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 2.7m below Ordnance Datum.
Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between.
Source (extreme water levels): Babtie, 1998. Shoreline Management Plan, River Tyne to Seaham Harbour. Sub cell 1b. NB. Values for 200 yr ARI are interpolated between 100 yr and 250 yr values.

Wave climate

Return Period (1:X years)	Wave Height Hs (m)
0.10	3.94
1	5.55
10	7.14
20	7.61
50	8.24
100	8.71
1000	10.26

Source: Babtie, 1998. Shoreline Management Plan, River Tyne to Seaham Harbour. Sub cell 1b. OUTRAY used to determine inshore wave data at 10 m contour.

Baseline Erosion Rates

Whitburn	0.1m/yr
Whitburn Bay	0.4m/yr , more rapid erosion of low water identified
Parson's Rocks	0.4m/yr , more rapid erosion of low water identified
Marine Walk	0.2m/yr , more rapid erosion of low water identified
Sunderland Harbour	Re-adjustment re-establishing the Wear Estuary
Hendon	0.4m/yr , more rapid erosion of low water identified
Salterfen	1m/yr, more rapid erosion of low water identified
Pincushion	0.4m/yr
Seaham North	0.3m/yr
Seaham South	0.5m/yr
Blast Beach	Continuing rapid erosion of waste then 0.3m/yr
Chourdon Point	0.3m/yr

All the above rates are based on existing evidence and are likely to increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

At the high level this zone should be considered as a unit. Below this, at increasing levels of local detail, the processes and interactions change; such that, while at this high level, it is demonstrated that there is an overall net drift of sediment to the south, at the local level there can be areas where there is little sediment transport against the shoreline. Over time (over the 100 years of the SMP and beyond), there may be radical changes in processes and interactions at a local level. These will depend on management decisions and on the continuing natural evolution of the coast (such as the erosion of existing natural hard points). This change will be within the context at the higher level of a continuation of the general processes affecting the frontage.

At the higher level, as described earlier, the zone has developed as two bays, divided by the dynamic influence of the Wear Estuary, with its sand and mud banks overlying the rock out crops in this area. This natural division is now reinforced by the defences and harbour works of the Port of Sunderland. Several studies have considered the sediment drift patterns for the area, with apparently significantly different results in terms of potential volume of movement. These differences may be resolved by considering the different zones of movement; working from the offshore to inshore. In the offshore area there is a strong net southerly drift, working typically over a zone between 500m and 1250m from the foreshore. The principal determining factors as to width and position of this movement pathway are the slope of the nearshore area and the orientation of the offshore contours. To the north of Sunderland this zone of movement is shown as being within an area extending some 500m of the shoreline, indicting a continuous profile of movement over foreshore and nearshore shore zones. Further south, in the area of the Pincushion rocks, and even down to Seaham Harbour, the main offshore zone of movement is seen as being quite distinct from foreshore movement, being of the order of 1000m from the shoreline. Even so, in both situations there is likely to be a transfer of material, onshore/offshore, between the zones. In crude terms, therefore, over the whole section of the coast, and indeed, continuing further north and south, there is seen to be a significant potential for sediment movement, sometime driven north by more southerly wave conditions but more typically driven south by the dominant northerly wave climate. The degree to which this sediment pathway is realised depends on the nature and depths of sediment in the offshore area. While this remains uncertain, surface samples of material in this offshore area suggest that there is mobile sediment capable of being moved.

The linear extent and orientation of the outer length of Roker Pier, together with the limited degree of accumulated sediment to the north of Sunderland Harbour, indicates that the Harbour structures do not significantly interrupt the flow of sediment in this offshore zone. Similarly, Parson's Rocks, to the north of Sunderland harbour is set back further than the Harbour and will not impact on the general sediment drift. In the south, at Seaham, it has been established that the harbour arms, again, do not significantly cut across the offshore sediment pathways.

The assessment of the volumes of beach and foreshore sediments derived from cliff erosion over the zone is variable along the coast, with an estimated total volume of some 3,500m^3/yr north of Sunderland and some 50,000m^3/yr from the cliffs between Sunderland and Seaham; only a fraction of this being coarse material. Although this material may be important in feeding beaches locally, the supply to the offshore zone of sediment drift is believed to be relatively small; in relation to the amount of material moving in this offshore area. The transfer of material between the offshore and the inshore may however be more significant in relation the volume of sediment at the shore. This is seen in the volumes of dredged material from the Harbours, which must be sourced from the offshore stream (50,000m^3/yr to 100,000m^3/yr at Sunderland and 80,000m^3/yr at Seaham, although, in this latter case, this has been reducing since cessation of the tipping of colliery waste). In other areas the variation in beaches levels, most obviously in the length between Sunderland's New South Pier and the North East Pier where material can only come from the offshore stream, suggests a significant potential transfer between the offshore and shoreline regimes.

In relation to the general processes, therefore, it is highlighted that while management at the shoreline would currently appear to have only minor influence on the overall processes of the zone, the interaction between offshore processes and the shore is important to the management of the shoreline. Substantial reduction in the availability of offshore sediments would significantly alter the ability of the shore to respond to variation in short term wave climate or to longer term climate change. A better understanding of potential change in the offshore regime is therefore required.

Within this general regime there is greater variability in behaviour and interaction along the shoreline. North of Sunderland the general shoreline is quite stable, the erosion rates of the Whitburn cliffs are low, the rock outcrops, such as Whitburn Steel and Parson's Rocks, provide a general control of the

beaches and Roker Pier acts to retain foreshore sediments at the southern end. There is a general concern that beaches are steepening, in that the crest of the shore is being held by hard defences while there is some evidence that the low water mark is moving landward. This low water retreat is at present only interpreted from map data and detailed monitoring has only recently been instigated. There is an indication that the low water retreat is more significant in the south of this section but this could be as a result of the large degree of wave reflection from Roker pier. The structure was constructed in the late 19th century and may have significantly affected the area over the period covered by the map based analysis.

At a more local level, the construction of the wall, seaward of the natural shoreline, just to the north of Parson's Rocks, has resulted in a local area of high wave energy where any accumulation of the beach is easily eroded during storm conditions. The influence of Roker Pier in reducing exposure to more southerly waves has meant that beach sediment tends to accumulate in the southern corner between Marine Walk and the Pier, at the expense of beach levels just to the south of Parson's Rocks. This is possibly exacerbated by waves running along the hard defence to the toe of Roker Cliff Park and by wave reflection off the face of the Pier.

The frontage between the Bents and Roker Pier is subject to a substantial degree of overtopping affecting the promenade, the road and properties behind the road. If beach steepening does continue, which has to be assumed from current information, and given increasing sea levels, the low lying areas of rock outcrop will become less effective in controlling sediment movement. Beach levels generally at the shoreline over the whole length will drop and there will be increased levels of overtopping and pressure on defences; particularly in the two local areas described above (just north of Parson's Rocks and between Parson's Rocks and Roker Pier).

Roker Pier and the New South Pier act to create a sheltered enclosure for port operations but also create a sheltered bay within which beaches supplied from the offshore zone have been able to develop. The backshore of this bay is cut by the River Wear, and the North and South Piers confine and control the channel of the river; while also limiting direct spill of beach material in to the channel. Sea level rise would tend to reduce the width of the beaches resulting in increased wave interaction within the outer harbour.

The New South Pier together with the promontory created by the North East Pier forms a small bay, with the South Rocks, midway between, tending to pull forward the natural coastline within the centre. The similarity in shape and orientation between this bay and the shape of the coast further south, associated with the natural headland of Pincushion Rocks, suggests that this bay is relatively stable in terms of longshore drift. This indication is further supported by the presence of natural beach material along the frontage and, associated with limited longshore drift of material, the fact that the South Inlet has not rapidly infilled. The frontage has been built out on the natural accumulation of materials associated with the old Wear Delta but the advanced position of the area and the hard defences have resulted in an area of high wave energy which tends to result in considerable fluctuation in foreshore levels. This is most noticeable in the crook between the Stone Hill Wall and the New South Pier. This variation in level indicates a transferring material between the shoreline and the offshore zones. Variation in wave direction means that, while in terms of net drift the frontage remains relatively stable, under certain conditions sediment will be moved south and will be lost to the bay. Sea level rise will increase the wave energy, reducing the capacity for the frontage to retain sediment and increasing pressure on the existing defences.

The drift supply to the Hendon Foreshore Barrier frontage is limited and, although due to the steep south westerly facing orientation of the defence line, it will only tend to be wave conditions from a more easterly direction which scour material from the frontage, transport from the frontage will be high. This is reflected in the heavy nature of construction of defences along this lengths, the depth to toe of structures and the degree of overtopping experienced. Sea level rise will increase the wave exposure, although not necessarily the potential for scour.

South of this return length of the harbour structures, the length of the Hendon Tip, Banks and Sea Walls and beyond to Salterfen Rocks is likely to be subject to significant variation in drift, resulting in differential erosion and accretion. To a degree the main harbour area should provide some protection from the more northerly wave directions. This shelter diminishes south along the shore. The tendency, therefore, would be for material to be moved north along the Hendon Tip wall and south along the Hendon Banks wall. Significant differential erosion would then be expected in the area of drift divide at the Hendon Banks.

This situation will change for wave conditions between north east and east, where waves will tend to

scour any transient mobile material down the southern face of the harbour return frontage and along the southern frontage, tending to deposit material in the area of the Hendon Sea Wall; drift becoming less acute on this section of the frontage. In reality, this can be seen to a degree in the fluctuating foreshore at Hendon Tip, the consistently low levels in front of the Hendon Barrier wall and, in part due to the fact that the Hendon Sea Wall is set back slightly from the walls to the north, in the relatively higher foreshore in front of this southern wall. It was noted in the report prior to the construction of the Hendon Sea Wall (Lewis and Duvivier 1968) that material from the Hendon Tip area was obvious on the foreshore at Hendon Sea Wall. Although the walls to the north, therefore, limit direct input from backshore erosion to the south Hendon area, their presence and character may give rise to a mechanism for offshore sediments feeding through to this southern area. This supports the observations that, while beach levels in front of the Hendon Sea wall have fallen since its construction, there can be and has been some improvement since the intense reflected energy has been reduced by the more recent introduction of a rock toe. There is, therefore evidence of continued sediment supply allowing the foreshore to recover. While this mechanism is not confirmed by modelling, it does further highlight a potential linkage which would need to be considered in management of the defences further north.

South of Hendon the coast is naturally eroding cliffs. The processes depend on three factors, the erodabilty of the cliffs, the width and stability of the foreshore and the sediment supply. In terms of geological timescales the whole this section of coastline, between the Wear Estuary and the harder coastal features at Seaham; and to the immediate south of Seaham, is eroding slowly, at a uniform rate. Within this process locally harder sections of cliff are being exposed, resulting, for a period of time, in the formation of headlands. This process may be seen at a relatively large scale in the headlands at Salterfen and at Pincushion, but also on a smaller scale just south of Salterfen Lane and, at an even more specific scale, in the stack to the south of Pincushion. If the area of resistance (the harder sections of coastline) is sufficiently large and is effective over a sufficiently long period of time, the coast to either side is able to adjust to the wave energy, forming scalloped, or crenulate bays[4]. To the north of any headland there is significantly less sediment transport and material from the eroding cliff acts to protect the cliff from erosion, while to the south of any headland, potentially starved initially of drift from further north, erosion cuts deeper beyond the headland until, within the shelter of the headland, the wave climate is modified to the extent that again material falling from the cliffs tends to protect the cliff from further erosion. The coast is, therefore, continually in a process of adjustment to the net wave energy direction approaching the shore.

The current headlands, geologically speaking are transient features. The depth to which bays need to develop to become inherently stable is dictated by the spacing and the relative position (relative to the direction of net wave energy) of the headlands. The erosion of the headlands (or in the more local situation, outflanking of the local hard point) can cause a significant readjustment in the shape of the coast. In some cases these earlier hard points may continue to affect the coast due to a residual raised area of rock outcrop to the beach. Such a feature may be seen just north of the Halliwell Banks. Sea level rise would make such submerged features less prominent in the control of the coast.

The various studies for the area have shown that there is a tendency for erosion rates to reduce along the section of coast from north to south. Most particularly, over recent times erosion to the north of Salterfen has apparently increased, giving possible rates of erosion of the order of 1m/yr. This, consistent with the above discussion, is associated with an increased rate of erosion at Salterfen Heading. South of Pincushion erosion rates are significantly lower, to the extent that there is significant vegetation to the cliff face. It is reasonable to assume, because of the erosion of Salterfen; and its relatively local nature, and the observed broader extent of the Pincushion Headland; and hence slower rate of general erosion, that this variation in erosion will continue. There is some indication of a harder point in the shore being exposed midway between Salterfen and the end of the Hendon Sea Wall, but the degree to which this will resist erosion or link through to Salterfen, forming a broader headland is very uncertain.

The cliffs north of Seaham currently provide only a limited, but possibly quite important, sediment drift supply to the protected Seaham frontage. At Seaham the longshore drift is quite small due to the orientation of the beach in relation to wave direction. The level of the beach to the north promenade does vary significantly, but does also tends to recover. Longer term trends will be established from

[4] A crenulate bay, or half-heart shaped bay, is formed in the lee of a headland. The headland acts to protect the coast, creating an area of shelter. Waves progressing beyond the headland diffract, creating this spiral shape in the shoreline.

monitoring. There may be a slight overall loss of material now, which would be exacerbated with sea level rise. Similar to the area just north of the Roker Pier in Sunderland, The Seaham Harbour North Pier acts to retain a beach in the crook with the cliffs to the north but also, due to reflections off the arm of the pier, may increase exposure to the revetment around the Featherbed Headland.

Seaham Harbour acts to the protect the cliffs to the back of the Port, but unlike the return line of defences at Sunderland Harbour, the steeper orientation of the Seaham South Pier regularly gives rise to waves building along the exposed face, impacting on the Dawdon Cliff frontage, providing significantly less shelter to this section of the coast to the south.

There is a relatively weak sediment drift system along the Dawdon Cliff frontage and this will be further contained if erosion allows Nose's Point to re-emerge as a prominent headland. The colliery waste within Blast beach is being eroded and, while a significant proportion of this material is in the nature of fines, some beach material is lost to the south. Increasingly, as the Chourdon Headland dominates the bay, so this sediment drift will reduce. Rising sea levels will tend to roll back the beach within the bay, potentially eroding the back cliffs at the same slow rate as Chourdon Point.

Unconstrained:
In the absence of the main man-made control features the coast to the north of Sunderland would erode and roll back, initially at a relatively rapid rate, but slowing as erosion of the softer areas allowed the hard features of the Souter Headland and Parson's Rocks to take greater control. The current pressure to do so, however, is relatively small. This pressure would increase with sea level rise.

Over the mouth of the Wear, the unconstrained behaviour of the coast is less clear. It is likely that the mouth of the river would widen and shallow. The degree to which material would be carried into the river cannot really be determined, however, it is probable that the old ebb tidal delta would be re-established, potentially forming a low level deposition of material to the north, maintaining an offshore bar and protecting the cliffs to the south. In this event, it is unlikely that there would be a significant increase in sediment to the coast to the south along the shore, interactions being primarily linked to the sediment stream in the offshore zone. The Estuary would still act as a control point to the coast.

South of Sunderland there would be significantly greater change in the long term. The Hendon area would continue to erode. On the assumption that the influence of Salterfen rocks would diminish and in the relatively unlikely event that no new headlands emerge, there would be rapid erosion of the frontage linking through to the more major control point of Pincushion. In this configuration, the stable coastline would run close to the A1018 within Grangetown cutting through Hendon and linking to the area of the Wear Estuary. It would take two to three hundred years to develop a stable bay but does demonstrate the significance of the hard points on the coast. With the loss of the existing hard points there would be a change in locations where pressure would develop along the shore. Substantial loss of Pincushion, in the future, would allow an even deep bay to form between Seaham and Sunderland, significantly cutting through only a limited extent of Ryhope, but cutting even more substantially through Grangetown and Hendon. Such estimates of the future shape of the coast are hypothetical but are not unrealistic assuming no management and assuming the typical erosion rates currently occurring at Salterfen. Unless new headlands emerge, the development of a stable bay shape might take 500 years.

At Seaham the unconstrained coastal change would be less dramatic, with slower erosion more uniformly over the frontage of some 60m over the next 100 years.

MANAGEMENT

Present Management

SMP1	Policy
The zone is divided into management units B4, B5, B6, B7, B8, B9 B10 and part of C1:	
B4	Do Nothing
B5, B6, B7, B8	Hold the line
B9	Do Nothing
B10	Hold the line
C1	Do Nothing
Whitburn	
The strategy recommends no active intervention.	No active intervention
Whitburn Bay to Ryhope Coast Protection Strategy	
The strategy recommends maintaining existing linear defences over the frontages north and south of Sunderland and in the area of the Harbour.	Hold the Line
Do Nothing in MU B9	Do Nothing
Seaham Coastal Strategy	
The strategy recommends no action over the length north of Seaham Hall.	No active intervention
Hold the line for the defended sections and just south of Seaham	Hold the line
Investigation of potential contamination issues north of Noses Point.	Hold the line
No active intervention to Blast Beach	No active intervention

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

The area to the north of Whitburn Bay will continue to erode, reducing the width of open ground between the properties and the top of the cliffs but not affecting assets over the 100 years of the SMP. This will continue to provide a small but important drift of material to the frontages to the south.

At the Bents, long term erosion will have more impact on the urban area resulting in the loss of the Fishermen's Cottages, loss of the road, impinging on the residential area of the Bents and affecting the sea front down to the Seaburn Park roundabout. Although Roker Pier will fall into disrepair, it would still act to control the frontage over the next 75 years. Beyond this time its influence would diminish, allowing loss of the sand beach and greater erosion of the cliffs behind; affecting all areas back to Roker Terrace and the property behind. Over much of the frontage, all defences would act similarly; falling into disrepair and eventually allowing sudden spates of erosion. This process would be exacerbated by sea level rise, submerging the rock outcrops and reducing their ability to control sand levels over the frontage. Progressively over the SMP period of 100 years, the quality of the beach would reduce (although in the long term this might be restored as the backshore reverts to a more natural state). As beach levels fall initially there would be increased overtopping, potentially making the road and properties unusable well before they are actually lost to erosion. In the long term, the intent of the UDP coastal zone area might be restored as a natural recreation area, the intent of the seafront zone, as an area of more formal amenity with appropriate facilities serving the City and attracting tourism, would be lost.

The progressive loss of the Roker Pier and the loss of the New South Pier, together with the increased exposure and subsequent loss of defences within the harbour will close the use of Sunderland as a nationally important Port. This would have major implications for the whole associated urban area and the region in general.

Failure of the New South Pier and the defences immediately to the south would render the

seaward area of the docks unusable for development and would disrupt the use of the associated port areas (although these would no longer be viable if the main harbour structures had failed in the meanwhile). All these defences, together with the defences along the southern return of the harbour would fail over the 100 years of the SMP. As defences fail and as the alignment of the shore is fragmented, there would be periods of increased sediment to the south and periods of diminished sediment. There could be, in the longer term, a decrease in sediment supply to the coast to the south as material is redistributed and stored within the re-establishing Wear Estuary Delta. There would be serious concerns in terms of pollution due to the loss of the sewage treatment works and the Tank Depot and, even if this were addressed, there would be a need to relocate the sewage works elsewhere, potentially occupying valuable lower lying land, possibly within the river valley. This would have a serious consequence for the City. The loss of potential development within the old docks area would, similarly, constrain opportunity for integrated land use management, with broader consequences to the hinterland and region as a whole.

South of Sunderland, there would be eventual failure of the Hendon sea wall, both directly and due to outflanking at its southern end. Even assuming the erosion of Salterfen reduces, loss of the Hendon Sea Wall would, over the longer term, result in loss of the dock spur railway behind. (Arguably this would not matter since, under this scenario for the coast, the loss of the port would no longer require the transport link.) However, on the assumption that the current erosion of Salterfen is indicative of a longer term trend, the associated loss of the Hendon Sea Wall would result in increased erosion of the whole frontage, such that within 50 to 75 years the new southern radial would be under threat. This road, together with the main coastal-link railway line and properties at the fringe of Grangetown, would be lost over the next 100 years.

The erosion would continue to the frontage to the south, between Salterfen and Pincushion and between Pincushion and Seaham. This, despite the increase in sediments moving through the frontage from the north. The erosion of frontages to the north would provide an improved supply of sediment to Seaham.

The present rates of erosion are threatening to expose the waste tip at the Halliwell Banks. In the future, under this scenario, this exposure would increase.

At Seaham there may be a slight improvement in both the level of the beach and, as a consequence, the resilience of the defences. However, it is probable that defences would still deteriorate to the extent that they no longer formed a coherent defence to the cliffs within the next 50 years. This would result in the loss of the road, access to and eventual loss of some properties at the northern end of Seaham. There would also be continued erosion to the bay south of Featherbed Rocks and the loss of the sea front core to the town. The deterioration of the Seaham Harbour structures would result in closure of port activities and other activities associated with the harbour area and further erosion of the area behind. This would have an impact on the coast both to north and south. These adjacent frontages would come under increasing pressure to erode, despite the increase in sediments supply from the north.

To the south of Seaham the coast would continue to erode slowly.

Due to the significant impacts of potential contamination and pollution and due to the very unnatural influence of deteriorating defences; affecting both local areas but also impacting on the overall geomorphological development of the coast, there would be significant issues relating to the water framework directives under this scenario. In terms of pollution this might be seen due to the loss of the sewage works, material generally lost from the harbour areas and the potential contamination from the Halliwell Banks waste tip. In terms of geomorphology, the loss of either harbour could result in loss of SSSIs but would also impact on the internationally designated sites to north and south. These affects would be of a scale that might be significant to the Tyne and Wear Water Body. Unless dispensation

were granted, if this scenario were allowed to develop, then substantial action would be required to return the coast to its natural function and good ecological status by 2015. There would be significant cost implications in areas such as Whitburn Bay, Sunderland Harbour and Seaham, despite no further coast protection expenditure.

MDSF Evaluation		*PValue Damages*
Erosion	152 residential and commercial properties lost	£3,338
Flooding	119 residential and commercial properties at risk primarily around Wear entrance	£67,539
Other Information	The strategy for Sunderland identifies potentially an £80 M damage which, in addition to the above, covers overtopping damages at the Bents. The Seaham strategy identifies a further £2.6M damages associated with loss of the coastal road and access to properties. No account is taken of future economic loss of railway or road south of Sunderland.	
Assessment of key objectives	• The scenario would eventually (>100 years) produce a naturally developing coast and it provides increased exposure of the geology. In the interim there disruption to existing habitats. • It fails to support sustainable development of the coast and hinterland. • It fails to support the activities associated with the Ports of Sunderland and Seaham • It fails to maintain key transport links and re-establishing these would have significant impact to the hinterland. • It fails to support cultural heritage. • It would result in contamination. • It would reduce reliance on defence but at significant economic cost.	

With Present Management (Scenario 2):

The present management at the northern end of zone, the Whitburn Cliffs, is for no active intervention. Erosion will continue, supplying limited supply of sediment, with no damage to assets.

With present management, the no active intervention policy also applies to the northern end of the Bents. Here there would be a loss of physical assets and important heritage features. Over the southern area of the Bents, and over rest of the frontage down to the Roker Pier, the assets; the road, property and the promenade would be protected. The potential rate of erosion and possible pressure on the defence line is such that, even with sea level rise, management of these defences would not be excessive and they are therefore considered sustainable with respect to the assets they protect. Holding these defences would have no significant impact beyond this area in terms of coastal processes. Neither would there be any substantial impact on the designated areas of nature conservation.

However, there would be implications with respect to the beach and beach use. It has been identified that there may be a steepening of the general foreshore in the area. This coupled to anticipated sea level rise will tend to increase energy at the defence line; tending to lower beaches. Based on a linear maintenance of defences, here would be a further loss of beaches and hence a commitment to increased levels in defence to address the worsening overtopping. The potential of such a commitment would be a separation of the sea front from the coastal zone; in terms of reduced beach usage and in terms of reinforcing the visual barrier between the sea front area and the shore.

Roker Pier would be maintained and this would act to help sustain defences immediately to the north, although potentially still maintaining the pressure, due to wave reflection, on the defences to the south of Parson's Rocks.

The Roker and the New South Piers would continue to provide shelter to the outer harbour area, maintaining the ability to manage defences within the harbour. This would in turn allow management of the entrance to the Port and the river Wear.

Continued defence to the existing line of the frontage between the New South Pier and the North East Pier would allow development of the full area behind. Continued defence of this area will, however, become increasingly difficult. Assuming that the South Outlet (just in the lee of the North East Pier) is not infilled for development, this area does offer opportunity for local environmental enhancement. This would be reliant on maintaining the North East Pier which is currently in a very poor condition.

Under this scenario of with present management, the southern flank of the planned regeneration area would be maintained, protecting significant assets and further supporting the port operations. In particular the Hendon Foreshore Barrier maintains the access to the outer dock area and the corner of the Hudson Dock. Continuing the defence of this whole frontage allows continued use of the sewage treatment works and stops potential contamination of the coastal regime. It also maintains the possible drift mechanism feeding the coast to the south.

The Hendon Seawall will in the long term become more difficult to maintain, but again is unlikely to become technically unsustainable. The wall does protect an important area of open space, valuable to the South Sunderland area and the Port railway spur behind. More significantly, the southern end of the wall provides a substantial anchor on the coast, which will limit the erosion of the land to the south. With current erosion rates, particularly at the Salterfen Headland, the route of the new Southern Radial road will only come under threat in 75 to 100 years. This time scale does rely on the presence of the bastion at the end of the Hendon Sea Wall, limiting the development of a larger bay described in the earlier section on evolution of the coast.

The current Do Nothing policy for the Salterfen frontage, however, will mean that the new road, once constructed will have a life of only 75 to 100 years. The same applies to the main railway line and the Ryhope road. There is little scope for subsequent realignment of these transport routes. More immediately at risk are the two outfalls and the area of potential contamination at Halliwell Banks.

Further south, the erosion of the frontage would reduce areas of agricultural land and would have a local impact on the access to the foreshore via the Denes. At the southern end of this section between Pincushion and Seaham, the coast will cut back behind the Seaham Promenade and maintenance of this defence at the southern end will require works to stop outflanking. Over the next 100 years, maintaining the defence to North Seaham will be technically sustainable, but as in the north of the zone (at South Bents and Seaburn), there may be a general decrease in beach levels, despite continued feed of sediment from the north.

Defending the assets at the crest of the cliff will result in a squeeze between the beach, wishing to retreat, and the hard cliff line. Given the relatively narrow width of promenade, the position of the defence, whether it be set back at the toe of the cliff or in the current position, becomes relatively insignificant to the long term process of pressure on the frontage.

Between Featherbed and the Harbour the general current policy is for holding the line. This has assumed that there is scope for allowing some retreat of the cliffs behind. This would be compromised by development directly above the coastal slope, although this would be at only a local scale.

Maintaining the harbour structures at Seaham both protects the port, water sport activities and the new coastal road, as well as providing some benefit in maintaining defences to

either side (i.e between Featherbed Rocks and the Harbour and between the Harbour and Noses Point. The continuation of the defence to the south of Seaham extends the defence of the new road and the commercial area behind. While essential to maintain the stability of the cliff, these works are not under a significant degree of pressure because of the other natural and man-made features of the coastline. The issue of defence further towards Noses Point is seen, primarily; in the recent strategy, as being related to potential contamination. While the defence of the area is fundamentally sustainable, its justification depends on further investigation as to the impact of erosion of contaminated land on the coastal zone.

At Blast Beach the policy is for no intervention. The only asset identified within this section is a wartime pill box on the beach and this would not justify any intervention.

MDSF Evaluation	*PValue Damages*
Erosion	6 properties at risk, residual damage at South Bents £106,000
Flooding	No flood damages assessed
Other Information	No account is taken of the economic losses associated with the railway and road to the south of Sunderland.
Assessment of Key objectives	• The only area of potential enhancement to nature conservation would be at the South Outlet. However, overall there are no substantial conflicts between the key nature conservation objectives and the outcome of this scenario. • The scenario only partially meets the objectives on sustainable development because of the difficulties in maintaining the expectation of beach use at Whitburn. • The operation of the Ports of Sunderland and Seaham would be maintained. • Key transport links south of Sunderland would be lost in the longer term. This would have significant consequence to the regeneration plans of the harbour. • Key cultural heritage would be maintained but there would be specific loss at the Bents and along the Whitburn frontage. • There would be threats of contamination from the Halliwell Banks quarry and south of Seaham. • There would be a general increased dependence on defences but overall this would be considered sustainable in relation to other objectives. Only in the areas on the seaward face of the Sunderland Docks, due to further development of the area increasing expectation of defence, and at the southern point of the Hendon Sea Wall would there be significant increased coast protection be required.

DISCUSSION AND DETAILED POLICY DEVELOPMENT

An overall future scenario of no active intervention is evidently not acceptable. It does not achieve the balanced approach of reducing reliance on defence with sustainable forward looking development of important urban areas. There seems little argument, therefore, against the need to manage the coastline in this area. While current policy for defence, which is in effect to hold the line in all areas of current defence, would appear justified and achieves a valuable reduction in risk, there are essential local issues arising from this general policy which need to be re-examined.

The length of coast has needed to be examined as a single zone:

- Primarily because there is the linking offshore sediment stream (although this seems unlikely to be significantly affected by any shoreline management).
- Secondly because, in virtually each individual section, there are associated management issues with the coast to either side (for example the influence of the Roker Pier both on the Harbour and in relation to the coastal defence to the north; in effect a chain of linkages).
- Finally because of the significant association between areas of the hinterland. An example of this is the transport link to the docks, protected by the Hendon wall. This link is only of value if the docks remain a viable operation. However, this specific length of railway also relies on maintaining the transport link behind the coast to the south.

It is these last two points, the chain of linkages and the linkage created by associated land use that tends to dominate the approach to coastal management over this zone, rather than the large scale processes.

With respect to both Sunderland and Seaham, maintaining key aspects of the coast are seen as essential to the broader welfare and sustainable development of the City or the Town. In both cases, the harbour areas are important in this regard; the port operations provide essential employment and opportunity for economic growth and the port structures act to defend or enable important new development and water activity. The justification for maintaining the basic port structures goes beyond mere flood and erosion risk management.

In terms of how this influences management of the coast, at Sunderland, the Roker and New South Piers consolidate what is considered to be a natural control point of the coast. While the structures do have a local impact on adjacent frontages; primarily beneficial, their presence is not believed to fundamentally alter coastal processes at a broader scale. At Seaham the piers have only a local impact on processes and again, overall these are beneficial. On this basis, given the overriding economic importance of these two sets of structures, the fact that sustaining these structures is justifiable against this broader economic value and the fact that they have little significant detrimental impact on to either conservation or adjacent defence issues, the preferred policy for these structures would be to hold the line. This then provides fixed reference points from which to examine shoreline management policy in detail elsewhere.

Sunderland North

North of Roker Pier the coast may be considered as five potential policy units:

- Whitburn Cliffs (currently Do Nothing)
- The Bents (currently Do Nothing)

- South Bents/Seaburn (currently Hold the Line)
- Parson's Rocks (currently Hold the Line)
- Marine Walk (currently Hold the Line)

For the Whitburn Cliffs there is neither justification nor benefit in adopting any other policy than no active intervention. This is the preferred policy. The implications of this in terms of planning are the setting up a buffer zone between the cliffs and any development behind. This has been achieved to date but needs to be recognised in future planning.

At present defence of South Bents/Seaburn through to Marine walk is justified in terms of the assets protected from erosion and flooding due to overtopping. More significant in terms of policy is that this area is identified in the UDP as a vital asset to the Sunderland City Council. Over the short to medium term the shoreline management policy and that of the UDP are consistent. The UDP identifies a sea front zone in which appropriate development would be allowed, and a coastal zone, for passive recreational use. The identification of the coastal zone, distinct from the sea front zone, creates the opportunity for improving defence through the use of set back flood defence. Any environmental improvements in the future should look to incorporating additional defence to reduce flood damage. Over the longer term, however, even within the UDP policy for a sea front zone and a coastal zone, there is inherent conflict. Possibly over the next 50 years beach levels may continue to drop, both due, potentially, to the nearshore steepening and due to sea level rise. This will increase pressure on the defences and would also reduce amenity value of the frontage. The pressure on the defences would tend to affect all sections of the frontage, including the currently undefended section behind Whitburn Steel.

While linear defence of this section would be feasible, this would tend to contribute to the loss of beach. Alternative options should include consideration of advanced control structures; possibly making use of nearshore rock breakwaters or similar structures, with the aim to re-establish the effective control and shelter provided by the natural rock outcrops. The effectiveness of this is demonstrated by the presence of Whitburn Steel in that it has allowed a narrow dune to develop in the area of the Bents. It has also been identified during the latter stages of consultation, following the issue of the draft plan, that a control structure is already provided to an extent by the length of man-made boulder wall constructed over the gap to the north of Whitburn Steel.

Therefore, in considering defence in this area, monitoring will be essential. The intent would be to allow a degree of erosion, so long as this does not immediately affect assets such as the Fishermen's Cottages (i.e allowing a degree of retreat) but with a longer term intent that the influence of Whitburn Steel and the existing man-made structure is not ultimately lost. This would allow a more natural defence to be retained along the upper beach. Such an approach would have to be considered in conjunction with the approach to management of the frontage south to Roker Pier, with benefits being considered over the whole area.

A similar approach should also be considered at other strategic locations along the frontage, potentially most critically in the area of the Seaburn Park roundabout, where already there is increasing pressure on the defences. Quite correctly the strategy for the area demonstrates that simple cross-shore structures would have to be excessively long to substantially trap sediment. However, the SMP analysis of data indicates that there would be a good opportunity to retain material moving in an inshore/offshore direction. Any works would have to be integrated with the SAC and SPA interests in the outcrops of rock. Potentially, in the

case of the SPA, additional extension of the rock outcrops could provide compensation for the gradual submergence of the existing rock feature with sea level rise.

The approach to retain beach material would similarly have potential at the southern end of Parson's Rocks, to act both to reinforce the more exposed length of defence and to allow some re-adjustment of the beach between Marine Walk and Parson's Rocks. Having reinforced either side of Parson's Rocks, in effect anchoring the coast at these points, justification for defence of the actual headland would be solely based on the value of the promenade. While loss of this from an amenity perspective may be to the area's detriment, a long term policy could be to abandon this defence, potentially enhancing opportunity for increasing the area of SPA and Ramsar site. This again would have to be assessed in terms of management of the whole of the Sunderland North frontage, considering both the direct benefits of protection to fixed assets and use of the sea front, together with the benefits of retaining beaches and providing enhancement to the natural environment. Such an approach requires input from several areas of interest, in terms of tourism, planning, environment and coastal engineering, more closely linking long term spatial planning for the area, moving beyond sectorial funding solely under coast protection.

There is the possibility that wave reflection from the Roker Pier may increase wave action on the area of Parson's Rocks. Any long term maintenance of this Harbour structure should carefully consider any advantage of placing rock to the outer face to reduce this.

The function of the SMP is not merely to identify immediate policy for the specific areas of the coast but also to highlight the need for potential longer term changes in thinking about sections of coast as a whole. On this basis, from the above discussion the following preferred options are recommended:

- Whitburn Cliffs (No active intervention)
- The Bents (Accepting a degree of retreat but with nearshore control; possibly using nearshore rock structures, reinforcing the natural and existing defence to the area, to improve beach levels and sustain a more natural defence to the assets at risk.)
- South Bents/Seaburn (Hold the Line, with a medium to long term policy for controlling and maintaining beach levels)
- Parson's Rocks (short to medium term Hold the Line, consideration of retreat controlled by structures in the longer term)
- Marine Walk (Hold the Line, with a medium to long term policy for modifying and maintaining beach levels).

Without a broader funded long term approach, with the aim of delivering the overall objectives of the UDP, it is probable that coast protection funding may only be available to maintain, in effect, the existing line of defence. Based on the findings of the Whitburn Bay to Ryhope Coast Protection Strategy, with respect to the potential steepening of the foreshore area and while defence of the existing line is considered sustainable, this purely linear approach is likely to result in long term loss of the beaches and possible loss of assets at the Bents. While no immediate change in policy is proposed, it is recommended that adaptation needs to be considered at an early stage such that opportunities are not lost for a more sustainable approach to be developed in the latter period of the SMP.

Sunderland Inner Harbour

The objectives for this area are clearly to maintain the two main harbour structures on the basis of maintaining port and harbour activities. This overall policy would provide the basic

shelter necessary to sustain the defence to the north and south Harbour areas. To North Harbour the existing defences provide essential protection to the new development behind. The orientation and length of the North Pier, and the associated revetment, provide adequate potential to retain the North Beach, even though this feature will tend to be squeezed by increasing sea level. To the south the defence maintains important protection to the Port infrastructure. Consideration should be given to allow the small area of beach in the southern corner of the South harbour to move back, so as to retain the SSSI interest. The preferred policy for these areas is:

Main Harbour Piers (Hold the Line)
North Harbour (Hold the Line)
South Harbour (Hold the Line, with a potential to locally retreat in the long term.)

Sunderland Harbour East Bay (Stonehill Wall to North East Pier)
This area of the Port is considered important regeneration land and this is currently being examined in the Port Regeneration Study. The coast protection strategy for the area has identified that the likely expenditure to restore each individual length of defence to a suitable condition would be economically justified given the potential subsequent the loss of key infrastructure to erosion. There are, however, difficulties in attracting coast protection grant, although recent emergency works have been undertaken. The two key structures of concern are the Stone Hill Wall and the North East Pier, with respective re-construction costs of £1.2M and £2.5M. While the SMP review concurs with the strategy as to the value of the area behind; the likely loss in terms of usability of that land if defences are not maintained, and the technical feasibility of maintaining the defences probably over the next 100 years, there are concerns that, if the land is developed, any future scope for improving the resilience or sustainability of the defence line through retreat could be lost.

The frontage is built on old sediment deposits, underlain, at least in part by rock. In effect the frontage forms a shallow bay between the New South Pier and the North East Pier. There is, therefore, good justification for treating the frontage as a complete unit in terms of its defence, rather than placing reliance on maintaining individual existing defence lengths. This requires proper integration of defence management within the framework of the Port Regeneration, recognising the importance of successful delivery of this project. Opportunity, therefore, needs to be sought in setting up a sustainable defence approach balanced against the needs identified in the Port Regeneration Study.

With respect to the main frontage, between the New South Pier and the North East Pier, there is scope to make use of the natural promontory in the area of the South Rocks (the outcrop midway between the two piers), reinforcing this area providing control on the further development frontage. This could then allow a degree of initial retreat to either side, still with the clear intent of controlling erosion and holding a slightly realigned shape, but with less pressure in the longer term on the line of the defence.

The proposals to regenerate the Port area include options to increase development land by reclaiming and infilling the old South Outlet. Should these not go ahead then consideration could be given to maintaining the old South Outlet, potentially enhancing its quality in terms of its nature conservation value.

The area of the South Outlet is currently protected by the North East Pier, acting as a critical headland point. The existing structure is in poor condition and, will require either strengthening or replacement. The manner in which this is achieved will significantly impact

on both the subsequent defence management requirements of the South Outlet and the main front face of the regeneration area; reinforcing the need for the integrated approach within the Port Regeneration Study.

While the overall intent of management to the East Bay area is determined by the need to provide defence of the important regeneration project and the policy is, therefore, sensibly Hold the Line, consideration has to be given to how this underlying policy may be best delivered in managing the longer term pressure on defences, taking account of whole life cost. Where practical, should the regeneration of the Port proceed, consideration should be given to how realignment can be incorporated at a detailed level.

Furthermore, it is highlighted that grant under the Coast Protection Act 1949, is only considered with respect to existing assets and not in relation to potential development value. Under the existing situation, the strategy has demonstrated a relatively low benefit cost ratio for works, unlikely to attract full funding. In proposing a policy of hold the Line, therefore, this assumes alternative source of funding in providing protection to the frontage.

Sunderland Harbour South Face (South West Breakwater to Hendon Banks Barrier)
The important assets at risk, both in terms of port operation and direct economic value to the nation, are such that sustaining these defences is justified. There is no real scope for retreat, and even if there were, this would not substantially reduce the pressure on the frontage; scour would still occur due to the obliquity of wave attack. The frontage through to the southern end of the Hendon Banks Barrier does not significantly impact on sediment supply to the south and, if anything, may assist with transferring sediment from the offshore zone. The preferred policy for the frontage, as set out in the coast protection strategy, would be to Hold the Line.

Hendon to Seaham
The current policy at the northern end of this section is to hold the line of the Hendon Sea Wall, whilst the policy for the coast down to Seaham is Do Nothing. However, as discussed earlier in the assessment of scenarios 1 and 2, these sections cannot be considered independently. Locally at Hendon, the strategy has demonstrated that there is justification for maintaining the line of the defence. Primarily, the economic justification arises from the benefits of maintaining the railway line and commercial properties to the rear, which, it is assessed, would be lost sometime within the next 50 to 100 years. In addition to this loss there would be a loss of the promenade and open area which have been identified as being of equal significance in terms of benefits to the area of South Sunderland; although more difficult to evaluate in monetary economics.

However, the decision to hold this line and the reasons for this decision have strong association with the management decision further south. The new Southern Radial road runs to the rear of Salterfen, together with the realigned sewer and gas lines and the line of the railway. Further south still is the quarry tip at Halliwell Banks and again the railway line to the back of the open land at Ryhope.

Based on current erosion rates, and assuming that both Salterfen and Pincushion still maintain some control over the coastal shape, it has to be assumed that the new road and railway line, north of Salterfen, would be lost sometime between 75 and 100 years in the future. South of Salterfen the railway would be lost, possibly within the next 50 years. In many ways the position and resilience of Salterfen is key to this assessment. However,

equally important, to the north of Salterfen, is the control imposed on the coastline by the southern end of the Hendon Sea Wall.

Several local scenarios can be envisaged:

Scenario (a)

Description: Extend the no active intervention policy further north to include the Hendon Sea wall.

Rationale: The future loss of the railway between Salterfen and Pincushion negates much of the justification for continuing to hold the Hendon Sea Walls.

Implications: There would be a need to substantially increase the defence at the end of the Hendon Banks Barrier both to address the risk of outflanking and to resist increased erosion in front of this wall. The loss of the southern end of the Hendon Sea wall would substantially increase the extent of erosion potential between Salterfen and the southern end of the Hendon Banks Barrier, such that a long term stable profile for the shore would cut back some 300m from the coast; including significant areas of Grangetown. Since, even without maintenance the southern end of the Hendon Sea wall would still maintain some control over the next 50 years, there would be little change from the current situation in terms of anticipated loss of the route for the Southern Radial road.

Further south there would be, over the next 100 years, near total loss of the open space between the cliffs and the development landward of the railway line.

Impacts: There would be potential improvement to the marine aspects of the SAC, SPA and SSSI in that the whole section of coast would continue to move back, maintaining a continuity of nature conservation interest along the foreshore. The grassland and agricultural land to the crest of the cliffs would be substantially lost over much of the length between Hendon and Pincushion, squeezed between the eroding cliff and the development behind. In terms of maintaining access along the heritage coast there would be significant loss. There would be a loss in terms of transport access to the Port and this would significantly affect the viability of the Port and the proposed regeneration of the area. There would be a more general loss in terms of sustainable public transport and transport opportunity. The current design life of the Southern Radial road is understood to be over a 50 year period. Within this time frame the road would not be lost. There would, however, be no opportunity to extend use of this route and this may have significant impact on transportation more generally as the overall network adjusts to the existence of this southern route. The longer term impact of a Do Nothing policy would be to accept substantial loss to the developed area of Grangetown in the future.

Scenario (b)

Description: Maintain the Hendon Sea wall with Do nothing to the south

Rationale: This is the current policy.

Implications: There would be an increasing effort to maintain the southern end of the Hendon Sea wall as Salterfen erodes back and there is increased pressure on the end of the sea wall. Maintaining the wall, however, limits the long term development of the larger bay shape between Salterfen and the Hendon Banks Barrier and acts to transfer pressure from this northerly wall. There would still be a loss in 50 years of the railway line further south and the loss of the route for the Southern Radial road from year 75 onward.

Further south there would still be near total loss of the open space between the cliffs and the development landward of the railway line.

Impacts: There would be potential improvement to the marine aspects of the SAC, SPA and SSSI in that the currently designated section of coast would continue to move back maintaining a continuity of

nature conservation interest along the foreshore. The grassland and agricultural land to the crest of the cliffs would be substantially lost over much of the length between Hendon and Pincushion, squeezed between the eroding cliff and the development behind. In terms of maintaining access along the heritage coast there would be significant loss. There would still be a loss in terms of transport access to the Port and a more general loss in terms of sustainable public transport and transport opportunity.

Scenario (c)

Description: Maintain the Hendon Sea wall and extend linear protection further south

Rationale: The aim of this approach would be to protect the important transport links as they become threatened.

Implications: Typically works would be undertaken, most probably in a staged manner, addressing areas of concern over a period from year 50 onward, with the intention of providing direct protection to sections of erosion threatening specific lengths of assets. Initial lengths of defence would be over the length between Salterfen and Pincushion to protect the railway line and the southern extent of the Southern Radial route. A second section of defence would be constructed between the Hendon Sea wall and Salterfen. As erosion continued between sections of defence, there may be a need to extend the line of defence to maintain continuity. While it would not be expected that the whole length of coast is protected, much of it would be.

Impacts: There would be significant damage to the integrity of the marine aspects of the SAC, SPA and SSSI in that a rock toe would be extended over much of the foreshore. The grassland and agricultural land to the crest of the cliffs would be partially retained. In terms of maintaining access along the heritage coast, this would be maintained. The transport links would be maintained.

Scenario (d)

Description: Maintain the Hendon Sea wall and act to enforce or reinforce control at strategic points along the coast.

Rationale: The aim of this approach would be protect the important transport links by limiting the extent of erosion through the creation of smaller bays.

Implications: An earlier decision would need to be made as to when to take action compared to scenario C. Typically control points would be created between Salterfen and the Hendon Sea wall, at Salterfen and potentially at two further points between Salterfen and the Halliwell Banks. Works may be required over a period between year 10 and year 20, based on current rates of erosion, if benefit is to be derived from the width of land between the cliff and the assets at risk. Natural cliff evolution would occur between the hard points.

Impacts: There would be some damage to the integrity of the marine aspects of the SAC, SPA and SSSI in that the hard points would occupy areas of the foreshore. The grassland and agricultural land to the crest of the cliffs would be partially retained. In terms of maintaining access along the heritage coast this would be maintained. The transport links would be maintained.

There is still considerable uncertainty associated with specific erosion rates for the area and also in how sea level rise might impact on these rates. Therefore, regardless of the scenario it would be recommended that detailed monitoring of cliff recession is continued and, to a large degree, the selection of a preferred policy would need to be assessed in relation to this. Even so, it is important to develop in principle a preferred approach so that local

response to immediate issues that arise may be judged within an appropriate long term framework. As such the scenarios may be assessed in terms of what they deliver.

Scenario (b), the current policy, fails to address the broader issue that the benefit of holding the line along the Hendon Sea wall is negated to a large degree by the subsequent loss of transport links to the Port due to erosion further south. This scenario would need to be re-assessed as a better understanding of erosion rates is developed but in reality over the longer term the policy would revert to Scenario (a); as the justification for the Hendon wall is lost.

Scenario (c) would result in significant damage to the nature conservation interests on the coast. It is unlikely, that this approach would be acceptable unless there was really found to be no alternative.

Scenario (a) would result in major damage to the infrastructure and in the still longer term (beyond 100 years) may result in decisions on a more local basis to protect the extensive areas of development as these came under threat. There would be little scope for a more adaptable transition from a natural coastline to a controlled coastline. It is probable that there would be overriding public interest eventually to defend the coast.

Scenario (d) attempts to minimise damage to the natural coast line by taking advantage of the existing width currently available between the cliff and assets at risk.

On this basis Scenario (d) is seen as a preferred approach with the policy, therefore, to hold the Hendon Sea wall and to allow strongly controlled retreat of the coast to the south. More detailed studies would need to be undertaken to determine the detail of this southern policy.

Even under this policy there remains the potential threat of contamination from the Halliwell Banks Quarry. This is currently under investigation. If unacceptable levels of contamination were determined then under the above general policy, the recommendation of the SMP would be for potential contamination to be removed. Only if this were found to be excessively expensive and resulting in broader damage to the environment should consideration be given to protection to the area. This should then be considered in terms of whether protection at this position could be incorporated with the longer term policy of developing key control points on the coast.

Fundamental to the above preferred policy would be the need to ensure that no additional development or infrastructure were placed in the open area above the existing cliff line.

South of Pincushion, along the currently undefended section of cliff, the policy would be for no active intervention. The interface between the policy of managed realignment and no active intervention would be re-assessed as the preferred policy over the northern section was progressed. During consultation, concern was expressed that over this section of the coast there may be loss of the coastal road and potentially properties at the northern end of Seaham. The preferred policy would aim to address this in providing control to erosion north of Pincushion. To the south neither the road nor property is considered at risk. The defence to the north of Seaham is discussed below, but in line with the proposals set out in the Seaham Coastal Study the intention would be to hold the line of defences.

On this basis the following preferred options are recommended:

- Hendon Sea wall (Hold the Line)
- Hendon to Pincushion (No active intervention initially with a longer term policy of retreat controlled by local hard defence).
- Pincushion to Seaham Hall (No active intervention).

Seaham

The harbour structures, the piers and the revetments to the south of the harbour, as discussed earlier, are seen as being important in sustaining the significant local and regional benefit of the Port. In addition these structures support the new coastal link road and support the commercial area to the south of the Town. The existing works have no general overall impact on the evolution of the coast, although they do act in a beneficial manner in maintaining beach levels to the north.

The strategy study for Seaham identifies that the beach in front of the north promenade is at risk in the longer term. This will give rise to increased pressure on the defences and the strategy has identified a possible need in the future to construct a rock toe to the defence. This will need to be reviewed against on-going monitoring results and, as in the area of North Sunderland, further consideration would need to be given to alternative responses to beach erosion such as local rock groynes. The strategy confirms the economic justification for maintaining defence to this frontage and this policy of holding the line would allow sustainable development of the north area of the town and protect the important coastal road.

The area between Featherbed and the North Pier has also been considered in the strategy and while the preferred option is determined as allowing some further monitored erosion to the cliff to reduce the need for increasing effort in defences, the overall policy for the frontage is to hold the line due to the important amenity and regeneration features at the crest of and set back slightly from the cliff crest. As in the area to the north monitoring of the frontage would be important. This would define the timing of when defence to the cliff needs to be extended. It is noted that some further development of the land to the crest of the cliff has been carried out. Further development close to the cliff should be discouraged. Ensuring support to the existing development line would then trigger the need for defence.

South of Seaham at Dawdon, the decision to protect the coast between the Edith Street Roundabout and Noses Point would depend entirely on the potential degree of contamination in there areas of fill behind. The extent and depth of potentially contaminated material may not sensibly allow a policy based on excavation. Equally the possible nature of contamination might be such that diffused release to the coastal zone would be unacceptable. These options would need to be considered in detail. Even so, the preferred policy would be for no active intervention. Eroded material from the cliff provides little foreshore sediment and the policy for this section has little strategic impact, beyond that related to contamination.

Beyond the main Seaham frontage, there is no justification for intervention at Blast Beach.

On this basis the following preferred options are recommended for the Seaham area.

- North Promenade (Hold the Line)
- Red Acre Cliffs (short term policy to retreat, with a longer term policy of Hold the line)
- Seaham Harbour structures (Hold the Line).
- Seaham South (Hold the Line)
- Dawdon Beach (No active intervention unless driven by the need to stop contamination)

- Blast Beach (No active intervention).

MANAGEMENT AREAS

While the discussion above has split the zone into several different sections in terms of developing these policies, it is recommended that policy units are grouped in the following way to achieve appropriate management of the zone. These management areas are:

- Whitburn Bay, from Souter Point through to Roker Pier. This allows a more strategic approach to managing individual policy units, with the intent of maintaining both protection to important assets and creating the opportunity of maintaining beach levels.
- Sunderland Harbour, between Roker Pier and New South Pier. The principal objective within this area is maintaining the use of the Port and associated developments within the mouth of the Wear.
- Ryhope Bay, covering the southern area of the Harbour, the Hendon frontage and the section of coast from Hendon to Pincushion. While the policies within this area differ, considering the whole of this frontage is important in recognising the impacts with respect to the essential transport links.
- Seaham, including the coast from Pincushion south to Chourdon. This allows consideration of the impact of Seaham Harbour on the adjacent frontages and establishes the important links in terms of the continued sediment supply from the eroding cliffs north of Seaham and the links between the management of the coast at Noses Point and Blast Beach to the south.

The management areas can to a degree be considered separately but there are still linkages between areas that have to be acknowledged.

- The Roker Pier is important with respect to the management of the section of coast to the north.
- The New South Pier influences the way in which the Port regeneration area is managed.
- The management of Pincushion has implications for the management of the area to the north and the evolution of the coast to the south, affecting then the management of the Seaham area.

Policy statements or summaries are presented by management areas in the following sheets.

4.3.2 MANAGEMENT AREA POLICY STATEMENTS (MA06-MA09)

Location reference:	Souter Point to Sunderland Harbour
Management Area reference:	MA06
Policy Development Zone:	3

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The management intent for this area aims to provide a transition between the important nature conservation interests to the north and the management of protection of important urban and recreational interest to the north of Sunderland. The main transition area is at the Bents and the plan recommends for here a policy of retreat initially, where this would not result in loss of assets, with the intent to reinforce the nearshore area of rock outcrops in the future. This would maintain a relatively natural defence of the road, heritage features and property. The danger of defending the area of South Bents and Seaburn is one of coastal squeeze. This is already evident in the area of the Seaburn roundabout due to the alignment of the sea walls. There is economic justification for defence of this southern section but management needs to consider how, in the longer term, a beach may be retained. This would be important in delivering the coastal zone management objectives of the UDP. Use of foreshore structures could potentially offer this opportunity but then also provides the opportunity to allow a controlled retreat in the local area of Parson's Rocks Headland, potentially supporting objectives for nature conservation. Long term management to achieve amenity objectives is likely to require funding other than that for coast protection. Strict coast protection needs can be sustained through maintenance of linear defences, but this would result in long term amenity damage.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Planning policy for the creation of a buffer zone along the Whitburn Cliffs needs to be confirmed. The present management approach of the hard defences would be maintained.
Medium term	Options for foreshore management need to be developed, integrated with development of the UDP coastal zone management. This would be developed for the length from the Bents through to Roker Pier, with consideration being given to managed retreat of the Parson's Rocks promenade.
Long-term	Existing hard defences would be sustained, with the exception of Parson's Rocks, in association with management and control of the foreshore and the beach. Defences would be constructed to the area of the Bents.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
6.1	Whitburn Cliffs	NAI	NAI	NAI	No change
6.2	The Bents	MR	MR	HR*	Provide additional nearshore protection
6.3	South Bent/Seaburn	HTL	HTL	HTL	Maintain defences and improve beach control.
6.4	Parson's Rocks	HTL	HTL	R	Eventually removing defences
6.5	Marine Walk	HTL	HTL	HTL	Maintain defences and improve beach control

Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention
* HR – Hold the Line on a retreated alignment MR- Managed Realignment.

CHANGES FROM PRESENT MANAGEMENT

The SMP2 identifies the increasing pressure on the existing defences. Management of this in strict protection terms can be sustained but with loss of the beaches. While the policy for most of the frontage does not change from that defined by SMP1 and the Whitburn Bay to Ryhope Coast Protection Strategy study, SMP2 recommends a different approach in the longer term. Through this change in approach the opportunity exists in extending a degree of protection further north to address problems at the Bents and the opportunity of removing defences in front of Parsons Rocks.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

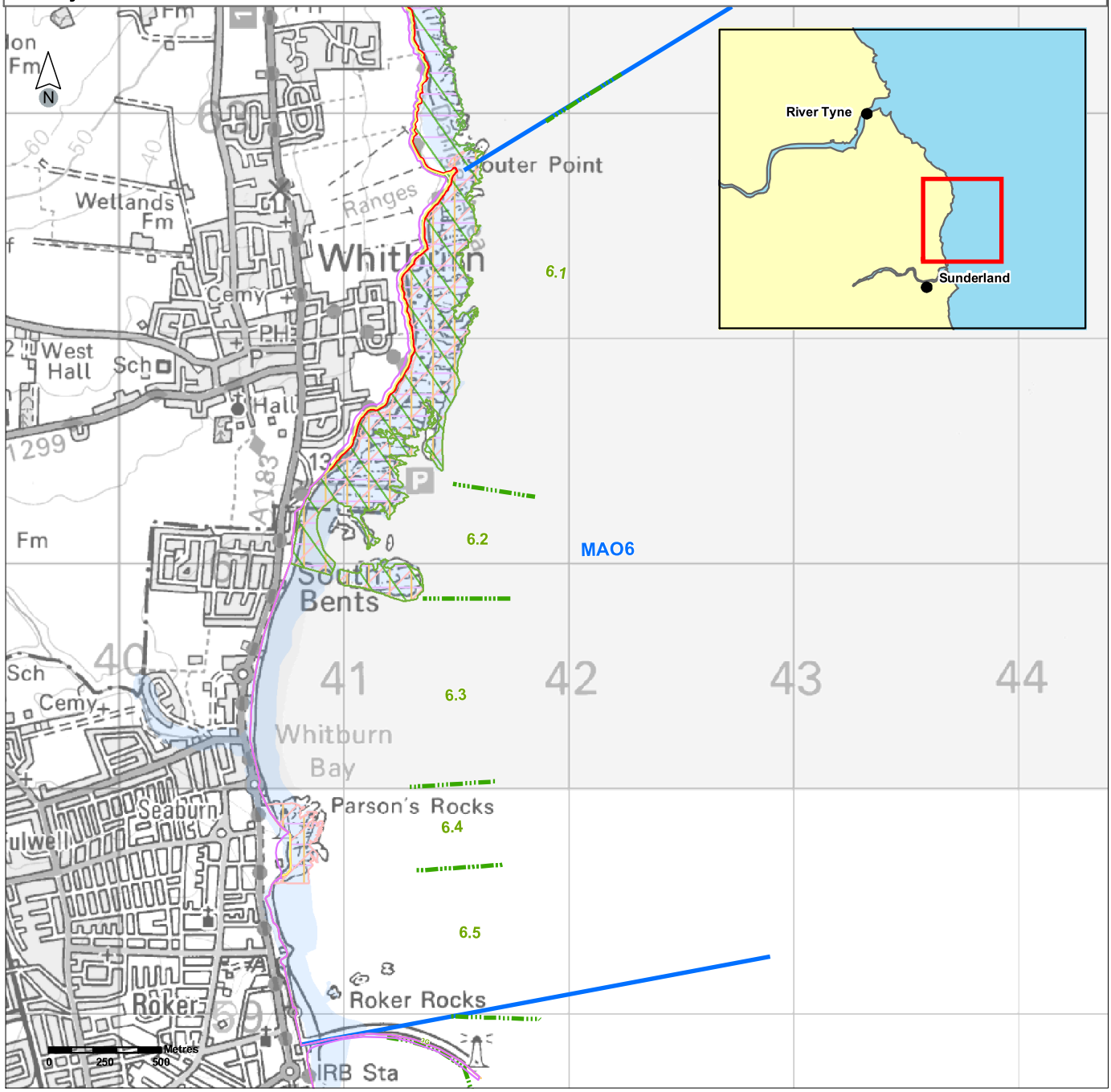
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	153	543	249	946
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	153	543	249	946
	Costs of Implementing plan £k PV	3,500	618	142	4,312
Costs are based on strategy No account is taken of NAI overtopping damages identified in strategy Description of damage and benefits under preferred plan: • Loss of the Parson's Rocks promenade in 2055. • Protects property and the coastal road.					
Heritage	No loss of heritage structures. Fishermen's Cottages protected.				
Amenity	Sustains beach use. Loss of amenity use in the area of Parson's Rocks Potentially intrusive structures to the foreshore.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	Potentially at a local scale

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA06
Policy Units 6.1-6.5



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Planning policy for the creation of a buffer zone along the Whitburn Cliffs need to be confirmed. The present management approach of the hard defences would be maintained.	Options for foreshore management need to be developed, integrated with development of the UDP coastal zone management. This would be developed for the length from the Bents through to Roker Pier, with consideration being given to managed retreat of the Parson's Rock promenade.	Existing hard defences would be sustained, with the exception of Parson's Rock, in association with management and control of the foreshore and the beach. Defences would be constructed to the area of the Bents.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, ruddy turnstone, purple sandpiper)	
Sub Feature(s) Littoral rock (between Souter Point and The Bents and a short section covering Parson's Rocks)	**Sensitivity** Loss of habitat (exposed littoral rock and boulder habitat); with particular reference to usage by purple sandpipers at Parson's Rocks	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores with associated boulder and cobble beaches.
Potential effect of policy	This policy suite supports the long-term natural erosion of the cliffs and in turn the littoral rock and boulder habitat. The main transition area is at the Bents and the SMP recommends a policy of retreat but introducing a reinforcing of the nearshore natural controls to provide better opportunity for maintaining a relatively natural defence. The reinforcement of nearshore controls could conceivably result in the creation of structures covering areas of SPA habitat, i.e. on top of the littoral rock, which would represent a loss of SPA foreshore habitat.	
Preventative Measures Ensure that any control structures required within the foreshore zone, take the form of rock habitat suitable for the SPA interest, and, therefore, represent no net loss of available SPA habitat.	**Mitigation** None	**Implications for the integrity of the site** Provided that the preventative measures described are implemented, no adverse effects are anticipated on the integrity of the European site.

SAC Site Feature	Annex 1 habitat: vegetated sea cliffs of the Atlantic and Baltic coasts	
Sub Feature(s) Neutral lowland grassland (between Souter Point and The Bents)	**Sensitivity** Loss of vegetated sea cliff habitat as a result of natural erosion.	**Conservation Target** The overall length and / or area of the cliff habitat of the site is maintained taking into account natural variation.

Potential effect of policy	This policy suite supports the long-term natural erosion of the vegetated sea cliffs between Souter Point and The Bents.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA06

	Description of Designation	**Effect of Preferred Plan**	**Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution**
National	Parsons Rocks and the coastline from Souter Point to South Bents are part of Durham Coast SSSI (vegetated coastal magnesian limestone cliffs)	6.1 Potential loss of geological SSSI features due to possible cliff protection works to protect proposed new comprehensive school. SMP identifies a policy of no active intervention.	Investigation of alternative construction locations should be completed.
	Whitburn Point LNR	No likely impacts	None proposed
Local			

ACTION PLAN FOR MANAGEMENT AREA 06

Action	By when	Responsibility	Cost £k
Scheme development. Review strategy and develop appraisal for maintenance and refurbishment plan. *Significant economic loss due to erosion and flooding. Aim to extend life of existing defences. A key driver for future works will be to maintain important amenity of area. The condition of defences is becoming critical*	2010	Sunderland City Council/ Co-ordinated with South Tyneside Council	40
Schemes: Refurbishment of defences	2012	Sunderland City Council	3000

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Sunderland Harbour
Management Area reference:	MA07
Policy Development Zone:	3

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The management of the area is driven by the objective to maintain nationally important operation of the Port of Sunderland. Maintaining the outer Piers, the Roker Pier and the New South Pier provides the basic structure for management of the area within the outer harbour. North Pier and the associated defences along North Harbour is essential in maintaining the control to the mouth of the Wear and in providing adequate protection to the developed area behind. There may be an opportunity to retreat the line of defence over the South Harbour frontage without affecting the warehouse area behind. This would allow further development of the habitat in this corner while maintaining and important spending beach area for dissipation of wave energy.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain main Piers and defences within the harbour
Medium term	Maintain main piers. Improve condition of North Pier
Long-term	Maintain main piers. Maintain defence of North Harbour Consider retreating the line of defence to South Harbour

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025.	2055	2105	Comment
7.1	Main Harbour Piers	HTL	HTL	HTL	Principal benefit to Port operation
7.2	North Harbour	HTL	HTL	HTL	Improve condition of North Pier
7.3	South Harbour	HTL	HTL	HTL	Examine opportunity for local retreat
Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention					

CHANGES FROM PRESENT MANAGEMENT

No change from present management.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

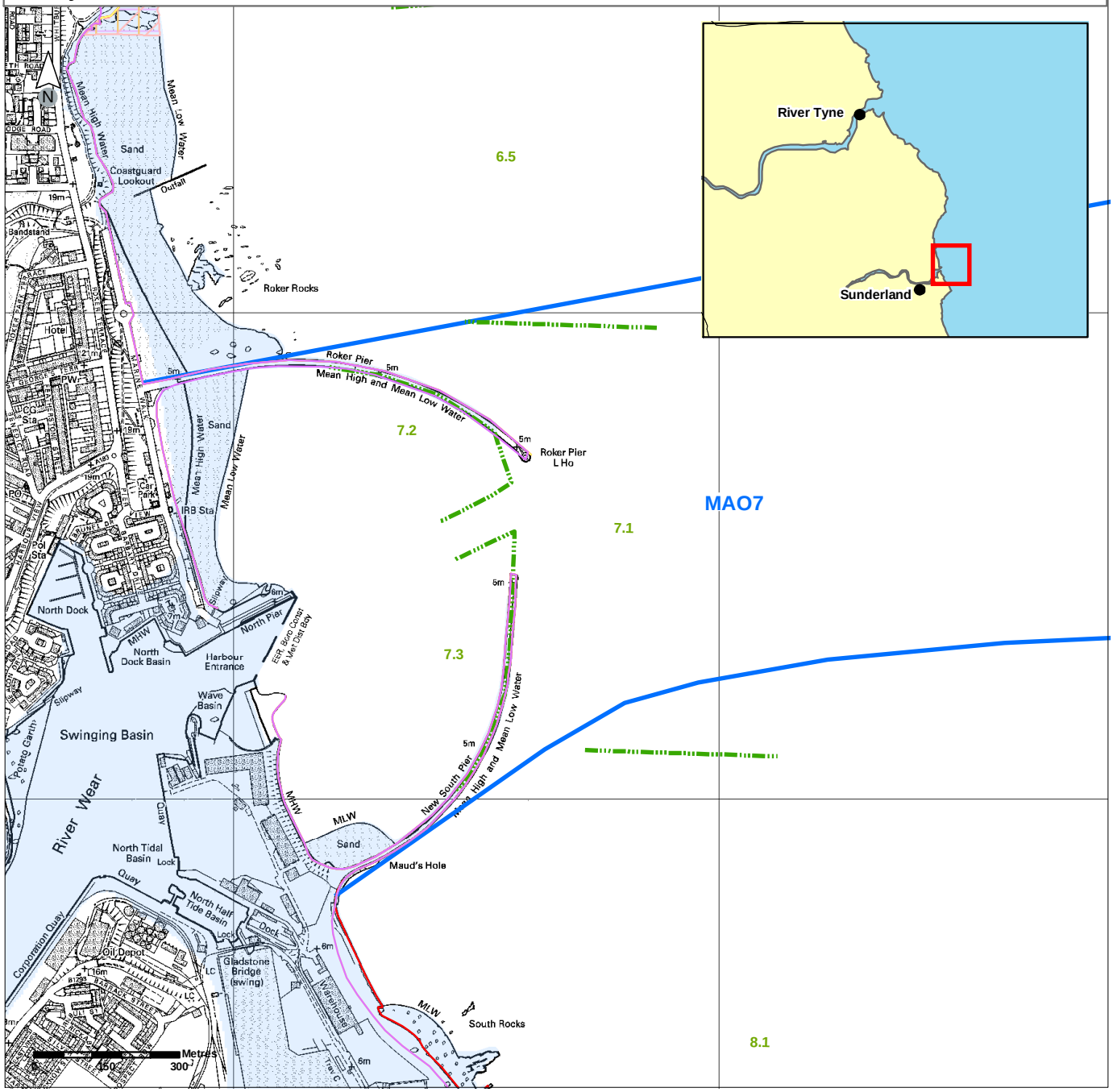
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	19,452	13,613	8,240	41,305
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	19,452	13,613	8240	41,305
	Costs of Implementing plan £k PV	3,602	652	656	4,866
Costs are based on strategy Description of damage and benefits under preferred plan: • No losses • Maintains operation of Port and protects assets.					
Heritage	No loss of heritage structures.				
Amenity	Maintained use of water sports.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	Potentially at a local scale
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA07
Policy Units 7.1-7.3



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Maintain main Piers and defences within the harbour	Maintain main piers. Improve condition of North Pier	Maintain main piers. Maintain defence of North Harbour Consider retreating the line of defence to South Harbour

Key:

Predicted Shoreline Mapping*
Preferred Plan
- 20 Years
- 50 Years
- 100 Years

- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA07

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
National	none	N/A	None proposed
Local	none	N/A	None proposed

ACTION PLAN FOR MANAGEMENT AREA MA07

Action	By when	Responsibility	Cost £k
Review strategy *High economic risk. Possible biodiversity opportunities. Maintaining SSSI. Port operation and watersports*.	2017	Sunderland City Council	30
Schemes: Continued refurbishment of harbour piers. *In addition to their function to port activities, the piers provide an important coast protection function.*	2012	Sunderland City Council	1500

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Sunderland Harbour to Pincushion Rocks
Management Area reference:	MA08
Policy Development Zone:	3

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: None of the individual policy units within this management area can be considered independently. If regeneration of the Port area is to be taken forward, there is a need to manage the coast to the south so as to maintain essential transport routes. If this southern section of the coast is managed there will be an impact on the nature conservation interests. If it is not managed, in the longer term there will be significant threat to the urban development of the South Sunderland. The intent of the plan is to reconcile these different issues. In terms of regeneration of the port area, the plan recommends a broader approach to maintaining defences, looking to adjust the alignment to the East Bay frontage, but within a policy of Hold the Line, such that individual lengths of defence are more manageable in the future. This needs to be undertaken in association with developing plans for regeneration. There is no scope for doing other than a strict hold the line on the southern face of the harbour and in doing this there may be benefits in terms of providing a sediment supply to the shore to the south. The defence of the Hendon area is seen as an important control of future evolution of the coast to the south but this needs to be supported by additional control points further south. Over this southern frontage, between the Hendon sea wall and Pincushion, there is uncertainty with respect to erosion rates. This critically needs to be monitored over the next 10 to 20 years such that a long term management plan for this currently undefended area may be developed. Investigation of the potential contamination from the Halliwell Banks area is on-going. The results from this, together with issues of access to the foreshore need to be considered in the context of controlling the future erosion of the shoreline as a whole. Subject to this further investigation it may be appropriate to position local control points addressing both the immediate and long term objectives.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Consider realignment of the defences of East Bay, with the intent to hold the line to the regeneration area. Maintain defences to the south face of the harbour and at Hendon. Monitor erosion of the frontage between Hendon and Pincushion. Investigate the waste tip at Halliwell Bank.
Medium term	Hold the Line to East Bay Hold the line to the harbour South Face and at Hendon Construct control structures to the section between Hendon and Pincushion.
Long-term	Maintain all defended areas.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
8.1	Harbour East Bay	HTL	HTL	HTL	Integrate with land use planning
8.2	Harbour South Face	HTL	HTL	HTL	
8.3	Hendon Seawall	HTL	HTL	HTL	linked benefits with area to south
8.4	Hendon to Pincushion	R	MR	MR	Hard point control

Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention MR- Managed Realignment.

CHANGES FROM PRESENT MANAGEMENT

The most major change from present policy would be controlled management of the section between Hendon and Pincushion. This needs to be planned during the first 10 to 20 years of the SMP to avoid defence creep along the frontage. Works are necessary to sustain transport links to sections further north but are also essential in managing the future threat to major urban areas in the longer term.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

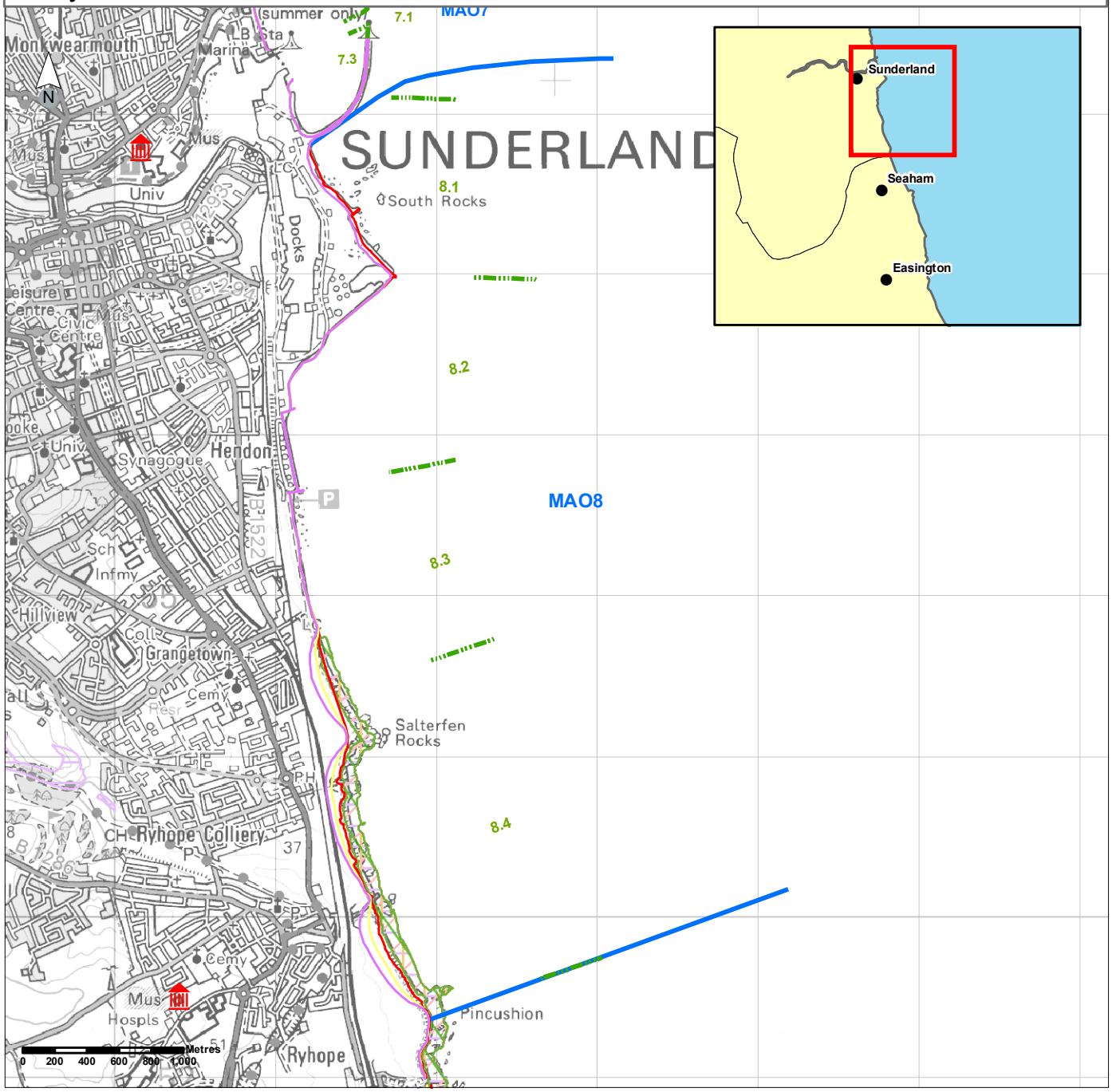
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	13,317	10,043	5,082	28,441
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	13,317	10,043	5,082	28,441
	Costs of Implementing plan £k PV	6,218	668	593	7,014
Costs are based on strategy, with additional costs estimated for control of coast to south of Sunderland. NAI damages do not include economic loss of railway and road. Description of damage and benefits under preferred plan: • The approach to defence being integrated within the regeneration strategy. • Protects the main area of regeneration. • Protects the use of Hudson Dock. • Develops a long term sustainable plan maintaining transport links and defence of South Sunderland.					
Heritage	No loss of heritage structures.				
Amenity	Maintains opportunity for developing amenity benefit at Hendon. Maintains access along the cliffs to the south.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	Potentially at a local scale
Impact of geomorphology and hydrodynamics	Potentially at a local scale

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA08
Policy Units 8.1-8.4



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Consider realignment of the defences of East Bay, with the intent to hold the line to the regeneration area. Maintain defences to the south face of the harbour and at Hendon. Monitor erosion of the frontage between Hendon and Pincushion. Investigate the waste tip at Halliwell Bank.	Realign defences to East Bay. Hold the line to the harbour South Face and at Hendon Construct control structures to the section between Hendon and Pincushion.	Maintain all defended areas.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, ruddy turnstone, purple sandpiper)	
Sub Feature(s) Littoral rock (Salterfen Rocks to Pincushion)	**Sensitivity** Loss of habitat (exposed littoral rock and boulder habitat); with particular reference to usage by purple sandpipers	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores with associated boulder and cobble beaches. Specific reference: Maintain site fabric to support purple sandpiper.
Potential effect of policy	This policy suite supports the long-term natural retreat of the littoral rock and boulder habitat. The SMP recommends hard point control in order to offer an element of control over erosion rates. The provision of limited nearshore controls could conceivably result in the creation of structures covering discrete areas of SPA habitat, i.e. on top of the littoral rock, which would represent a loss of SPA foreshore habitat.	
Preventative Measures Ensure that any control structures required within the foreshore zone, take the form of rock habitat suitable for the SPA interest, and, therefore, represent no net loss of available SPA habitat.	**Mitigation** None	**Implications for the integrity of the site** Provided that the preventative measures described are implemented, no adverse effects are anticipated on the integrity of the European site.

SAC Site Feature	Annex 1 habitat: vegetated sea cliffs of the Atlantic and Baltic coasts	
Sub Feature(s) Littoral rock (Salterfen Rocks to Pincushion)	**Sensitivity** Loss of habitat (exposed littoral rock and boulder habitat).	**Conservation Target** The overall length and / or area of the cliff habitat of the site is maintained taking into account natural variation.
Potential effect of policy	This policy suite supports the long-term natural retreat of the littoral rock and boulder habitat. The SMP recommends hard point control, thereby allowing the natural erosion of the cliffs to continue but with an element of control over the rate of erosion.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Semi-natural retreat of vegetated clifffs, resulting in no net loss of habitat, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA08

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
National	Just north of Salterfen Rocks to Pincushion are part of the Durham Coast SSSI	8.4 Potential contamination of SSSI foreshore features due to leaching of contaminants from former coastal quarry and landfill site. Also potential loss of SSSI foreshore features due to possible cliff protection works to protect new southern radial road and railway.	Managed retreat and monitoring of landfill to assess risk and investigate potential of the coast to absorb diffuse pollution. There is little scope for re-aligning the road and the railway.
Local	None	N/A	None proposed

ACTION PLAN FOR MANAGEMENT AREA MA08

Action	By when	Responsibility	Cost £k
Scheme development for Harbour East Bay. Review and develop defence requirements to Port regeneration area. *High economic risk. Examine opportunity for realignment to provide an integrated approach with regeneration. Defences in poor condition.*	2008	Sunderland City Council	50
Complete investigation of Halliwell Banks. Management of potential contamination. *Potentially high economic value. Take account of and integrate with long term policy. Management of coastal access issues*	2007	Sunderland City Council	80
Longitudinal access study to Hendon Beach.	2007	Sunderland City Council	5
Review strategy along Hendon/ Rryhope frontage. *High economic risk. Part of regeneration plan.*	2012	Sunderland City Council	25
Schemes: • Scheme under review for Harbour East Bbay • Potential schemes	 2009 2012	 Sunderland City Council Sunderland City Council	 6000 4000

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Pincushion Rocks to Chourdon Point
Management Area reference:	MA09
Policy Development Zone:	3

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The management plan centres on sustaining the use of the Port of Seaham and supporting the regeneration of Seaham town centre. The plan recommends no active intervention in defence of the cliffs north of the existing urban area of Seaham, accepting a natural retreat of this frontage. Despite the anticipated loss to the beach area of the town's northern promenade, there is little benefit retreating the line of defence and in line with the Strategy Study recommendations the policy is for maintaining the protection to the coastal road and promenade north of Featherbed Rocks. Between the Featherbed Rocks and the Harbour, the frontage is relatively contained and even limited retreat of this undefended length would be beneficial in allowing adjustment for sea level rise. The extent of retreat would be determined by maintaining the support to the existing development line at the crest of the cliff and the need to intervene would be determined through monitoring. There needs to be further investigation as to the nature of contamination within the cliffs to the south of the Harbour. Existing defences maintain protection to the commercial area above the cliffs and, therefore, extension of the line of defence towards Nose's Point would only be justified by the potential impact of contaminated material being allowed in to the coastal zone. The potential difficulty of excavating the contaminated material would possible mitigate against its removal. To the south of Nose's Point the natural erosion of the coast would continue with diffusion of mining waste into the coastal zone.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Defences at Seaham would be maintained. Investigations into potential contamination due to erosion of the cliff south of Seaham
Medium term	Review management of defences north of Seaham in particular with respect to the transition from the eroding cliff line to the north and the potential reduction in beach levels. Protect the cliffs between Featherbed Rocks and the Harbour, Potentially extend defence towards Nose's Point.
Long-term	Maintain defended areas.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
9.1	Pincushion to Seaham	NAI	NAI	NAI	
9.2	Seaham North Prom.	HTL	HTL	HTL	
9.3	Red Acre Cliffs	R	HR*	HR*	
9.4	Seaham Harbour	HTL	HTL	HTL	primarily for port activities
9.5	Seaham South	HTL	HTL	HTL	
9.6	Dawdon Beach	NAI	NAI	NAI	subject to potential contamination
9.7	Blast Beach	NAI	NAI	NAI	

Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention
* HR – Hold the Line on a retreated alignment

CHANGES FROM PRESENT MANAGEMENT

With the possible exception of extending defences south of Seaham, there is no change from the SMP1 policy nor from that put forward in the strategy..

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

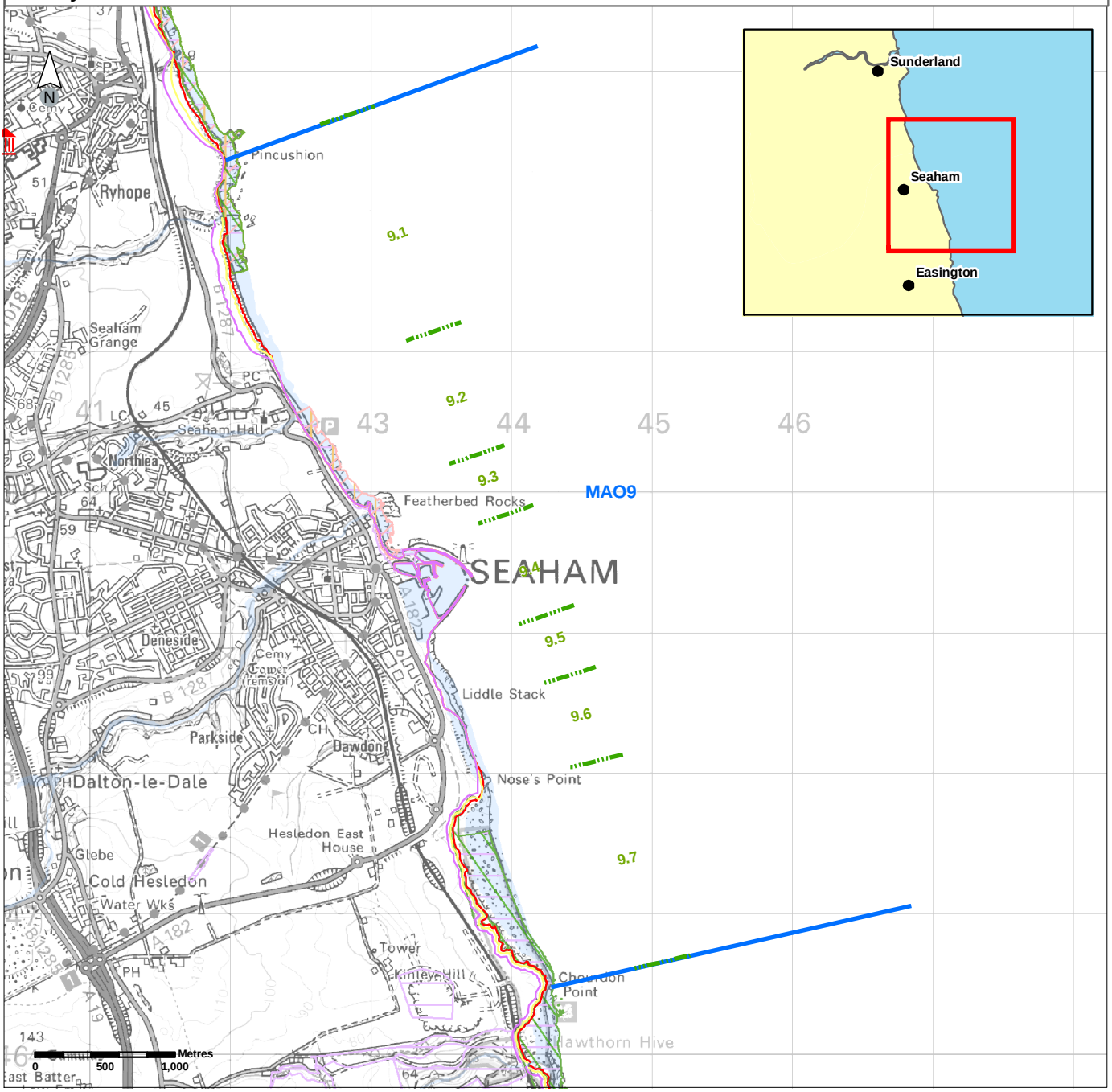
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	0	2,612	190	2,802
	Preferred Plan Damages £k PV	0	3	3	0
	Benefits £k PV	0	2,609	187	2,796
	Costs of Implementing plan £k PV	10	1013	8	1,031
Costs are based on strategy NAI damages taken from strategy Description of damage and benefits under preferred plan: • Loss of agricultural land north of Seaham. • Protects the town and coastal road. • Maintains operation of the Harbour. • Maintains defence to the commercial area south of Seaham.					
Heritage	No loss of heritage structures.				
Amenity	Potential loss of amenity beach to the north of Seaham..				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	Yes
Impact of geomorphology and hydrodynamics	Yes

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA09
Policy Units 9.1-9.7



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Defences at Seaham would be maintained. Investigations into potential contamination due to erosion of the cliff south of Seaham	Review management of defences north of Seaham in particular with respect to the transition from the eroding cliff line to the north and the potential reduction in beach levels. Protect the cliffs between Featherbed Rocks and the Harbour, Potentially extend defence towards Noses Point.	Maintain defended areas.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

I:\9P0184\Technical_Data\Arcview\Figures\Policy_Development_Zones\Management_Areas\MA09.mxd

ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, ruddy turnstone, purple sandpiper)	
Sub Feature(s) Littoral rock (South of Pincushion and associated with Featherbed Rocks)	**Sensitivity** Loss of habitat (exposed littoral rock and boulder habitat); with particular reference to usage by purple sandpipers	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores with associated boulder and cobble beaches. Specific reference: Maintain site fabric to support purple sandpiper.
Potential effect of policy	This policy suite supports the long-term natural retreat of the littoral rock and boulder habitat south of Pincushion. The existing defences between Seaham north promenade and the harbour will be retained (with limited retreat between Featherbed Rocks and the harbour); resulting sea level rise would be expected to lead to losses of the SPA and Ramsar foreshore in this vicinity. In addition, there is potential contamination within the cliffs to the south of the harbour, which could enter the coastal zone, and potentially affect the SPA interest feature.	
Preventative Measures Managed retreat combined with monitoring to assess the risk of exposure to contaminants and the potential for the coast to absorb any potential effects of diffuse pollution.	**Mitigation** None	**Implications for the integrity of the site** No adverse effects are anticipated on the integrity of the European site provided that: - the risk of exposure from contaminants is fully assessed and monitored; and - appropriate mitigation measures are implemented once the nature of the contaminants and risk of exposure are fully determined.

SAC Site Feature	Annex 1 habitat: vegetated sea cliffs of the Atlantic and Baltic coasts	
Sub Feature(s) Calcareous lowland grassland (between Nose's Point and Chourdon Point)	**Sensitivity** Habitat loss through natural erosion	**Conservation Target** The overall length and / or area of the cliff habitat of the site is maintained taking into account natural variation.
Potential effect of policy	This policy suite supports the natural development of this SAC habitat to continue.	

Preventative Measures	Mitigation	Implications for the integrity of the site
None	None	Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA09

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
National	Pincushion, Featherbed Rocks and Nose's Point to Chourdon Point are all part of the Durham Coast SSSI (vegetated coastal magnesian limestone cliffs)	9.6 Potential contamination of SSSI foreshore features due to leaching of contaminants.	Managed retreat based solution with monitoring of contamination to assess risk and investigate the potential of the coast to absorb diffuse pollution is preferable to possible defence works
Local	none	N/A	None proposed

ACTION PLAN FOR MANAGEMENT AREA MA09

Action	By when	Responsibility	Cost £k
Investigate potential contamination at Dawdon Beach. *Potential consequences of contamination. Providing advice in planning regeneration of port. Management of coastal access.*	2010	Easington DC	50
Review overall coastal strategy	2014	Easington DC	25
Schemes: No schemes anticipated			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.4 PDZ 4 Chourdon Point to Hartlepool Headland

4.4.1 Policy Development Analysis

DESCRIPTION

Physical

The zone extends some 17.5km from Chourdon Point south to the Hartlepool Headland. The northern section of the zone has been heavily modified by the substantial quantities of colliery waste deposited during the last century. Considerable effort has been made to restore the natural coastline, although over much of this section there remain significant deposits of waste material. South of Blackhall Rocks the coast is less affected by the colliery waste tipping, with a wide expanse of sandy beach backed by dunes. This then runs to the bare rock outcrop foreshore of the Hartlepool Headland, with its large seawalls and revetments protecting the raised platform of northern Hartlepool.

Over the northern section, the coast comprises relatively hard Magnesian Limestone cliffs, with specific headlands defining a series of bays. The most southerly of these headlands is at Blackhall Rocks. The colliery material largely in-fills these bays, often obscuring the toe to the old cliff face behind. Since the work associated with Turning the Tide, removing waste from the beaches, and the subsequent erosion of material has meant that the headlands have largely re-emerged, typically with rocks and boulders overlying large areas of outcropping rock; evidence of former or eroded headlands. Above the cliffs planning initiatives have been put in place to reduce development of the coast, creating a buffer zone against the future erosion of the cliffs. This buffer zone is effectively bounded on its western side by the coastal railway line which runs the full length of this section. To the rear of the railway line are the various settlements Easington, Horden and Blackhall Rocks. Cutting down through the rock to the shore are a series of Denes and Gills; the main features being Hawthorn, Fox Holes and Castle Eden Dene, extending as heavily wooded valleys back; in the case of Castle Eden, several kilometres from the coastline. While being lower than the surrounding hinterland these denes slope to the shore and are not subject to significant tidal inundation. At Hawthorn Dene and the next bay south, Shippersea Bay, the railway line is close to the cliff line.

Immediately south of Blackhall there is some 2km of sloping, generally well vegetated cliff line before the coast drops into the dune-filled valley of the Crimdon Beck. The crest of these cliffs is largely occupied by the Crimdon Caravan Park and, to the south, the more recently improved car park and open coastal park.

The Crimdon valley comprises a low sand dune spit running south across the mouth of the Crimdon beck, with the beck cutting into the high dunes in front of the Hart Warren Golf Course, before flowing as a wide delta across the foreshore. Over the foreshore in this area there are intertidal sandbanks, established several hundred metres parallel to the shoreline.

The higher dunes to the north of Hart Warren reduce in height forming, eventually, a sandy dune coastal slope overlying made ground in front of the Britmag works, the Cemetery and the Spion Kop area of industrial works and warehousing. This whole area is North Sands. South of here starts the main residential development of the Hartlepool Headland, with continuous coast protection works extending nearly 2km along and around the headland. In the northern section there is a narrow width of sand against these defences, overlying the broader expanse of rock outcrop. This vestige of sand is soon lost with defences constructed directly onto the rock scar. In the northerly section a road and promenade is directly behind the defences with properties immediately backing the road. Over the southerly section of the headland, the defences step slightly forward and are backed by open recreational land all the way to the Battery. Immediately beyond the Battery, through to the Heugh Breakwater, there are properties up close to the sea wall. In the nook of the Heugh Breakwater there is a small area of accumulated rock and medium sized boulders, forming a narrow stony beach.

Environment

Although the specific nature of land use, in the immediate area behind the coast, changes over the zone; from the open buffer zone in the northern section, through the recreational use of Crimdon, to the industrial and then residential value of the Headland, there is a strong and near continuous theme of nature conservation over the whole area. There is a SAC designation covering virtually the whole coast from Chourdon Point to Castle Eden Dene and again from Blackhall Colliery to Crimdon and the SPA and Ramsar designations of the rock foreshore at Hartlepool, extending north to include Hart Warren. These international designations derive from the extensive SSSIs designations for the coast line, which also extend back into the Denes at Hawthorn Hive and Castle Eden Denes. Much of

Castle Eden Dene is also a National Nature Reserve.

The Heritage coast covers Crimdon Dene to Blackhall Colliery, and continues from Horden virtually to Seaham and the National Trust own some 5km of the northern section of the coast including Hawthorn Hive and Shippersea, Horden Point, north of Castle Eden Dene.

The aim for the northern section of the coast is to balance encouragement of visitor enjoyment of the natural coastline with enhancement and protection of the nature conservation interests. This is being achieved by planning and management, through establishing the open coast buffer zone, by improving, and to a degree formalising access to the coast; generally through the denes and gills, and through the creation of a continuous coastal path along the cliff line. This is supported by the creation of limited but frequent parking areas, again associated generally with the denes. Within the Crimdon area the aim has been to create a more focal point for tourism and recreation, as reflected in the new large car park to the back of the coastal slope and is more generally supported by the privately run Ponyworld, to the north of the beck, and the golf course, to the south; and indeed by the caravan park situated on the cliffs to the north.

There is an intention to continue the coastal path through the industrialised ridge to the south of Hart Warren, through to the Hartlepool Headland, with the newly established Local Nature Reserve of the Cemetery forming a key way-point on this route. The general designation and strategy for the frontage is supported by management of access and activities at a local scale.

The Headland itself is the oldest part of Hartlepool and is an important residential area but also has important Heritage value, both specifically in terms of individual listed structures and more generally as a composite area of archaeological interest. There is also the associated redevelopment and regeneration of the Victoria Docks.

The railway line is of national significance but is also a potentially important at a regional scale as a transport link between the northern and southern ends of the coastal path.

In terms of the built environment, the residential area of the headland is important to the town and the open areas and cultural significance of the Headland are recognised as being important to the wider area.

Several bio-diversity opportunities have been identified for this zone of the coast. These include:

- Creation of intertidal habitat at Horden and Blackhall, although this really relates to allowing natural development of the dunes.
- The potential use of dredged material to enhance the formation of offshore sand banks at Hart Warren Dunes, although the issues of possible contamination have to be addressed.
- The creation of additional bird roosting and foraging sites associated with the hard defences at the Headland.

There are concerns as to potential contamination from the made ground coastal slope at the Spion Kop and in the area of the Britmag works, although current information indicates that the potential threat is of a low order and not a problem for Controlled Waters.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence
- To support the objectives of the Durham Coast initiatives and maintain the opportunity to extend recreational use generally of the coast.

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To maintain and protect residential assets of the Headland
- To minimise contamination.
- Maintain the nationally important railway line.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:25yr	1:50yr	1:100yr	1:200yr
-1.90	2.70	3.30	3.53	3.66	3.73	3.84	3.91

Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 2.7m below Ordnance Datum.

Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between.

Source (extreme water levels): Babtie, 1999. Shoreline Management Plan, Seaham harbour to Saltburn, Sub cell 1c.

NB. Values for 200 yr ARI are interpolated between 100 yr and 250 yr values.

Wave climate

Return Period (1:X years)	Wave Height Hs (m)
0.10	4.03
1	6.17
10	8.63
20	9.42
50	10.51
100	11.36
1000	14.32

Source: Babtie, 1999. Shoreline Management Plan, Seaham harbour to Saltburn, Sub cell 1c. OUTRAY used to determine inshore wave data at 10 m contour.

Baseline Erosion Rates

Chourdon to Blackhall	*0.3m/year*
Natural Headlands	*Potentially less than adjacent bays*
Crimdon Valley	*0.3m/year*
North Sands	*0.3m/year*
Hartlepool Headland	*0.3m/year*

All the above rates are based on existing evidence and are likely to increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years (1.8 at Hartlepool Headland). Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

The shape of the coast is dominated by the harder geological headlands of the northern section and the massive, protected bulk of the Hartlepool Headland. The coast over the northern section between Chourdon Point and Horden Point runs effectively north/south. However, locally between headlands the bays have developed to reflect the net direction of wave energy. The Hartlepool Headland anchors the coast such that the coast south of Horden Point has developed with a more northeast/southwest orientation with better alignment, generally, with the net wave exposure. At the southern end, at Crimdon the coastal orientation is well aligned, such that net wave energy approaches the coast normal to the shoreline. Only at the southern end of the Headland does the coast change such that waves again approach at an angle to the coast.

There is a general net southerly drift over the nearshore zone. At the coast, in the past, with the injection of colliery waste, the shoreline was advanced beyond the influence of the geological headlands. Drift of colliery waste was to the south. As waste has eroded the re-emerging headlands have restricted this drift and the bays are now settling back to a more stable shape. There is still some drift south, but there is a reducing erosion of colliery waste, which will slow further as the

retreating shoreline encounters the harder cliff line. While the general southerly drift system in the nearshore region will still continue, drift directly from the bays will reduce. There is, however, believed to be significant feed from the nearshore zone to the shoreline, and potential loss from the shoreline to the nearshore zone. The area of Crimdon Beck acts as a sediment sink. This is evidenced by the development of the dunes and the formation of the offshore bank system. Much of the accumulation of sand would appear to be derived from the nearshore zone, rather than being reliant upon direct feed from the longshore drift from the actual coastline.

Over the Hartlepool Headland length, drift against the shoreline in the northern section tends to feed back towards Hart Warren; reinforcing that area's characteristic as a sediment sink, while at the southerly end, any sediment that arrives on the rock scar will tend to be driven south. The various pipes running across the foreshore in front of the Britmag works do tend to hold a higher level of foreshore, again confirming both the tendency for this area to be generally a sediment sink and to be fed from the nearshore zone. This higher foreshore acts to a degree to divide the Crimdon/North Sands frontage, creating a slight embayment in front of the Spion Kop (North Sands).

The underlying system of drift can vary so that under specific wave conditions material within the bays to the north may be locally driven north on occasion, beach material from within the Crimdon frontage may be moved further south and lost to the south past the Headland. Areas of the Headland may accumulate and then lose sediment. Within each bay or section of the coast there may also be local variation or behaviour dictated by local features at a local scale. This is seen at Crimdon, with the general pressure of sediment drift from the north forcing the beck channel south and in land against the Hart Warren Dunes; causing erosion within a section of the coast generally well supplied with sediment. In many ways it is the accumulation of sediment that is driving the erosion of the Hart Warren Dunes, forcing the flow of the beck in land. With sea level rise there would be increased pressure on all sections of the dune.

Unconstrained:
In the absence of the main man made control features the coast would continue to erode; this being made more pronounced by sea level change. The erosion over the section of the coast to the north will slow as the face of the colliery waste retreats within the control of the natural headlands, but these headlands will also continue to erode and the coast will gradually move back. The rate of erosion as the coast retires to pre-tipping days is uncertain due to the lack of reliable records before tipping began. The fact that there will be erosion is, however, evident.

Without sea level rise and assuming an adequacy of sediment in the nearshore zone, there would be little net erosion within the Crimdon Beck area. With sea level rise, although the area would tend still to act as a sink, the coast will attempt to roll back to establish a new equilibrium profile.

At the southern end of Hart Warren the coast has been taken slightly further forward by reclamation south of Spion Kop Cemetery, where it has been reinforced by gabions, and into the northern section of the Headland; by a wall and revetment. The coast is further held forward by the affect of the pipes in front of the Britmag works. Without defence this whole area would erode back more sharply than the coast to the north. The forward position of the coast to either side gives some protection to the area of the Cemetery and so under this unconstrained situation this would also suffer erosion. The main Headland defences are understood to be constructed in front of the old cliffs. There is significant pressure on this area to erode and it has been the presence of the harder cliff material which has resisted this.

It is unlikely that even in the unconstrained scenario that erosion over the next 100 years would break through the ridge of land to the lower lying flood plain behind.

MANAGEMENT

Present Policy

SMP1	Policy
The zone is divided into management units:	
C2, C3 and C4	Do Nothing
C5 and part of C6	Hold the Line
Seaham Coastal Strategy	
The strategy confirms a do nothing approach for management units C2 and C3, but identifies the potential need for local action in relation to the railway line.	Do Nothing
Hartlepool Coastal Strategy	
The strategy is in draft and recommendations are provisional. The emerging strategy, however, recommends managed retreat would be appropriate. There are no existing assets which warrant defence. The Headland defences would be maintained.	No active intervention. Hold the Line

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

This is the current policy for the northern section of the zone through to the southern limit of Hart Warren Dunes. There would be continued erosion, initially of the colliery waste and at a slower rate the headlands. As colliery waste is removed, as it has substantially been in some areas, the cliffs and foreshore to the back of each bay will be eroded at a slower rate. At Crimdon and Hart Warren there would be little immediate change, but with sea level rise the coast would attempt to roll back.

Sensible planning policy has ensured that overall there is no conflict with this policy over much of this northern section. Only locally is there any threat to the railway line, at Hawthorn Hive and Shippersea Bay and this towards the end of the SMP 100 year period. There has been an identified wish that the SMP policy be changed to one of managed retreat at Castle Eden Dene to take opportunity for habitat creation.

The erosion of the cliffs south of Blackhall rocks will impact on the caravan park and could cut back sufficiently to affect the new car park area.

The rolling back of the coastline in the Crimdon valley will tend to force back the channel of the beck, which in turn will increase erosion to the dunes in front of the Golf course; potentially opening an area of lower lying land through to the Club House. Dunes on the east coast tend to form as a single ridge (except where there has been major advance in the shoreline area) due the dominance of offshore winds. It is probable that as the coastline rolls back the old high dunes of Warren Hart would be lost and a new dune ridge develop slightly further back. This process, while closing off any low lying land would impinge further on the golf course.

Under this scenario the coast to the Britmag works and further south would be put under increasing pressure. The existing piped outfalls and intakes do act to retain a slightly higher beach but it is assumed that, as the works suffer erosion, so these structures would fall into disrepair and any further influence would be lost. There is the potential for erosion of the frontage of the order of 50m and this would take out a substantial area of the works, the cemetery and the Spion Kop industrial area; with the potential for contamination, although insignificant in relation to Controlled Waters. The retreat of the coastline would allow development of a more natural dune system.

There would initially be a discontinuity between the eroding coast to the north and the protected area of the Headland, however, as unmaintained defences fail, erosion would cut back beyond the road and into the area of residential property. Further south, erosion would be more intermittent as the old cliff line was exposed. There would be significant loss

of the open area on the coast and loss of individual assets such as the Battery. There would be little benefit in terms of maintaining a more stable coast line to the north and, in fact, loss of the defences and their function reinforcing the natural headland could result in a slight increase in loss of material from the Crimdon area to the north over the longer term.

MDSF Evaluation		*PValue Damages*
Erosion	313 properties lost, principally towards the second part of the SMP period. Principally at Hartlepool Headland	£4,665,000
Flooding	No flooding damages assessed by MDSF	£0
Other Information	The Strategy identifies damages of £20M for the Headland due to overtopping and loss of amenity areas.	
Assessment of key objectives	• Supports the development of the natural Durham coastline although provision would have to be made to retreat the path. • Allows natural development and evolution of the coast but nominally constrains local management. Provides additional roost areas in the failing defences to the Headland. • Fails to protect cultural value of the Headland. • Fails to protect residential and commercial interests • Fails to maintain the nationally important railway line. • Reduces reliance on defence	

With Present Management (Scenario 2):
Over the northern section (Chourdon to Hart Warren) there would be little change from the strict non active intervention scenario described above. However, the strategy policy does allow for future local protection to the railway.

Over the remaining sections of the coast, works would be undertaken to maintain the existing defences of the Headland. The area of North Sands, the Britmag Works and Spion Kop would not be protected. This will result in the loss of the Cemetery and LNR area between.

As the area of Hart Warren and North Sands erode back there would some increasing pressure on the Headland and works would be needed to manage this transition. Over time there would tend to be a loss of beach area at the northern end of the Headland defences.

The strategy for the Headland suggests that, to maintain the defence to the area, there will need to be extensive further works to the toe to avoid undermining and increased wave overtopping, as sea level rises. While the concerns with respect to integrity of the walls are quite immediate, the longer term need is based in part on the relatively high predicted vertical erosion rates of the rock platform. If these are confirmed there will also be a loss of intertidal rock outcrop, quite separate from the decision as to whether the headland is protected or not. This would impact on the integrity of the SPA.

MDSF Evaluation		*PValue Damages*
Erosion *Flooding*	Continued loss of agricultural land	£16,000
Other Information	Not yet available from the strategy	
Assessment of Key objectives	• The objectives of the Durham Coast initiatives would be supported although there would be a need to retreat the coastal path. • Over much of the frontage the natural conservation interests would be improved but there would be a loss of integrity (not necessarily totally associated with the defence policy) at the Headland. There would also be loss of the Spion Cop Nature reserve. • There would be a loss of important heritage interests in terms of the Cemetery, but other features would be maintained.	

	• Economic and residential assets of the Headland would be sustained. • Maintains the nationally important railway line. • Increasing reliance on defence.

DISCUSSION AND DETAILED POLICY DEVELOPMENT

In comparing the two scenarios, there are local issues associated with management of the northern section of the coast, but the principal area of difference between scenarios lies in the management of the southern section of the coast. The northern section of the zone is not affected significantly by issues relating to the north of Hartlepool and can be addressed first.

Chourdon Point to Blackhall Rocks.

Current policy for this area is non active intervention, enabled by the planning policy in creating a buffer zone for natural development of the coastline. With the possible exception in the future of protection to the railway line at Shippersea and Hawthorn Hive (as identified in the coastal strategy) the SMP2 confirms this policy. With respect to the specific lengths of the railway, the strategy indicates that protection to these areas would not have any significant impact on coastal processes generally and, apart from local interference with the exposure of the geology and the local visual impact, such future management would not fundamentally alter the intent of a policy of non active intervention. Consideration has to be given to re-alignment of the railway line. However, while this might be considered in more detail at an appropriate time, it is evident that re-alignment at the key locations would require substantial works, which would include major construction of a new railway bridge at Hawthorn Hive. Such construction works are likely to be far more intrusive on the sensitive natural environment.

A degree of local realism has to be taken in interpreting the overall policy of No Active Intervention. With respect to issues of local management for the denes raise by the Bio-diversity opportunities study, it is not considered necessary to alter the overall policy of no active intervention to accommodate this. There are no defences in these areas and the overall intention is to support the aims and objectives of the Durham Coastal Strategy. If local action is felt appropriate to manage the development of dunes and saltmarsh in the areas of the denes, or indeed manage provision of access to the coast, this would be extremely unlikely to influence the overall evolution of the coast. If such actions (effectively transient management of natural retreat) were deemed appropriate in meeting the Durham Coastal Strategy objectives then they would not be in conflict with the preferred SMP policy.

There was an issue of potential contamination from ground water associated with mine workings raised by consultees. This is not strictly an issue for the SMP, although quite rightly a concern in relation to broader management of the coast and in relation to the Water Framework Directive. Within the time period of the SMP it is not expected that mine workings will be exposed to erosion. This will require monitoring in relation to actual erosion rates associated with anticipated sea level rise.

Considering now the southern section of the policy development zone, it may be seen that Scenario 1 (No Active Intervention) fails to address the needs associated with the human, cultural and heritage issues. Also, because retreat of the defences to the headland would not substantially increase the area of intertidal rock outcrop in the area of the SPA, the scenario would not address concerns of a lowering of the rock platform. There might be increased roosting areas as the old cliffs become exposed amidst the failing defences. Scenario 2 (current policy based on the emerging strategy) would partially address the issues of the built environment, in the area of the Headland itself, but equally do nothing to address the lowering of the rock foreshore. This scenario would not, however, address current issues in relation to the management of the Spion Kop Cemetery nor would it provide opportunity for

development of the along North Sands frontage. In both Scenarios, within the area of the Crimdon Valley, the policy is for No Active Intervention.

During consultation on the Draft SMP the inter-relationship between issues was highlighted by consultees, particularly by the Friends of Spion Cop. In this, the potential difficulties were recognised that the area extending between the Headland and Crimdon was subject to erosion but also that defences may result in damage to important natural features of the frontage. This latter point was also raised by the Teesmouth Bird Club.

In discussing these three areas there is a need to consider how all three sections interact. The discussion, therefore, considers first the areas to either side of North Sands, before considering various approaches to defence in the central section, assessing how management here may influence the areas to either side. The aim of the discussion is to examine how the overall integrity of both the historic and natural attraction can be addressed.

The Headland

Over the main Headland frontage the Hartlepool strategy has demonstrated a strong economic justification for continued defence and is exploring this in detail in consultation with English Nature in terms of its local impact on the SPA. From the perspective of the SMP, this is an area where there is an existing long term expectation of defence and where there is little strategic benefit in removing or retreating defences as this would not create a substantially more sustainable coastline in the longer term. In effect, retreat from the current defence line would involve major works to actually remove defences, the natural coast line would continue to erode, with rapid loss of significant economic and heritage assets and damage to the character of the area; still with an expectation of defending areas further to the rear. Due to the nature of the frontage and the continued erosion of the rock platform, the expenditure on such future set back defence would be of the same order as that currently experienced. As such the preferred SMP policy for the Headland concurs with that of the more detailed strategy; to hold the existing line.

The key issues relating to the detail of defence are currently being examined. There are concerns, however, as to the impact on the designated areas in front of the defence, it being argued that to extend defence over the intertidal rock is in effect advancing the line of defence. In defining a line, the intent of the SMP is with respect to the areas at risk rather than the specific nature of a defence. While the SMP highlights the potential impact on the natural environment, the preferred policy remains to Hold the Line in terms of protecting the land behind the defence. In detail, it has to be recognised that over much of the Headland frontage, options for maintaining the line of defence are limited and the discussion of this falls outside the remit of the SMP. It is only towards the northern end that there is any real scope for managing the coast in a more strategic manner. This links through to the management of the area of North Sands. The aim here, in terms of the Headland frontage is to ensure a sensible transition between areas, with the intent of reducing the pressure on the Headland defences in such a manner as to work with maintaining the integrity of the designated areas rather than continuing to be in conflict.

Hart Warren to Blackhall Rocks (including Crimdon)

Under the non active intervention scenario the coast will roll back and the cliffs to the north will continue to slump and erode. There will be some loss to the Golf Course and in the longer term possibly to the main car park. There will be a continued loss to the caravan park. There is, however, no overriding benefit in protection to these assets and any major

works to intervene would reduce the integrity of the natural conservation value of a naturally evolving coast line. The SMP policy for this frontage may be confirmed as active intervention meeting the overall aim to maintain a naturally developing frontage, important for both recreation and natural heritage.

Within this policy, however, it should be recognised that there is little significant interaction beyond that at the local level. The overall pressure on the frontage is quite small. Several issues result.

As part of the Bio-diversity opportunity study, it was suggested that consideration should be given to the use of dredgings from Tees Port to create offshore banks which would provide enhanced roosting areas for birds. While supplementing beach material in the area would tend to support and potentially slow the process of roll back at the shoreline; possibly resulting in increased development of the natural dunes, it is unlikely that there would be a substantial increase in the size of the offshore banks. It would, however, act to maintain supply of beach material to the south and some coast protection benefit would be derived from this. The use of such material would require detailed examination of dredgings in terms of potential pollution and assess suitability in terms of material size. An excess of fine material could result in fine material being deposited temporarily on the SPA rock outcrops of the Headland. While it is recognised that this impact might be slight, given the high energy environment of the Headland, this would need to be considered.

In addition, the increased amount of material would tend to reinforce the development of the spit across the mouth of the Crimdon Beck and this would result in a tendency for the beck to erode the High Dunes of Hart Warren more quickly.

Even in the absence of additional material being deposited in the nearshore zone, the beck will continue to be diverted by natural processes in towards the High Dunes. This is a local feature of the frontage, caused by the more general coastal processes, but having little impact on the overall coastal behaviour. Local management of the situation, such as minor training of the course of the beck could be feasible; if at the local level this was felt desirable to manage use and interests in the area, without any significant change to the overall policy of non active intervention. Any such actions of this nature would need to be considered in detail with the clear intent of steering the natural development of the frontage rather than imposing a long term hard control of the overall processes.

As with the Headland area, consideration has to be given to the interface between the Hart Dunes/Crimdon frontage and the area to the south. The aim of this transition is to maintain the ability of Hart Dunes to develop relatively naturally, maintaining the degree of sediment supply and retention. At present there is a degree of influence imposed by the array of outfalls in front of the Britmag frontage.

North Sands

The main strategic concern in developing the SMP policy really focuses on the area of North Sands. Here, there remains a degree of flexibility in the approach with potential longer term benefits. With the closure of the Britmag works and the investigations showing that contamination from the Spion Kop bank is relatively insignificant, the current policy from the emerging strategy is for no active intervention. The predicted erosion zone over the next 100 years is of the order of 50m and as such the frontage is not under significant pressure; this being largely down to the fact that the area still acts as a sediment sink (an area where there tends to be a net accumulation of sediment rather than a net loss). With sea level rise

there would be this pressure for the coast to erode back, maintaining the shore's ability to retain material. As this process continues, so the hard defences at the southern end (the northern end of the Headland frontage) would become more exposed with a loss of the beach in this area. Similarly, to the north (the interface with Hart Dunes) the whole frontage will progress back. In this area the impact may be more significant initially as the outfall array in front of the old Britmag works is lost.

Within the area of North Sands itself, there would be loss of the dunes and to the LNR, fronting the Cemetery, as the natural shoreline is squeezed against the area of the Cemetery. This is the concern expressed by the Friends of the Spion Cop in their response to the Draft SMP. There would also be the loss of sections of the Spion Kop industrial area and a general significant reduction in width of useable land along the North Sands ridge.

Consideration is being given to appropriate development opportunity in the area as part of the general regeneration of the Hartlepool region. This, strictly, does not form a consideration in determining coast protection policy; policy and funding under coast protection being aimed at reducing risk and, where justified, being for the protection of existing assets. To a large degree this becomes a planning issue, in relation to the sustainable development of the area as a whole. However, taking the broader intent of the SMP2, this discussion has to take development opportunity in to account, given that this is a potential pressure on the coast over the next 100 years.

In considering this and not withstanding the coast protection recommendation for no active intervention emerging from the detailed strategy this discussion still needs to consider different scenarios of management. The essential consideration in this area is in allowing a width of defence rather than maintaining a specific line. Given the assessment that this is an area where sediment has an opportunity to accumulate due to the underlying orientation of the shoreline, three scenarios may be considered.

Scenario (a)

Description: Embark upon a policy of linear defence based on development pressure for the full width of the ridge.

Rationale: To maintain a viable area of development and providing a continuation of defence from the Headland. .

Implications: Works to support the defence at the northern end of the headland and to allow full width of development would typically be in the form of rock revetments. These would form effective headlands on the coast. As the coast between defended areas and at Hart Warren rolls back these works would either need to be extended along the line of the coast, most probably linking to provide a continuous hard defence over the frontage or would require works to be undertaken to defend against outflanking. In the latter case the erosion of the area would result in loss to some of the Cemetery; although controlled by the adjacent hard points, this would be less than under a non active intervention policy. In the former case the Cemetery would be defended, but with significant loss in integrity of the LNR. In either case there would be a need to continue the defence at the northern end to stop outflanking of any new development.

It would be anticipated that having commenced this approach that planning policy would be to allow development of the frontage because it had been defended.

Impacts: The long term impact of the scenario would be for a continuation of the highly visible defence line acting to continue the defence of the already developed residential area to the south. While being sustainable in that linear defence of the frontage would require little major effort to

maintain, there would be increased need for defence in the longer term, with a general reduction in beach levels as this frontage is exposed by the roll back of Hart Warren to the north. There would be loss of both amenity value and that of nature conservation. The cost of defence would be partially justified by the need for works at the southern end in maintaining the defence of the start of the Headland, but the principal costs would need to be justified in relation to the development of the area. Even if defence were extended to include protection to the Cemetry there would be a loss of the natural beach and dune in front. Such a defence would be to the partial detrement of the LNR andto the aspirations expressed by consultees on the Drfat SMP.

Scenario (b)

Description: Creation of a buffer zone of some 50m behind the current backshore crest.

Rationale: The aim would be to exclude new development within a 50m zone of the present cliff line, allowing width for a natural roll back of the shore. This would be reassessed from monitoring but at some point the zone of coastal erosion would impinge on the zone of permitted development and a retired defence line would be constructed. The intent would be to delay the needs for works and to build such works on a more sustainable line.

Implications: No works would be undertaken to protect assets within the buffer zone and as existing structures (assets) were exposed these would be removed. It has been shown that it would be acceptable to allow a slow dispersion of the eroding made ground in to the coastal zone. (The acceptability of this in relation to the water frame work directive would need to be confirmed.) Defence works would be constructed eventually in a more sustainable position based on a developing improved understanding of the impact of sea level rise on the frontage. Works would be undertaken to maintain the defence at the northern end of the Headland defences.

Impacts: The anticipated loss of the pipes running over the foreshore would reduce their affect in maintaining local beach levels and this may result in a period of quite rapid erosion of the shoreline. The existing use of the Spion Kop area would be determined by the rate of loss. The dune to the front of the Cemetery would reduce in width and a significant proportion of the Cemetery itself would be lost; in part due to submergence under the rolling back of the dunes. Development of the frontage would be more limited but would remain considerably less in conflict with coastal processes. No benefit would be derived to adjacent frontages in that there would continue to be a general erosion of the Hart Warren dunes and there would be a loss of beach at the northern end of the Headland frontage.

Scenario (c)

Description: Limit and manage erosion through strategic control structures.

Rationale: Rather than purely rely on planning control, the aim would be to allow the frontage to develop physically in a planned, controlled manner, creating width and then accepting erosion in a planned manner as the coast readjusts.

Implications: Typically, works would be undertaken in the form of detached or shore-linked breakwaters at the northern end of the Headland defences and at strategic areas along the frontage. There would still be a need for planning buffer zones such that development of the width created is not developed. The details of such an approach and the extent to which control would be advanced would need to be developed in terms of a master plan for the area. There would be limitations to the degree to which control was moved in to the foreshore area so as not to act to the detriment of the general sediment movement to the coast to the north. The intention in this would be to allow a controlled adaptation from existing use to a more sustainable planned use of the frontage.

Impacts: This approach would allow a less severe transition from the hard defence line to the south, through to the natural coastline to the north. The scale of intervention would not significantly affect the general coastal behaviour and could provide scope to increase protection to the northern hard defence line, potentially reducing impact on the SPA. Although an overall master plan would need to be developed, works could be staged such that:

- expenditure could be staged.
- that a degree of flexibility is maintained, given the uncertainty associated with future development and climate change.

Works would be planned such that the LRN could be enhanced while protection was still provided to the Cemetery. Potential contamination could be minimised.

Scenario (a) cannot be demonstrated to be economically justified based on existing assets. As such defence policy of the coast is being fundamentally driven by development opportunity. This would, however, still imply a future commitment to maintaining coast protection, which might eventually fall upon the Council. There is no environmental benefit and this approach does not meet the basic principle of the SMP that there should be a reduction in reliance on defence in reducing risk. The scenario provides little scope for adaptation and while nominally technically sustainable because of the nature of pressure and behaviour of the shoreline, it is likely that there would be regret in adopting this approach when considered from a future perspective. As such a simple hold the existing line is felt to be inappropriate as the SMP policy.

Scenario (b) has significant merit in reducing the overall impact of coastal defence upon a frontage that has value as a semi-natural frontage. In the longer term there would still be squeeze between the nature conservation interests and the wish to protect assets set further back such as the Cemetery. Also there would still be a need to address the maintained defence at the northern end of the Headland frontage, both to reinforce the existing defence and to provide end protection to stop outflanking. The scenario buys time but ultimately is likely to lead to a similar decision as at present, where a linear defence would still be required. The SMP policy would be for short to medium term retreat, with a longer term policy of hold the line. The policy is reactive to development pressure and while alleviating the need for immediate needs in terms of coast protection, implies a future need with little scope for adaptation.

Scenario (c) would require a co-ordinated plan for the frontage based on the principles of coastal management but would provide scope for adaptation in the future with a view to providing a longer term, more sustainable management approach to the frontage. By reinforcing the existing width of the shoreline there would be greater flexibility in subsequent decisions as to local defence of the frontage, driven by planning rather than defence. It would be anticipated that within the created width there would still be the creation of a buffer zone allowing semi-natural development of the coast and dunes. The approach also provides scope for examining how defence in this area may be best configured to modify the exposure at the northern end to the Hartlepool Headland, potentially reducing the need for longer term works in this area. This policy approach would need significant detailed consideration in association with the forward planning authority with potential joint funding between coast protection and potential development funds. In terms of SMP policy this scenario would be short to medium term hold the line with a long term policy of retreat within thresholds defined by the control structure imposed on the coast.

Hold the existing line is rejected due to its longer term impact. Retreat and then hold, is a viable option over the period of the SMP. Hold and then controlled retreat only becomes a practical approach within a master plan for the area. Assuming this is accepted, this is would be the preferred SMP policy. Because of the requirement in drawing together different interests and putting together a co-ordinated funding approach, this policy has to remain provisional. Should this be unacceptable, or considered unachievable then the policy would

revet to Scenario (b) with a planning decision being required as to the extent of a buffer zone.

MANAGEMENT AREAS

The policy development zone is sensibly divided into two Management Areas. The first of these covers the coast between Chourdon Point and Blackhall Rocks, being treated as one policy unit. The second draws together three policy units:

- The Crimdon Valley
- North Sands
- The Headland

In terms of the broader management of the coast, the interdependency between these two management areas is primarily that progression of values from those of the Heritage Coast through to the needs to the developed area of Hartlepool. Policy statements or summaries are presented by management areas in the following sheets.

4.4.2 MANAGEMENT AREA POLICY STATEMENTS (MA10-MA11)

Location reference:	Chourdon Point to Blackhall Rocks
Management Area reference:	MA10
Policy Development Zone:	4

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area supports the intent of the Durham Heritage Coast, allowing natural development of the coastline. Within the policy of no active intervention there is scope for local management of access and management of natural heritage in that minor works adapting use and interest of the shoreline will not impact on the overall coastal processes. In the long term there may be local works required to maintain use of the railway line. There is little scope or advantage seen in relocating this feature. There needs to be planning for he retreat of the coastal path in areas as this is threatened by erosion.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	To allow natural development of the coast.
Medium term	To allow natural development of the coast.
Long-term	To allow natural development of the coast, but to review the need for local protection to the railway line.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
10.1	Chourdon Point to Blackhall Rocks	NAI	NAI	NAI	Local management in line with objectives of the Durham Coastal Strategy
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

There is no change from the present policy or that developed within the strategy.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

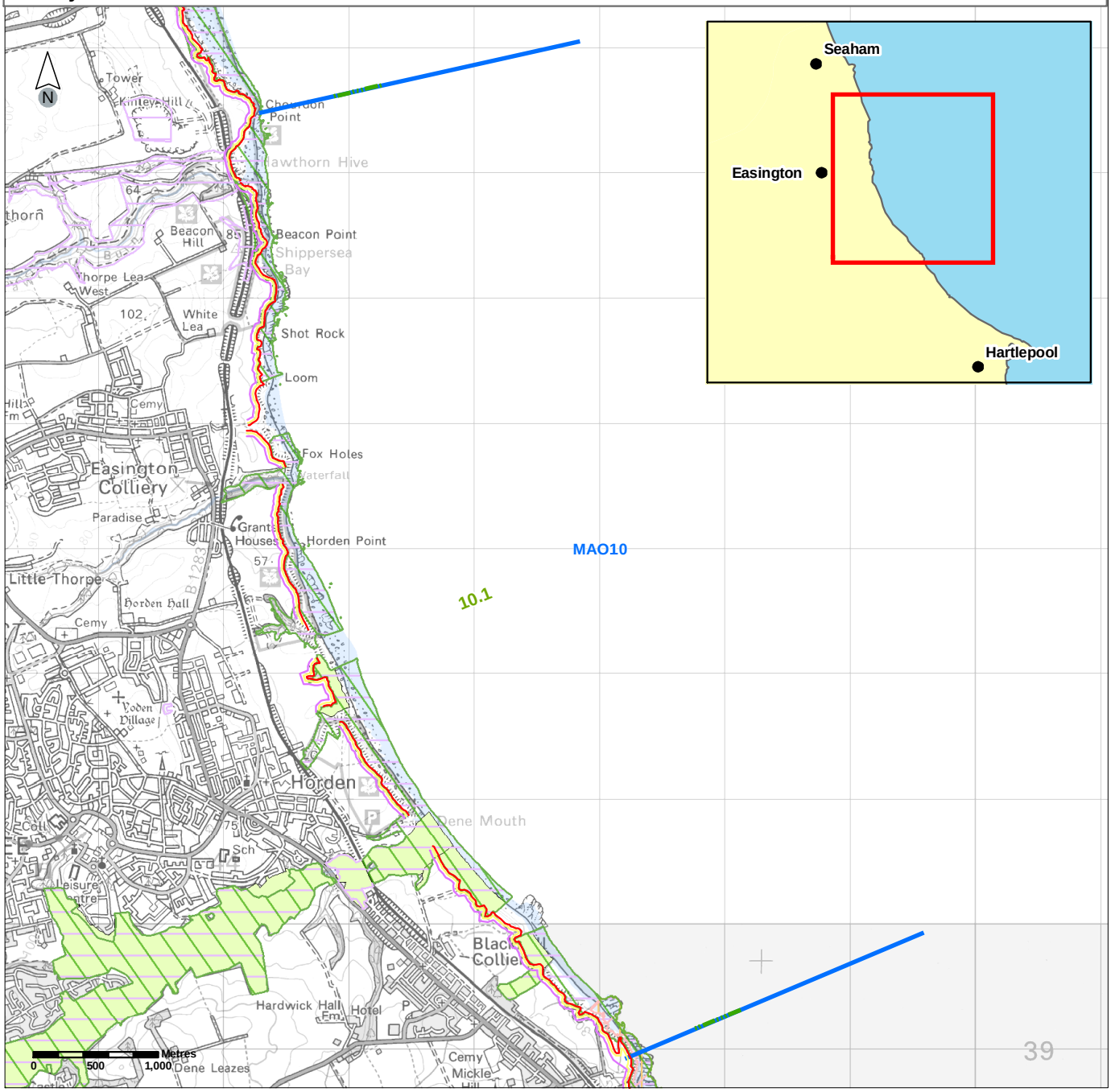
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	8	5	3	16
	Preferred Plan Damages £k PV	8	5	3	16
	Benefits £k PV				0
	Costs of Implementing plan £k PV	0	0	0	0
Description of damage and benefits under preferred plan: • No loss of hard assets. • Loss of agricultural land.					
Heritage	Loss of some pill boxes.				
Amenity	• Maintains use of coastline in line with Heritage Coast Policy.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	Yes, in relation to mining waste.
Impact of geomorphology and hydrodynamics	Yes, in relation to mining waste.

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA10
Policy Units 10.1



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
To allow natural development of the coast.	To allow natural development of the coast.	To allow natural development of the coast, but to review the need for local protection to the railway line.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 habitat: vegetated sea cliffs of the Atlantic and Baltic coasts	
Sub Feature(s) Littoral Rock (Blackhall Rocks) - This unit is important for its large stromatolite domes (present as part of the foreshore)	**Sensitivity** Loss of SPA and Ramsar designated habitat through natural erosion.	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores with associated boulder and cobble beaches.
Potential effect of policy	This policy suite supports the natural development of this SPA and Ramsar designated coastal habitat to continue.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

SAC Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, ruddy turnstone, purple sandpiper)	
Sub Feature(s) Calcareous lowland grassland (between Chourdon Point and Hornden)	**Sensitivity** Habitat loss through natural erosion.	**Conservation Target** The overall length and / or area of the cliff habitat of the site is maintained taking into account natural variation.
Potential effect of policy	This policy suite supports the natural development of this SAC habitat to continue. However, the area of most concern is the eroding cliffs between Foxholes Dene and Horden Point - here the vegetation is suffering coastal squeeze as this area of clifftop is still subject to arable crops. To the south of Horden Point the cliffs are protected by colliery wastes on the beach.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA10

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
National	Chourdon Point to Loom and onto Blackhall Rocks is part of the Durham Coast SSSI. Dene Mouth and Blackhall Colliery are all part of the Durham Coast National Nature Reserve.	10.1 Easington Colliery, Horden Colliery, Blackhall Colliery - Potential contamination of SSSI foreshore features due to leaching of contaminants.	Assessment of risk of contamination from redundant mine workings, including potential to be subject to erosion, timescale and environmental consequences.
Local	None	N/A	None proposed

ACTION PLAN FOR MANAGEMENT AREA MA10

Action	By when	Responsibility	Cost £k
Local management	On going	Durham Heritage Coast	
Schemes: No schemes planned			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Blackhall Rocks to Heugh Breakwater
Management Area reference:	MA11
Policy Development Zone:	4

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the zone recognises the change between the policy of managing the natural evolution of the Durham Coast through to the need for hard defence in protecting important assets, cultural and heritage value and residential areas at the Hartlepool Headland. The key area for potential change is in the transition along the frontage of North Sands. To the north is a policy allowing natural development of coastal processes and to the South (at the Hartlepool Headland) is a policy for holding the line. Between a provisional policy is developed which relies on development of a coastal master plan. This provisional policy is for initially establishing a degree of control on the coastal processes with a longer term policy allowing the coast to develop in a controlled manner.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	To allow natural development of the coast between Blackhall Rocks and Hart Warren. To provide key point protection to areas of North Sands within a general master plan for future development. To hold the line along to Hartlepool Headland.
Medium term	To allow natural development of the coast between Blackhall Rocks and Hart Warren. To establish defence width through control to areas of North Sands as erosion takes place. To hold the line along to Hartlepool Headland
Long-term	To allow natural development of the coast between Blackhall Rocks and Hart Warren. To allow natural retreat within the imposed control to North Sands. To hold the line to Hartlepool Headland

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
11.1	Crimdon Valley	NAI	NAI	NAI	Local management to beck may be considered. Possible beneficial use of dredgings for environmental reasons.
11.2	North Sands	HTL	HTL	MR	Provisional policy of controlled management of the frontage subject long term development master plan. Otherwise the policy reverts to retreat.
11.3	Headland	HTL	HTL	HTL	Current discussions with EN with respect to impact on the designated area.
Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention, MR – Managed realignment.					

CHANGES FROM PRESENT MANAGEMENT

There is no change to present policy over the area of the Crimdon Valley, nor over the Hartlepool Headland frontage. Not withstanding the emerging coast protection strategy conclusion that defence along the North Sands frontage would not be economically justified in terms of existing risk, the broader perspective being allowed through the SMP2 identifies opportunity for a more managed approach to this frontage. As such the SMP recommendation is to change to a policy of controlled realignment. This remains provisional, dependent on appropriate master planning of the area

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

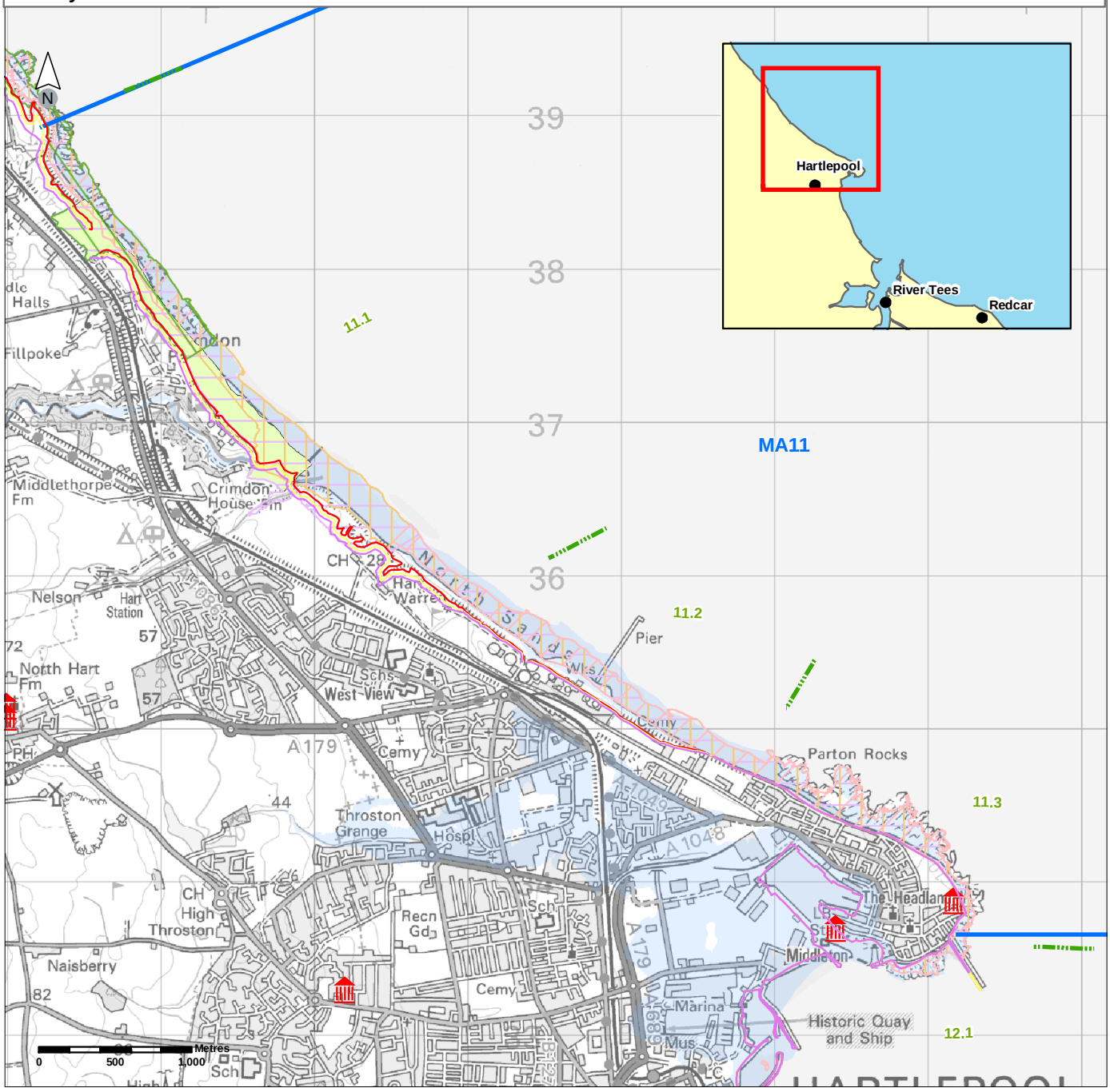
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	-	-	-	34,600
	Preferred Plan Damages £k PV	-	-	-	0
	Benefits £k PV	-	-	-	34,600
	Costs of Implementing plan £k PV	13,976	31	456	14,483
Damages from draft strategy not split over epochs. Costs based on strategy but including estimated costs of control at North Sands. Description of damage and benefits under preferred plan: • Retreat of coastline at Crimdon Park with progressive loss of sections of caravan park and car parking. • Potential loss of areas of the Golf course. • Maintain area for development to North Sands • Maintain management to LNR and Cemetry • Maintain defence to urban area of Hartlepool Headland. • Maintain Headland promenade and open areas.					
Heritage	No loss of heritage structures. Battery and Headland area preserved.				
Amenity	• Maintained use of Crimdon recreational area. • Partial loss of Golf Course • Recreational and tourism facilities retained to Headland.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	Yes, at a local sacle

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA11
Policy Units 11.1-11.3



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
To allow natural development of the coast between Blackhall Rocks and Hart Warren. To provide key point protection to areas of North Sands within a general master plan for future development. To hold the line along to Hartlepool Headland.	To allow natural development of the coast between Blackhall Rocks and Hart Warren. To establish defence width through control to areas of North Sands as erosion takes place. To hold the line along to Hartlepool Headland	To allow natural development of the coast between Blackhall Rocks and Hart Warren. To allow natural retreat within the imposed control to North Sands. To hold the line to Hartlepool Headland

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, ruddy turnstone, purple sandpiper, red knot and common redshank) and an internationally important assemblage of waterfowl.	
Sub Feature(s) Littoral rock (Blackhall Rocks) - This unit is important for its large stromatolite domes (present as part of the foreshore)	**Sensitivity** Loss of SPA and Ramsar designated habitat through natural erosion.	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores with associated boulder and cobble beaches.
Potential effect of policy	This policy suite supports the natural development of this SPA and Ramsar designated coastal habitat.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, red knot and common redshank) and an internationally important assemblage of waterfowl.	
Sub Feature(s) Littoral sediment (North Sands to Hartlepool Headland)	**Sensitivity** Loss of SPA and Ramsar designated habitat through natural erosion.	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores, intertidal sandflat and mudflat, shallow coastal waters and saltmarsh.
Potential effect of policy	There is currently a danger of short-term coastal squeeze and subsequent net losses of SPA and Ramsar designated foreshore habitat. However, the intent of the SMP policy suite is specifically seeking to provide enhanced levels of accretion of soft sediment in this area, within the context of a management plan. The default policy would be retreat with a buffer zone created against development. Additionaly toe defences may also lead to increased energy from wave reflection, and the impacts of this on foreshore communities will need to be fully considered at the scheme stage.	
Preventative Measures SMP policy (in the context of a management plan) will	**Mitigation** None	**Implications for the integrity of the site** SMP policy actively seeks to prevent coastal squeeze and enhance habitat levels.

provide for enhanced levels of littoral sediment and address the impacts on foreshore communities from wave reflection of any additional toe defences at the headland.		

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, red knot and common redshank) and an internationally important assemblage of waterfowl.	
Sub Feature(s) Littoral rock (Parton Rocks) - this feature is not identified within the SSSI unit, however, it is clear that this is an important feature for the SPA.	**Sensitivity** Loss of SPA and Ramsar designated habitat through natural erosion.	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores, intertidal sandflat and mudflat, shallow coastal waters and saltmarsh.
Potential effect of policy	This policy suite supports the natural development of this SPA and Ramsar designated coastal habitat. However, holding the line at Hartlepool Headland may result in the loss of habitat due to the provision of enhanced toe protection over the littoral rock sub-feature at Parton Rocks.	

Preventative Measures Ensure that toe protection takes the form of rock habitat suitable for the SPA interest, and, therefore, represent no net loss of available SPA habitat.	**Mitigation** None	**Implications for the integrity of the site** Provided that the preventative measures described are implemented, no adverse effects are anticipated on the integrity of the European site.

SAC Site Feature	Annex 1 habitat: vegetated sea cliffs of the Atlantic and Baltic coasts.	
Sub Feature(s) Calcareous lowland grassland (between Blackhall Rocks and Crimdon)	**Sensitivity** Habitat loss through natural erosion	**Conservation Target** The overall length and / or area of the cliff habitat of the site is maintained taking into account natural variation.
Potential effect of policy	This policy suite supports the natural development of this SAC habitat.	

Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA11

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
National	The coastline is all part of either the Durham Coast SSSI to the north, or Tees and Hartlepool foreshore and wetlands SSSI around the headland. The Durham Coast NNR extends to Crimdon Park. The area contains high quality fixed sand dunes and last the known colony of burnt tip orchid *Orchis ustulata* in the North East.	11.2 North Sands – Short term coastal squeeze, loss of SSSI foreshore. Possibility of longer term readjustment and recovery of littoral and dune habitats 11.3 Hartlepool Headland – loss of predominantly rocky SPA/SSSI foreshore	Limit and manage erosion through strategic control structures. Buffer zones should be applied to any new residential development in the vicinity. New works placed in front of existing defences would impact on SPA, impacts and compensation would need to be agreed
Local	None	N/A	None proposed

ACTION PLAN FOR MANAGEMENT AREA 11

Action	By when	Responsibility	Cost £k
Management strategy for Crimdon Valley. *Potential for biodiversity. Resolve local land use together with access and environmental enhancement.*	2009	*Co-ordinated by Hartlepool BC/ Easington DC/ Durham Heritage Coast*	5
Development strategy for area of North Sands. Develop an integrated approach to defence of the cemetery frontage. Identify potential erosion risk contribution. *Potential development in risk area. Opportunity for enhancement of designated area and local biodiversity. Ensure integration with redevelopment. Maintain heritage and amenity value*	2007	*Co-ordinated by* Hartlepool BC	25
Scheme Development for Headland. Detailed appraisal for improving defences. *High economic consequence. Impact on designated areas. Maintaining heritage and amenity*	On going	Hartlepool BC	40
Schemes: Schemes to be identified by strategies			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.5 PDZ 5 Hartlepool Headland to Saltburn Scar

4.5.1 Policy Development Analysis

DESCRIPTION

Physical

The zone covers a length of some 32km and can be seen as a series of three bays, formed between the Hartlepool Headland and the Long Scar rocks through to the rocks at Redcar and the shallower bay between Redcar and the Saltburn Scar beneath Huntcliff. There is further subdivision within these areas, reflecting the specific nature and local features of the coast line; most obviously in the complex structures around Hartlepool and the significant influence of the mouth of the Tees between Seaton Carew and Redcar, but also, still more locally, in the way in which the Coatham Sands is shaped by the nearshore slag banks or the slight forward position of Marske Sands. A more detailed description is provided by areas below.

Hartlepool. The northern end of the zone is defined by the Heugh breakwater extending out over rock outcrops (over a proportion of its length) beyond the main Headland. Between here and the entrance to the Victoria docks there is a promenade area (Block Sands) backed by sea walls and a raised road, giving on to the core residential development of the Headland. The foreshore is rock outcrop with a narrow, but in places dry, sand beach. The frontage curves into the area of the docks, with the outer limit of the docks being defined by the Pilot Pier. Within the shelter of the pier is a silty-sandy shingle/cobble foreshore in front of the Town Wall, again giving on to the core development area of the old town. Part of this area is defined at risk from flooding. Within the docks are generally vertical quay walls associated with the current port activities. The south western side of the docks, together with defences further south, provide a flood defence function in relation to one of the larger developed potential coastal flood compartments of the SMP area, extending back through both industrial and residential areas some 3.5km from the coastline.

The southern side of the docks entrance is trained by the Middleton Pier, with Middleton beach enclosed between here and the North Pier, covering the inner entrance to the main Hartlepool Marina. Middleton Beach is an area of intertidal sand with a small area of dry sand to the northern end. The back of the beach is fully defended, providing both a flood defence and erosion protection role. While the toe of the beach is well aligned with the general curved shape of the bay formed in the lee of the Headland, the upper beach shape, with its defences, is already well forward of the natural crest plan shape.

The arms of the breakwaters in front of the marina (North and South Piers) extend past the foreshore zone; but while acting to retain Middleton beach, have little influence on the general coastal shape, particularly on the heavily armoured defence running to the south. Far more significant at present, in this area, is the affect of the Long Scar and Little Scar rock outcrops further offshore. These natural features have clearly pulled the line of the coast out between Hartlepool and Seaton Carew. Even so, with the railway running close to the shore, the coastal road, intermittent areas of development and an area of flood risk extending inland, there has been a need to protect the natural curve of the coast with a rock revetment and seawall. This defence retains an area of open recreational land between the sea wall and the road behind.

Seaton Carew to The North Gare. To the south of Little Scar is the town of Seaton Carew, and beyond it, the open dune system of Seaton Sands. The northern section of the Seaton Carew town is relatively close to the defence line, with only the road between houses and the sea defence. The main part of the town sea front is set back and the defence line is fronted by a relatively wide, typically dry sand beach. While still exposed under more severe storm conditions, the defences are afforded considerable protection by the beach. Indeed, at the southern end of the town, the line of defence is set back behind the general line of dunes to the south and, quite probably, it is only the regular use of the beach, human trampling and use of the area by quad and motor bikes that stops much of this southern end from forming as dune. The dune itself is typically low, reasonably well vegetated and comprises a series of ridges further back indicating the line of the former wider mouth of the Tees and the accumulation of sediment that has occurred following the construction of the North Gare breakwater (1890s) and the training of the estuary mouth. To the back of the dunes is a wide flat and low expanse of estuarine land, now well vegetated, to the rear of which lies the core industrial land of the northern Tees Valley. Much of this area is defined as being at potential risk from coastal flooding, with the dunes providing the primary flood defence along the open coast. Within the dunes is a Golf

Course.

The defence of the low lying and industrial areas continues within the lee of the North Gare breakwater. Here there is a relatively narrow, straight section of dunes overlying a raised slag bank. This bank having been constructed at the same time as the North Gare breakwater. This section is fronted by a wide sandy foreshore over the northern section of the frontage, with a sandy silty foreshore running down to the slag banks protruding into the estuary at to the northern area of Seal Sands. The potential flood area includes the nuclear power station and extends in land to the Cowpen Marshes and significant areas of north bank to Teesport. There are, however, other defences set back from the shore line which defend this larger area. The Power Station is constructed at a slightly higher level than the land to the north.

South Gare to Redcar. To the other side of the Tees, the South Gare breakwater is a larger structure than the North Gare, but running parallel to the main channel of the Tees and built out over areas of deposited slag. Within the mouth of the Tees, to the south of the South Gare, is the Bran Sands bay, backed by dunes behind which are part of the Tees Valley industrial area. As with the northern bank, a significant area of the port infrastructure is defined within a potential flood risk area.

To the east of the South Gare breakwater is the wide expanse of the Coatham dunes. This area is protected at their western end by the slag banks, known as the German Charlies. Where these banks are high, they draw out the foreshore and the general line of the dunes. Between this point and the Coatham Rocks, at Redcar, a shallower dune backed bay has been formed. The dunes and open low-lying ground extend back some 400m, providing a good width of protection to the northern flank of the steel works and to the towns of Warrenby and Coatham. The dunes act as a flood defence system to the open ground and golf course behind, but unlike the north shore this potential flood area is not contiguous with the flood area associated with defences along the inner banks of the Tees. At the eastern end of the Coatham Sands there is a large caravan park, where human trampling of the dune face is very evident but where, even so, there is little obvious coastal pressure on the dunes. This good width of upper, generally dry sand beach continues in front of the Coatham car park, only reducing in width at the corner at the start of the Redcar sea front. There are coastal defences in front of the car park and these become heavier and more prominent approaching the corner at Redcar.

Redcar. The Redcar seafront extends as a defended headland over a distance of some 1.5km. This headland is formed by the presence of outcropping rock to the foreshore, with the Coatham Rocks to the west and the Redcar Rocks to the east. Between these two outcrops is a deeper channel (the Luff Way) opening to the east. In effect the general longer headland may itself be seen as two interconnected headlands formed behind the two main areas of rock outcrop with a shallow bay between. The natural protection afforded by these features and by the beach, therefore, varies along the frontage, with significant local variation in the interaction between waves and the hard linear defence at the actual defence line. The defences are predominantly concrete revetments backed by a low crest wall in areas, protecting the important coastal road, properties and commercial interests of the sea front town centre. The main core of the town extends back from the seafront, several kilometres inland. To the western end, returning round into the Coatham Sands, development is relatively sparse and the area is under consideration for redevelopment. To the eastern end of the seafront is residential property fronted by open sea front grass land, which in turn is fronted by a length of revetment and timber groynes. This area is still strongly influenced by the shelter provided by the Redcar rocks from the dominant northerly and north easterly wave directions. Although the coastal strategy for the area has demonstrated considerable risk of flooding due to wave overtopping of the main seafront defences, there is also a large area of property behind the open grassed strip which is at potential risk from flooding from inundation extending back over 1 km into the hinterland.

Marske to Saltburn. To the south east of Redcar the coastal hinterland starts to rise with initially low, vegetated till cliff rising to the higher coastal slopes at Marske-by-the Sea and through to Saltburn. While over the entire frontage there is a wide sandy foreshore with occasional evidence of rock outcrops, the backshore and toe of the coastal slope is more varied. At the western end there are areas of steeply cut till cliffs with little upper back beach material. This gives way to lengths where there are substantial shingle berms to the toe of the slope and, where the coast is cut slightly further back, areas of dry sand upper beaches; such as at Scanbeck Howle. At Saltburn, the toe of the slope is protected by a substantial sea wall and promenade and this continues through and is constructed to the rear of the small embayment at the valley of the burn itself. To the east of the burn there is fairly ad hoc defence in front of the Ship public house, behind a reasonable area of shingle and cobble upper beach. This merges through to the steeply rising cliff to the rear of the Saltburn Scar and continues through to the high cliffs of Huntcliff, at the end of this zone.

Much of this southerly extent of coast is backed by open recreational or agricultural land. Only at Marske and at Saltburn does development impinge on the coastal zone. At Marske much of the development is set back and only at Scanbeck Howle, where there are defences and further along at the Marske Cemetery, where there is not, do man made works closely approach the crest of the cliffs. In contrast, at Saltburn a significant area of the town, together with sections of the coastal road is situated close to the crest of the coastal slope or immediately behind defences. While at a broad level this southerly section of coast seems quite uniform in plan shape, in reality its shape and local orientation is extremely varied, influenced by local wave climate, by small changes in beach level and by variation in the materials of the coastal slope.

Environment

The whole zone exhibits a broad variation in both the human and natural environment. Virtually all of the northern section, from the Hartlepool Headland through to Seaton Carew is dominated by a complex mosaic of human development; from the residential and heritage values of the Headland, through the planned regeneration linking the Victoria Dock area through to the main commercial centre of Hartlepool; closely associated with the development of the Marina area, and through to the resort town of Seaton Carew. While these focus, primarily on the economic regeneration of the area, within this The Hartlepool Local Plan recognises the importance of developing and maintaining its Green Network, which includes areas of coastal common between Hartlepool and Seaton Carew, working within the broader context of the many internationally, nationally and locally designated areas for ecology and geology. Such designated areas include the SPA and Ramsar sites at the Headland and at Seaton Sands and the Hartlepool SSSI submerged forest just to the north of Long Scar.

During consultation on the Draft SMP, the importance of the commercial fishermen, yachtsmen and the lifeboat service were re-emphasised, in particular, with reference to the protection afforded to Tees Bay and these activities by the Heugh Breakwater. The point was also made by the Tees Bird Club that the area in the lee of the Breakwater provided important rock and sand foreshore habitat and that, as required by the designations for the area, this needs to be taken account of with respect to the management of the Heugh Breakwater.

The entrance and valley of the Tees is heavily modified from its natural state. Most obvious is the development of industry within the estuary plain and associated with this the reclamation of land and training of the Tees channel. Key developments are the Nuclear Power Station to the north of Seal Sands and the continuing operation of the Tees Port and associated port development; the latter being identified as structurally important within both the Hartlepool and Redcar and Cleveland Local Plans. Equally, within this area is the significant ecological importance of the international designation of the Teesmouth and Cleveland Coast SPA and Ramsar site extending either side of the Tees covering the Seaton Dunes and Common, Seal Sands and the South Gare and Coatham Sands SSSIs and further extending to cover the areas of the Coatham and Redcar Rocks and north to the Hartlepool Headland and Hartlepool North Sands (these latter areas being considered within the previous policy development unit PDZ4). The Tees Bird Club further emphasised the importance of these designations but also highlighted the importance of diverse habitats supporting these areas, expressing the need for considering the interaction between the need for intertidal foreshore, natural backshore habitat and high tide feeding areas.

Industrial growth, particularly associated with the lower Tees valley and the Port is seen as one of the keys to expansion of the local economy within Redcar and Cleveland. Even though coastal tourism has been in decline over the last few decades, tourism and coastal recreation, coupled to the natural attractiveness of the Redcar to Saltburn frontage, is seen as being a major component of economic regeneration for the area. The important elements in this, identified in the Redcar and Cleveland Local Plan, are the development of the water sport use of the South Gare and Saltburn areas, the high ecological value of the Coatham Sands and Dunes and the semi natural open coastline between Redcar and Saltburn. These areas are complementary to the different but essentially traditional formal sea front values of Redcar and Saltburn.

At Redcar the recently improved promenade, together with its associated amusement based commercial development, its local town centre, sea front accommodation and its local fishing industry provides a modern focus for tourism to the area. In addition Redcar is an important regional residential area. Further important development to the west of Redcar (the Coatham Links development) will take place, subject to planning permission. At Saltburn, the pier, the promenade and Victorian buildings has the quality to make it a significant visitor attraction and an important component to visitor appeal of the district as a whole. This is complemented by its attraction for surfing coupled to the water sports centre and the recent development of the “Saltburn Smugglers” centre associated with the Ship Inn.

In addition to the designated sites identified above, the coast south of Redcar is designated as a wildlife corridor and at Saltburn the shoreline falls within the Heritage Coast.

The English Nature Biodiversity Study identifies seven potential opportunities. These being:

- The potential realignment at Greatham Creek, to the northwest cells to create saltmarsh and extend grazing marsh.
- The potential use of dredgings from the Tees to support increased bird roosts through the creation of nearshore sand banks at Seaton Sands, at South Gare and Coatham Sands and at Bran Sands.
- Enhancement of North and South Gare Breakwaters to provide additional roosting and foraging sites.

Tees Archaeological records indicate an abundance of historic finds and features ranging from Neolithic period, through roman and medieval to present times. Particular clusters of features occur at the Hartlepool Headland, the area behind Long Scar, behind the North Gare and in the Redcar and Coatham areas. There is a more general scattering of interests over much of the rest of the coast. It is of interest that, taking the areas of the North and South Gare, there are distinct zones where features identified further forward are of the 19th and 20th century compared to those farther back being from earlier times. This emphasises the changes over the last 100 years and provides further indication of the habitable coastline prior to the works to train the mouth of the Tees. Quite clearly, there has been extensive human development of the coastal zone in this area for a long time and the archaeological potential of the area (as opposed to finds already identified) should be considered in management of the coast.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence.

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To support and help sustain the integrated development plans for Hartlepool, the Tees Valley and Redcar through to Saltburn.
- To maintain the operation and development opportunity of the internationally important Tees Port
- To reduce risk due to flooding.
- To maintain the tourism value of Seaton Carew, Redcar and Saltburn.
- To support the cultural heritage and recognise the archaeological potential of much of the area.
- To take account of the needs of the local fishing industry and boat use in the area.
- To maintain the diverse ornithological interests of the area.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:25yr	1:50yr	1:100yr	1:200yr
-1.95	2.65	3.25	3.48	3.61	3.68	3.80	3.87

Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 2.7m below Ordnance Datum.

Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between.

Source (extreme water levels): Babtie, 1999. Shoreline Management Plan, Seaham harbour to Saltburn, Sub cell 1c.

NB. Values for 200 yr ARI are interpolated between 100 yr and 250 yr values.

Wave climate

Return Period (1:X years)	Wave Height Hs (m)
0.10	3.87
1	6.03
10	8.63
20	9.50
50	10.69
100	11.63
1000	15.01

Source: Babtie, 1999. Shoreline Management Plan, Seaham harbour to Saltburn, Sub cell 1c. OUTRAY used to determine inshore wave data at 10 m contour.

Baseline Erosion Rates

Hartlepool	*0.3m/year*
Seaton Sands	*0.4m/year*
Coatham Sands	*0.2m/year*
Redcar	*0.4m/year*
Marske	*0.4m/year*
Saltburn	*0.4m/year*

All the above rates are based on existing evidence and are likely to increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

The whole zone is seen primarily as a sediment sink. Within the offshore area, there is general southerly feed from the north, and, although probably less strong, this continues to the south. However, the Tees Bay is sufficiently well set back within the influence of the Hartlepool Headland and the more massive general headland of the North York Moor, that sediment has tended to accumulate in the bay. The most obvious example of this has been following the construction of the Gare Breakwaters, with the growth of the Seaton and Coatham Sands.

Within this overall bay the principle control features are The Headland, Long Scar, the mouth of the Tees, Coatham and Redcar Rocks and Saltburn Scar and Huntcliff. In terms of existing processes, therefore various section of coast may be described.

The Headland to Long Scar. The general morphology is that of a crenulate bay with a typical movement of sediment in towards the Headland at the northern end and to the south behind Long Scar. While the overall shape of the bay is reinforced by the presence of the Heugh breakwater, this natural shape is, also interrupted and held forward of its natural line by various coastal works. The Headland (and breakwater) provides significant protection from waves from the north to north east. Furthermore the presence, particularly of the Heugh breakwater, tends to cause diffraction of waves from these directions and, due to the breakwater, further round to the east, allowing the deposition of material immediately in the lee of the Heugh breakwater, along Block Sands, within the entrance of Victoria Dock and on Middleton Beach. The source of material is likely to be from the nearshore bed. However, with the exception of the area of Block Sands, the advanced position of the defence line is such that the full width of a natural beach is never possible. Middleton beach is held initially by the Middleton Jetty (as is evidenced by the accumulation of sand at the northern end) but the extent to which this jetty influences the length of the beach is limited. In the absence of the Heugh Breakwater not only would there be a significant increase in wave height (as indicated by the strategy study) but there would be a substantial loss of sediment from this small bay. The orientation of waves into this area would be significantly changed causing scour along the back defence of the Middleton beach and to the face of the North Pier. In a similar manner, in the absence of the Heugh breakwater waves would scour along Block Sands creating both significant deposition within the entrance to Victoria Dock and the potential for a cross wave over the entrance channel.

Within the entrance of Victoria Dock, the Pilot Pier acts both to reduce wave activity against the old Town wall and allows deposition of material.

In its current configuration, and while there would be pressure on the frontage to erode, the northern frontage has reached a reasonable state of equilibrium and is not therefore seen as being unsustainable.

South of the South Pier to the Marina, the shore defences are again forward of the natural coastline. There would be only occasional sediment supply and the drift system is to the south. This has resulted in a low generally sediment starved beach. This is far less a feature of constrained feed into the area than the fact that the shoreline is too far advanced to allow a natural beach to form. The southerly movement of material from this section is partially held by the affect of the Long Scar and this has allowed an increase in beach level. The rock outcrop feature is submerged on high water and may be less effective given sea level rise. While currently there will be some movement of sediment further south, the influence the feature has on the coast suggests that the shoreline is not significantly out of line with the net angle of wave exposure.

Long Scar to Redcar. In many ways this section may be seen as the sump of the Bay. The estuary assessment has indicated that in the past the estuary was typically ebb dominant, suggesting a collecting point of coastal sediment from both north and west but with the flow of the estuary then transporting sediment back into the nearshore regime. The training of the channels with the construction of the breakwaters, together with the deposition of slag at the mouth moved the whole coastline forward allowing the development, or consolidating the development of the major dune systems to either side. The various dune ridges, most prominent to the north give a depth to these systems untypical of many of the more single ridge systems of the north east coast. While sediment still tends to be moved towards the mouth of the estuary under varying wave conditions, the frontages are seen as being in relative equilibrium. As such, and especially given the possible suggested change to a flood dominated estuary due to the construction of the barrage, there will be some loss to the open coast system as material is fed into the estuary and material is subsequently dredged and

deposited offshore. Depending on wave conditions material does by pass across the mouth of the Tees. Also, wave modelling in the area, does suggest significant wave focus, particularly at points along the Seaton Sands. The position of specific wave focus varies with offshore wave direction and this is seen as being confirmation of observations made during consultation of periods of erosion close to the North Gare. This effect is not, however, seen as being linked to the Heugh Breakwater as was suggested by the consultation.

Both Gare breakwaters hold the coast in a forward position. Loss of these structures would tend to cause a significant change in the coast to either side, resulting in loss of the semi natural equilibrium that has developed, with material moving south from Seaton Carew, causing significantly increased pressure on the defences to Seaton and a retreat of the Coatham Sands. It would also result in difficulty in maintaining the navigable channel to Teesport.

More locally at the northern end of this section of the coast, Seaton Carew benefits from being set slightly back from the general line of the shore. This has enabled a healthy beach to develop in front of its defences, highlighting the general net equilibrium of the coast.

At the Redcar end, the corner of the defences between Coatham and Redcar is seen as being quite critical. The strategy study for the Redcar frontage has demonstrated how Redcar and the Coatham and Redcar Rocks act as a headland. It is indicated that there is a general potential net movement of sediment across the frontage in a southerly/easterly direction but how, during any specific storm, movement particularly to the west; under an easterly storm, can cause movement of sediment an order of magnitude greater than this net drift. The study also highlights that the main extent of sediment movement is to the seaward face of the rock outcrops and that the Luff channel, between the two main rock outcrops, forms a significant sediment supply pathway from the nearshore zone. In addition, the modelling undertaken for the study demonstrates that under a variety of wave conditions there is a consistent strong wave generated pressure westward at the shoreline at the corner between Redcar and Coatham, towards Coatham. This forms a reversal of the net drift system along the Coatham Sands acting then to form an area tending to accumulate sediment towards the transition between Coatham Sands and the Coatham frontage (in the area of the Caravan park and the the corner of Majuba Road; this possibly helping to hold the beach against the eastern end of the Coatham Sands. At the same time there will be a tendency for a drift divide to have developed towards the eastern end of the Coatham frontage. The area to the eastern end of Coatham Sands should not, however, be described as a strong sediment sink (the converging drift systems aparently being far less clearly established than experienced to the North of the Hartlepool Headland; *reference to PDZ4, Management Area 11)*. Neither is the drift divide to the eastern end of the Cotham frontage fully developed such that this area is unable to hold sediment.

This section immediately to the west of Redcar is, therefore, an area of transition between the relatively stable shape of the Coatham Sands and the pressure on the Redcar frontage; in effect the frontage may be seen as the southern or eastern flank of the Tees Valley sump. Normally, with the easterly trend of sediment movement towards the western end of Redcar and the slight reversal of drift at the corner one would anticipate a reasonably healthy beach. This is seen in the wide expanse of sand infront of the low wall along this length and in the regular wind blown sand over the car park in this area. Under a more extreme easterly storm, the pressure would be at the corner to the Redcar sea front, tending to expose this corner and move sediment away towards Coatham. As long as the corner at Redcar is maintained this natural protection to the west of Redcar is likely to be maintained.

However, with sea level rise the processes will tend to change. The pressure on the corner to the Redcar seafront will increase as the nearshore rocks become more submerged, and the length of frontage to the west of Redcar that is exposed will increase. Possibly more significantly, as the Coatham Sands frontage sets back, there will be greater discontinuity of the coastal line between the set back dunes and the more exposed line of existing defence along the Majuba Road frontage. This area will tend to change from being a sediment sink to one where there is increasing pressure on the end of the existing defences.

Redcar to Saltburn. As stated above, movement of sediment over the Redcar frontage is very variable and highly dependent on offshore wave direction. This results in periods when the beach is healthy and periods of intense general scour. Due to the nature and position of the rock outcrops, wave exposure to the defence line is similarly varied. In particular the central section of the headland can be very exposed and this is exacerbated by local persistent scour problems between West Terrace and King Street slipways. Possibly associated with this is the general accumulation of sediment to either end of the critical central frontage.

There is little strong visual evidence for significant net sediment transport to the upper foreshore to the east of Redcar, although modelling of the frontage does indicate a net movement to the east. The initial groyned and reveted section of the coast has a history of long term slow erosion of the low till cliff (hence the protection works). Immediately behind this section is a potential flood area, with particular low points at the end of Granville Terrace; very clearly gaining protection from both the Coatham and Redcar Rocks, and at a point close to Lily Park; this area being more generally exposed to the open sea. The slight change in orientation of the coast at the end of the revetment does show continuing signs of erosion, although this is quite localised with a more resilient shingle toe having formed to the coastal slope only a couple of hundred metres further along the shore.

Such variation is evident along the entire frontage, again suggesting this is a well aligned shore, with little significant net drift. Wherever the coast sets back, even by only a matter of 20m, small pocket beaches of dry sand are able to be established. It is noted from wave modelling that the nearshore is highly irregular and local features such as The High rock outcrop cause local wave focussing and potentially variable drift patterns. It is also noticeable that the width of the beach varies over the frontage, again creating local areas of more intense pressure to the coast. Given a net movement to the east, it would be expected that Saltburn would tend to be an area of sediment accumulation. In reality, there is a far stronger indication that this is an area of higher wave energy with the tendency for a shingle upper beach and movement of finer sand sediment to the west.

Overall, therefore, much of the zone is seen to be in a relatively stable configuration, dominated by the various principal and largely natural control points. There is, however, a degree of interconnectivity with weak sediment transferring at the shoreline between bays and more significant general transfer around the bay in the nearshore zone and significant transfer between foreshore and nearshore areas.

Unconstrained:
In the absence of the main man made control features there would be significant change in the coast. The Hartlepool frontage would set back exposing the relatively large potential flood area extending back from Middleton. The area of Long Scar would similarly erode, but more slowly, exposing the coast to the south at Seaton Carew. More massive change would occur at the mouth of the Tees and this would cause a general loss of the sand dunes to north and east. To the northern side such change would also increase erosion of the Seaton Carew frontage. To the east, the Redcar Headland would form a harder point such that sediment drift along the upper beach to the east would tend to reduce and, material moved westward, would tend to be lost to the eastern frontages. The bay to the east of Redcar would deepen, albeit slowly with increased erosion to Marske and Saltburn. The cliffs at Saltburn would be undercut and there would be significant erosion to the crest of the slope.

From this it may be seen that while the training works to the Tees have only a local impact on wave exposure to the bay (the main influence in this regard being the natural hard Hartlepool Headland) they have a significant control on the whole shape of the central bay and a subsequent influence on sediment movement over the broader area.

MANAGEMENT

Present Policy

SMP1	Policy
The zone is divided into management units:	
C6, C7, C8, C10, C11, C13, C14,and C16	Hold the Line
C12, C9 and C15	Do Nothing
Hartlepool Coastal Strategy	
The draft strategy confirms the overall SMP1 policy for maintaining the general line of defences over the next fifty years. It does however recommend a deferred policy with respect to the Heugh Breakwater while anticipating a decision to only retain a part of the structure. This will result in the need to enhance defence of Block Sands either with a rock revetment or concrete toe beam.	Hold the Line
Victoria Harbour Master Plan	
The plan sets a future for redevelopment for the 121 hectare site focussed around the redevelopment of the Victoria Harbour, Middleton frontage and extending over the potential flood plain to the rear. The plan includes further development of the harbour and Middleton and assumes continued maintenance of defences to these areas.	Hold the line.
Redcar Beach Study	
The draft strategy considers the main sea front of Redcar and confirms the SMP1 policy to maintain the line of defence. The proposed work is a reconstruction of the revetment and increased height to the central length of defence to 1:100 year standard. The groynes to the east of the frontage would be retained and refurbished as required.	Hold the Line

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

The majority of defences to the Hartlepool frontage, with the probable exceptions of the Pilot, and South Piers but including the Heugh Breakwater, would progressively fail over the next 50 to 100 years. While the considerable debris of failed defence would still have local impact, the overall line of the coast would retreat some 100m to 300m further inland. This reflects the fact that the defended coastline is set in advance of the natural bay shape. This erosion would open up the flood area to regular inundation, isolating Victoria Harbour and making the Marina unusable. In addition there would be erosion to the Block Sands area of the Headland, potentially resulting in loss of much of the old core to the town in this area.

South of South Pier, while over the next fifty years erosion might only impact on the road and railway line, over 100 years, with the weakening influence of Long Scar due to sea level rise, erosion would take out most of the coastal road as well as opening up the potential flood area extending back behind Seaton Carew. Similarly at Seaton Carew, during the initial period of failing defences, only limited erosion would occur but long term erosion would take out most of the properties immediately landward of the Seaton Carew High Street, as the Gare breakwaters to the south started to fail and the whole dune frontage of Seaton Sands retreated inland. It would be in subsequent years that the more major changes occur at the mouth of the Tees, with increasing retreat of the dune line, in filling of the Tees Channel and greatly increased pressure for retreat to the Seaton Carew frontage.

Over the whole of the northern section of the zone there would be such massive disruption to Hartlepool, Seaton Carew and the operation of Teesport that the whole welfare of the towns and industry in the area would affected. It is likely, however, that the Seaton Sands dune system would remain intact, continuing to provide flood defence to the power station and areas behind.

To the south side of the Tees the South Gare, together with the slag deposits, would maintain a general influence on the coast and to Coatham Sands over the next 100 years. As in the north it would be subsequent years during which more major erosion would take place, with the coastline cutting back through to the Tees, infilling Bran Sands and increasing a general drift system to the west. The capacity of the Tees to adjust to this influx of material would be limited due to the extent to which the coastal plain has been reclaimed and the Tees channel would flow through a delta of sand and marsh.

The Coatham Sands would set back, there would be some resistance to this at the mouth of the Tees due to the effect of the slag banks and also due to the more resistant nature of slag tipped into the dune area. Over the more natural dune line, over the eastern side of the Coatham Sands set back would be more evident. Initially this would result in a discontinuity at the corner of Maajuba road corner but as the Redcar frontage erodes, and with the failure of the defences along Maajuba Road (the Coatham frontage), this would eventually be redressed.

At Redcar the headland would initially become more prominent and there would be limited sediment movement from west to east. General erosion over the 100 year period is crudely estimated as being of the order of 60m. This assumes that the height of the rock outcrops is sufficient to still maintain a relatively strong influence on the coast despite sea level rise. Even over the next fifty years, however, the erosion would take out the Esplanade and impinge on the front line of properties. These would in all likelihood have been abandoned due to the excessive regular overtopping and flooding once the main defence line had failed.

Further south, erosion would have opened up the potential flood area to the south of Redcar although the actual line of erosion would still be within the open grass land of the Stray. Dune development would be improved along this frontage. There would be general erosion in the area of Flat Howle at Marske, only affecting the most seaward line of properties and further along a section of the graveyard would be lost. At Saltburn loss of the sea wall will result in a set back of the whole coastal slope such that Marine Parade and all properties immediately to the rear would be lost.

Both Redcar and Saltburn would suffer extensive loss, in particular at Redcar to its important seafront tourist industry and at Saltburn to the overall important character of the area. The new proposed development to the west of Redcar would suffer erosion.

MDSF Evaluation		*PValue Damages*
Erosion	570 residential and commercial properties lost	£9,388,000
Flooding	1,409 residential and 228 commercial properties potential affected by flooding	£200,165,000
Other information	Strategy also identifies economic damages associated with amenity and loss associated with Hartlepool marina.	
Assessment of key objectives	• Fails totally to support and help sustain the integrated development plans for Hartlepool, the Tees Valley and Redcar through to Saltburn. • Results in loss of internationally important Teesport and associated industrial base to the region • Substantially increases risk due to flooding. • Fails to maintain the tourism value of Hartlepool Seaton Carew, Redcar and Saltburn • Results in substantial change to the natural heritage, although creating significant opportunity. • Results in significant loss to cultural heritage.	

- Results in significant disruption to local boat use.
- Minimises reliance on defence.

With Present Management (Scenario 2):

The general defence line around the Hartlepool frontage would be maintained. This would have little process impact on the rest of the zone. The strategy policy with respect to reducing the length of the Heugh breakwater will, however, have a significant impact on the manner in which the overall policy is implemented. This is discussed further in the detailed development of the SMP policy units.

The weak drift through Long Scar would generally be maintained with continuing feed of sediment from the nearshore area. Maintenance of the North Gare would sustain the general equilibrium of the Seaton Sands dune system although with sea level rise this frontage would tend to roll back. The affect on the Seaton Carew frontage would be a continuing loss of beach level such that the defences in this area would come under increasing pressure. This would be exacerbated by the reducing influence of Little Scar and to a lesser degree Long Scar, as these features become more submerged. Defences in this area would need to be reinforced and would act more as the primary headland to the frontage, rather than their current role as a backshore defence reinforcing the influence of the Scars. Assuming the Seaton Sands dunes are allowed width to develop they would continue to provide an adequate flood defence to the hinterland.

Within the mouth of the Tees, the two breakwaters would continue to impose overall control on the channel and reduce wave energy within the entrance. The semi-natural defences behind the North Gare would come under some increased pressure and, on the assumption that present policy is actually to hold the line, there would be a need for improved defences to the frontage down to the Power Station Point. With the increased sea level the slag deposits at the southern end would be less effective in retaining the beach flats to the north and there would be pressure for increasing movement of material into the area of Seal Sands.

On the Southern side of the estuary, there would be less distinct pressure for the coast to erode, although the back shore to Bran Sand would still tend to roll back. Sediment feed to this bay would not be a significant issue but, to fully benefit from this, there is likely to be a need to reinforce the area of the old steel work's jetty.

While current policy for Coatham Sands is to hold the line, this assumed no significant works to enhance defence of the frontage. As such the dune line would be expected to roll back. Initially, while the slag mounds close to the South Gare still influence the shape of the coast and act to retain sediment in this section of the frontage, the general rolling back of the dunes further east may expose access to the larger flood area through to Warrenby and Coatham. As the slag mounds become less effective, sediment would be redistributed across the frontage and the dunes would tend to perform as a more coherent defence. The policy to hold the line at the western end of Coatham Sands (along the Coatham/Majuba Road frontage) would result in a discontinuity between the dunes and defended section in the area of the caravan park. At least part of this area falls within the proposed new development of Coatham Links. This corner will come under increasing pressure. To fully maintain the proposed defence line, there would be a need to return defences inland to stop outflanking or for defences to be extended further west, thereby starting to impinge on the natural development of the Coatham dunes.

As the Redcar frontage comes under increased pressure, this will transfer along the Majuba Road frontage, in front of the Coatham Links Development increasing the need for harder defences along this section. The proposed masterplan for development shows that the area to the eastern extent of the frontage is to be car parking, with a new coastguard building at the corner of the actual development. Over the main frontage the plan shows small promontories extending seaward from a relatively wide promenade area. These promontories will, even under present conditions, come under significantly greater pressure

then the main frontage if they cross beyond the natural beach crest line and while potentially offering an opportunity for enhancing the management of the frontage could otherwise be areas of future concern.

The strategy for Redcar has demonstrated the value of continuing defence along the Redcar sea front. The strategy recognises that with a linear defence over the next 50 years this is likely to reduce the level of the beach and certainly over the 100 year period of the SMP and beyond this is likely to become a major issue. This specific implementation of the policy will result in the need for increasing levels of defence to maintain the proposed 1:100 year standard. Of particular concern would be the possible increased exposure to the western local headland in defence of the local direct flood area in front of the Leisure Centre and at the eastern end with the possible reduction in levels of defence at Lime Road slipway and the potential for flooding to the area behind Zetland park. The policy for defence along the Stray is to maintain the groyne field and revetment. The pressure on this frontage will increase but will act to maintain the flood defence in the area of Lily Park.

Between Redcar and Marske the policy is for no active intervention, while at Marske the policy is to maintain the defences. This by implication over the next 100 years will result in quite localized headland created by extension and improvement to the existing linear defence. Over the length between, erosion would be unlikely to affect the coast road but would require the relocation of the car parks. At each end of the undefended coast there would be a need to extend and reinforce defences to stop outflanking. Where the coast had been allowed to move back it is probable that a good upper sand beach would develop, with the opportunity for dune growth. However, in the absence of beaches to the north or in front of Marske, there would be increased pressure for beach use of this area.

A similar situation would occur between Marske and Saltburn, with the defence of Saltburn being maintained and the coast to the west retreating further behind the line of the defended sections. While over the whole section between Redcar and Saltburn a reasonably wide foreshore would be maintained and the general erratic drift across the whole beach face would not be significantly disrupted, the defence at Marske would tend to become a more distinct headland, potentially affecting the local drift system at the crest of the beach.

MDSF Evaluation	*PValue Damages*
Erosion *Flooding*	No erosion losses identified No flooding damages
Other information	Potential damages due to flooding through dunes, to south of the North Gare Breakwater and to the rear of Coatham Sands. These would need to be assessed in detail with the opportunity for retired local defences.
Assessment of Key objectives	• Current policy supports the integrated development plans for Hartlepool, the Tees Valley and Redcar through to Saltburn. • Maintains the operation and development opportunity of the internationally important Tees Port • Reduces risk due to flooding. • Impacts upon the tourism value of Hartlepool Seaton Carew, Redcar, while sustaining the key tourism potential at Saltburn • Maintains the natural heritage value to Seaton Sands and the SPA at Redcar and Coatham Rocks but results in potential loss at Hartlepool, at North Gare Sands and at Coatham Sands. • Provides protection to the principal cultural heritage interests. • Potentially impacts on local boat use. • Potential loss of foreshore and impact on ornithological interest. • Increases reliance on defence.

DISCUSSION AND DETAILED POLICY DEVELOPMENT

The major disruption and loss of opportunity for economic regeneration and loss to existing key infrastructure to meet the expectation of future generations, together with the increase in flood and erosion risk resulting from a general policy of no active intervention would be unacceptable. While there would be some benefits to the natural environment, this is seen as being unrealistic in terms of the impact on society. The current balance of policy, on the other hand, is seen as being sustainable in terms of the balance between the effort expended on maintaining defences and the need to maintain the key values of the area. Also in terms of the pressure on defence and the longer term geomorphological development of the coast, the current policies would not result in a significant increase in the need for defence effort to adjacent managed sections of the coast nor would it cause general disruption to the natural areas of the coast.

The primary elements of the policy for the zone are therefore:

- Maintaining defences to the Hartlepool Town frontage essential in maintaining the economic well being of the Town.
- Maintaining the navigation of the Tees, the operation of the port and core industrial area to the region and providing the basic structure of control on the open coast to either side.
- Maintaining the defence of the Redcar frontage, its importance as a regional centre and its ability to develop.

And at a more discrete level,

- Examining the approach with respect to the Heugh Breakwater.
- Considering the potential impact of proposed development to the west of Redcar.
- Maintaining the defence to Marske and Saltburn and sustaining it character.

Within this overall structure for management of defences and hence managed evolution of the coast, the SMP has identified more local issues, which either modify or define specific policy, or have a bearing on the implementation of policy. These are discussed below.

Hartlepool

The Strategy Study for the area from the Heugh Breakwater through to Newburn Bridge has demonstrated the value of a general policy of hold the line, although there are funding issues in that defence of the frontage may fail to attract full coast protection funding under the current priority scoring system. The overall policy is confirmed as appropriate by the SMP, in that this policy will not impose any additional pressure on adjacent frontages nor result in any long term expectation which might be technically unsustainable. The strategy, while indicating that the medium term decision is to allow the end of the Heugh to fail, defers decisions with regard to this. The decision, however, has a broader consequence on the long term definition of defence policy for the area.

In overall terms the strategy has identified the need to maintain the existing defences to the Marina frontage. Loss of the North Pier, even assuming works were undertaken to remove debris, would have a major impact on the use of the Marina. Wave exposure within the West Harbour would significantly increase, potentially resulting in reduced use of the Marina lock. There would also be implications with respect to possible overtopping from the West Harbour area. Similarly there would be major increase in wave energy entering between the South Pier and Middle Pier. This area would be unusable for regular boat use and significant upgrading would be required to the defences in this area. Works have been identified as being required to the walls within West Harbour and these costs have correctly been

included within the strategy evaluation. The decline in use of the marina would have an impact on the development policy for the area to the north and, therefore, on the decisions and assumptions being made in this development plan as to the area behind Middleton Beach.

The loss of the Marina defences would have an impact on Middleton Beach allowing some additional loss of sediment to this small system. This has further implications for the development of the Middleton area.

The Strategy identifies the value of North Pier in relation to the Marina operation, with associated implications with respect to funding. This also needs to be considered in the broader development plan for the area to the north.

The Strategy identifies that the Heugh Breakwater has an impact on the above situation. However, the final decision with respect to the Heugh Breakwater is deferred. The current strategic approach is to allow the failure of the southern seaward section. This is shown to increase exposure to the area of the North Pier, Middleton Beach, Victoria Harbour and the Block Sands. In the case of the former two areas, this has implications as to the improvement works proposed to either the full extent or inner section of the North Pier, with the probable need to consider further of the plan shape of any rock works (planned within the next five years). These decisions need to be made in advance of the proposed review of actions at the Heugh breakwater. There would also be implications associated with the development plan to the rear of Middleton Beach.

Within Victoria Harbour, modelling has demonstrated that loss of part of the Heugh will increase wave heights. This would have potentially significant implications with respect to flooding from within the Harbour (it has been identified during consultation that there is currently a problem in this respect). It would also have implications associated with the planned use of the harbour area and the sustainability of small boat use, in addition to concerns relating to access to the harbour. These latter impacts are emphasised in the responses to the consultation on the Draft SMP. Studies are currently underway examining the issue of flooding within the harbour and determination of the long term wave climate, and hence the decision with respect to the Heugh Breakwater would be critical to this. Similarly, before a Final decision can be confirmed with respect to management of the Breakwater the impact on the local fishing industry and boat use would need to be considered further. This issue moves beyond that strictly covered by the remit of the SMP in that funding issues beyond those of coast protection would need to be addressed.

With regard to Block Sands, concern has been expressed with regard to the impact the reduction in length of the breakwater may have on the SPA interests. Certainly, the reduction in length has been shown to result in increased scour to the frontage and the strategy has rightly included costs in relation to reinforcing the toe to the sea wall. However, the potential damage to the SPA is not evaluated but would need to be, prior to confirming the option for the management of the Heugh Breakwater. Reducing the length of the breakwater could significantly reduce the area of dry sand beach. There would also be significant loss of amenity value to the Block Sands area.

In terms purely of coast protection, the strategy recommends in the medium term to abandon the outer end of the Heugh Breakwater, taking into account the additional pressure and hence cost associated with the defence of other areas.

Finally in assessing the defence of the Hartlepool frontage, the Victoria harbour master plan indicates new development of the area behind Middleton Beach. While this is primarily a decision associated with this development plan, some of the issues discussed above could be alleviated to a degree if development was set back from the current line of defence. As defences in the area require attention, a planning decision to limit development close to the defence line would allow increased width of foreshore with the potential to substantially reduce future defence commitment. In any regard, future defence of the frontage needs to consider how wave reflection and scour may be reduced over the beach frontage.

In summary for this area the SMP policy through both the short, medium and longer term would be for holding the line, with consideration being given to retreating the line of defence at Middleton. The consequence of reducing the effective length of the Heugh breakwater needs to be fed into planning decisions, taking account of both the potential environmental impact and the impact on the local fishing interests and those of the local boat users. Funding to preserve the existing extent of the Heugh Breakwater would have to be obtained from sources, other than coast protection; reflecting the broader benefits which might be shown to accrue. The policy for hold the line does include continued protection to the Town Wall and specific measures to improve protection here are recommended by the Strategy Study and are being taken forward by the Coast Protection Authority.

Newburn Bridge to the North Gare

The northern section of the frontage between the bridge and the northern section of Seaton Carew will come under increasing pressure due to the reducing influence of the Long Scar and Little Scar. Even so protection of the frontage is considered important both to maintain the coastal road, to provide flood defence and to maintain the open green space in this area, highlighted as an important area within the Local Plan. While potentially there is opportunity to retreat the line, this would have only a marginal affect in reducing pressure on the frontage and tend to transfer the control of the coastal shape further south in front of Seaton Carew and, therefore, a decision to retreat the line would have significant cost implications elsewhere. There will be a need to improve the revetment in the longer term, allowing for increased exposure, this should be done with respect for the Submerged Forest SSSI such that there is no significant additional wave reflection. This may mean ultimately reducing the slope of the defence, in effect retreating the crest.

Currently, the main area of Seaton Carew frontage benefits from the control imposed on the larger area by the North Gare. This benefit will continue but will diminish over time, with the gradual rolling back of the dune line to the south. While the existing sea defences can be exposed to significant wave action, under storm conditions, and will require works over the next 20 years to sustain the defence, the existing line is not considered unsustainable over the period of the SMP. Any opportunity to retire the line, given the relatively undeveloped nature of the sea front should be given consideration and any development of the frontage should take this into account. The Local Plan has indicated that redevelopment of the area could be permitted. This would be better achieved through some co-ordinated plan for the area with a view to allowing greater width to the natural and manmade defence system and with recognition as to the threat posed by flooding due to overtopping.

There is positive benefit in allowing the roll back of the dunes to the south of the town in that they will provide a more coherent defence against flooding in their natural condition, adapting to sea level rise. There is adequate sediment and sediment supply to the area to allow this. The transition between the dunes and the town will, however, need to be examined with the sewage pumping station seen as being the critical location in this regard. Over the next 20

years while there may be some retreat of the dune face, there is likely to be benefit in some management of use in this corner which would allow better dune growth in the local area.

The Biodiversity Opportunity Study has suggested use of dredged material to supplement feed to the frontage. At present any such action is likely to be of short term benefit with material quite rapidly returned to the channel of the Tees. As the dune line rolls back there may be some improved benefit in this course of action. It is unlikely, however, that it would result in development of any significant nearshore banks, unless substantially coarser material were available, and would not therefore meet the specific purpose identified by the study.

The Golf course within and to the back of the dunes would be affected by a policy allowing the dunes to roll back. There is a danger that if this not accommodated within the management of the course the dunes would in effect be squeezed, becoming more susceptible to breach or blow outs occurring. This more fragile system would fail to provide a robust natural defence. An overall management plan of the area of the dunes and the golf course needs be developed taking account of the ecological interests; in particular the concerns raised by the Tees Bird Club over the loss of high water feeding grounds.

The policy for the frontage would be to hold the line through from Newburn to the Pump Station south of Seaton Carew, although retreat along the southern section of the Seaton Carew may be an option in association with a development plan for this area. To the south of the Seaton Carew the policy would be for no active intervention, with a possible use of dredged material to help sustain this roll back. The policy for the North Gare would be to hold the structure, providing strategic control to the whole frontage.

North Gare to Seal Sands

The Environment Agency is in the process of developing a strategy for flood defence within Tees. This strategy has identified that the area around the root of the Gare Breakwater can be considered independently from other potential flood cells within the Tidal Tees. This concurs with the estuary assessment carried out as part of the SMP2 development. The SMP, therefore, extends its assessment of management beyond the Coast Protection Act, Schedule 4 boundary to address the frontage from the North Gare south to the corner by the Power Station, north of Seal Sands.

The present policy for this frontage is to hold the line. Defence is provided by a slag bank underlying a thin dune crest. Holding the line seems unwarranted given that to maintain the position of the semi-nature system would ultimately require a significant expenditure in defence as sea level rises. While some additional control may be required at the southern end and further examination of defences would be required to ensure there was no possibility of flooding through to the Power Station, the works to the north of the Power Station and potentially the A178, the overall policy should be to allow retreat, allowing natural development of dunes and sand flats. This retreat and retention of material to the frontage would be controlled at the southern end and potentially midway along the frontage. Further examination of the policy is, however, recommended.

South Gare and Bran Sands

The policy for the South Gare is to hold the structure for strategic reasons. Within this context of control, the policy for the Bran Sands would be one of retreat. The Biodiversity Opportunity Study identified the possibility of using dredged material to create sandbanks in the area. Unless further control were provided to the area of the steel works quay, it is likely

that material would be lost back to the channel. This may, however, be worth investigating further. With sea level rise the expectation would be that the dunes to the back of the bay would roll back, the availability of sediment to allow this to happen should be explored but, in any event, to reduce squeeze the there should be no development of the existing buffer zone between the coast and existing industrial area. It will however be important to maintain the southerly extent of the Gare to avoid any possibility of a outflanking of the breakwater. As such the policy for the sections would be no active intervention to Bran Sands and Hold the Line to the Gare Breakwater.

Coatham Sands to Redcar

The policy for the South Gare is to maintain this structure. The existing policy for the Coatham sand is for no active intervention. The policy for holding the line at Redcar has been confirmed by the strategy study. The evolution of the coast between South Gare and Redcar is therefore controlled strategically, ensuring a good degree of overall stability but allowing the semi-natural coast of Coatham Sands to develop in a relatively natural manner. As the influence of the German Charlies slag banks diminish with the effect of sea level rise, so the bay will tend to readjust, tending to ensure a more uniform distribution of material over the bay. It will be important to monitor this and to ensure no weak points develop which might result in the potential for breach through to the potential flood plain behind. Equally, this process of readjustment and roll back and, indeed, the natural variation of the coast resulting from storm activity has to be taken into account in future management decisions. There will be times of apparent differential erosion and in order to maintain the overall well-being of the entire frontage there should be no local decisions to intervene. Any such intervention could result in significant imbalance in the system such that further intervention would then be required. Concern was expressed during the consultation on the Draft SMP that this policy of no active intervention would result in possible flooding to the housing behind Coatham Sands. At present there is a reasonable width of natural frontage backed by the road. The SMP policy aims to ensure that the natural function of the dunes as a front line flood defence as well as an area of important ecological interest is maintained. It is, however, accepted that this natural defence may not continue to provide adequate protection to housing behind. It is for this reason that there should be further detailed examination of the actual flood risk to Warrenby and Coatham and in order that there is confidence in long term flood risk management. The intent within the SMP is that any need for improving flood defences is undertaken to the rear of the dunes, without the need to disrupt the open coast system. This would ensure that flood defences may be sustained and are not in a position where pressure for erosion might impact on their long term sustainability. The intent is to establish width for the defence system to be maintained. Similarly, there has been consideration of flood risk and the potential need for local defence in association with the development plans for the proposed Coatham Links. The Environment Agency has advised that floor levels to this development should be above 5m OD. The flood risk assessment for the whole area should assume that the Coatham Sands will roll back. The justification for local defence measures should include both the economic assessment of damage to hard assets and as importantly the benefit to the natural environment in not imposing hard control on the open coast.

As the coast to the west retreats, the caravan park at the Redcar end of Coatham Sands will come under considerably greater pressure as would the corner of Majuba Road and the proposed development in this area. It would be unlikely that defence of the area of the caravan park would be justified, based on existing assets and, in any event this would be undesirable in extending hard defence into the natural dune area. In the same way, the general roll back of the Coatham Sands will tend to result in increased pressure on defences

on the western flank of the Redcar/Coatham frontage; although, the policy for the Redcar frontage, discussed below, will consolidate the overall control imposed on the frontage between Redcar and the South Gare. Management of this section needs to be seen as a transition between the desire to hold the main frontage of Redcar while equally allowing the natural development of the Coatham Dunes. The area is under consideration for development and there is no opportunity to allow the frontage of Coatham Links to be set back. This development is seen as an important benefit to the town. As such a hold the line policy should be extended to cover this whole frontage.

While this is the necessary policy to allow the development, careful consideration needs to be given as to how a suitable transition may be achieved between this area and the future evolution of the Coatham Sands. At the western end of the development the opportunity to build potential adaptation into the plan exists, such that the future problem of transistion may be addressed in the future. The area at this western end is proposed as a car park and if this is maintained there could be scope for using the area in the future for creating a more natural development of defence width. Design of the coastguard building should similarly look to the possible future need to create a more natural change from fixed to natural defence.

There is still much uncertainty as to the extent to which the dune line to the west will retreat, this being strongly dependent on rates of sea level rise. Maintaining an opportunity for increased defence width, while undertaking long term monitoring, provides an appropriate way ahead. There should be measures put in place as part of the development at this location to ensure that the car park does not encourage uncontrolled trampling of the dune. Control may be far more easily achieved if this is considered in the design of use of the area.

Currently, based on existing assets, the long term defence of the Coach and Car park at Majuba Road would be difficult to justify. Development up to the existing line of defence within this area is likely, therefore, to impose an additional requirement for defence against erosion in the future. A policy for retreat between the corner of Newcomen Terrace and the caravan park has been considered but would have significant impact on the proposed development, making this option unrealistic. Even so, in the longer term there will be a need for greater defence of the area making consideration of scope for creating a suitable transition through to the Coatham Sands, as discussed above, important at this stage.

The proposed masterplan does show a relatively wide promenade and this would be supported by the SMP in giving future scope for managing overtopping to the area. The small promontories as shown on the masterplan would tend to suffer greater exposure and could give rise to local beach lowering or local wave energy concentration affecting adjacent sections of the frontage. At the same time the concept of these promontories could be extended, through appropriate detailed design, to help retain beach material and reduce overall future pressure to the frontage. This could provide a more general sustainable transition from hold the line to one of no active intervention between Redcar and Coatham Sands.

Over the main Redcar frontage the policy is to hold the line, and there strong economic and social reasons for this. There is, however, a longer term threat that retention of the beach in front of the seawall will substantially reduce. There is currently a lowering of the beach over the central area and the gradual process of beach reduction is likely to spread to the west. This could well result in significantly greater pressure on the western corner of the main frontage, potentially affecting the proposed new development of Coatham Links. The corner

between these two frontage is seen as significant in this and for that reason when considering long term defence measures in one area consideration has to be taken of the impacts or benefits which may be derived to the other.

The SMP concurs with the strategy findings for the main Redcar Seafront. The strategy study has put forward various options and quite rightly identifies the broader benefits of maintaining a beach. However, due to environment concerns and concerns as to boat use, large scale offshore breakwaters are ruled out and the use of major groynes and beach recharge is dismissed on the grounds of excessive cost. In taking the strategic approach to linear defence forward in detail, however, further consideration could be given to local control structure which may stop the worse excesses of scour to the walls. In terms of development of the seafront, allowance needs to be made for the potential benefits of using the width of the Esplanade to minimise the impact of raising defence levels in the future.

In summary for the section the preferred policies are:

- No active intervention along the length of Coatham Sands. There could be benefit in use of dredged material to support this as suggested by the Biodiversity Opportunity Study and it is recommended that a vulnerability assessment is undertaken with respect to potential flooding.
- Hold the line to the western flank to Redcar but with the need to look to the future in creating a suitable transition between this length and the no active intervention along Coatham Sands.
- Hold the line along the Redcar Seafront.

Redcar to Saltburn

The frontage is controlled by the headland at Redcar but over much of the rest of the frontage there is little man made control. Currently works at Marske are of a trivial nature and the slightly forward position of the Marske frontage is natural. Existing policy is to maintain defence to those areas currently defended, and this would increase the prominence of Marske as a headland. Even so this would not be seen as significantly altering the dynamics of the frontage, in that currently where there are slight promontories these have purely allowed development of dry upper sand beaches to develop to either side.

The possible exception to this is the eastern flank of Redcar where there has been a need to revet the till cliffs and attempt to stabilise the beach with groynes. The strategy for this frontage suggests refurbishment of the groynes and to maintain the revetment, addressing the risk of flooding behind. The strategy indicates that the groynes will require further work in 20 to 30 years to maintain defence of the frontage over the next 50 years. It is in the longer term, however, that a more significant pressure will develop over this length and continuation of this policy would result in significant works being required to maintain this linear defence over the full 1.2 km. The key areas of concern are at the eastern headland to Redcar seafront, at Lime Road and at the Lily Park area. Between Zetland Park and The Stray, the open ground generally provides width and height sufficient to provide flood protection. While, therefore, the SMP concurs with the strategy for maintenance of the existing defence system in the short term and the assessment that flood defence should be maintained and is likely to be sustainable to the areas behind over the period of the SMP, the preferred policy is that opportunity is taken in the medium term to allow the length to retreat in a controlled manner. During consultation on the Draft SMP, several responses were received expressing concern over this policy with respect both to the flood risk and the open area of the Stray. Further responses were made stressing the importance of the

foreshore both for recreational purposes and with respect to the ecological significance of the area for bird populations. With regard to the latter, it is also recognised that over the main Redcar Town centre frontage that in the longer term there is concern that there would be loss of the sand beaches. In addressing these issues further clarification is provided of the intent of the SMP policy for the area to the east of Redcar.

As identified in the assessment of present management, it has to be expected that there will be an increasing pressure for erosion of the frontage as sea level rise continues. Holding a typical linear line of defence, such as the existing revetment or, as proposed by one consultee, encasing the full length of the frontage with rock, would resist this pressure for erosion, protecting the open ground of the Stray and continuing to provide flood defence to the properties behind. The most appropriate measures to achieve this protection, over the short to medium term are currently being examined in an extension of the Redcar Strategy.

In the longer term, however, taking such an approach would result in increasing erosion of the foreshore and result in the need for ever stronger defence measures to be taken. While this would continue to provide protection to the open ground and the properties, there would also be an increasing separation between the valued amenity of the Stray and the foreshore and beach, and lowering of the foreshore.

At present, the defence system to the frontage should be viewed in its entirety; that is a relatively healthy foreshore acting to reduce wave energy, the groyne system helping to retain the beach crest, the revetment providing a backstop against erosion and the Stray, itself, providing a height to the defence and reducing the overtopping and flooding. The intent of the SMP policy is to maintain this overall system and width of defence. As sea level increases and as the foreshore suffers erosion greater pressure develops on the linear revetment. There would come a point at which not only would the groynes no longer provide the ability to retain the beach but could actually act to increase turbulence at the toe of the defence increasing the potential for scour. This process is likely to be gradual, increasing over the latter part of the century. Two approaches may be taken to this. In the first the linear defence over the next fifty years continue to be reinforced, particularly over the latter part of this time period. At some point in time the investment in defending this line will become unsustainable and major works would be required on a set back line with the primary intent of ensuring the continued defence against flooding to the properties behind. The second approach is in taking a longer term more adaptive approach with the aim to realign the frontage, allowing some areas to erode back but controlling and taking the main pressure for erosion in other key areas. This approach aims to maintain the flood defence to the properties, reinforcing critical low points in the Stray and using landscaping over the width of the Stray to maintain the level of protection. It also aims to maintain the principal feature of the Stray as an open recreational area but creating a softer boundary between the open grassland and the foreshore; also allowing the foreshore to move back in areas so that wave energy can be dissipated through the natural process of wave breaking.

The opportunity for this second approach is that being developed through the intent of the policy put forward by the SMP. Management of this might sensibly involve strengthening the defence to the northern flood route, linking this through to the management of the main Redcar frontage and developing on the natural accumulation of sediment in this corner. At the same time, initially maintaining the existing line of the groynes and revetment but with a longer term intent of realigning this reveted frontage as the frontage comes under increasing pressure. There would still be a need to further strengthen the area of the southern flood route and this might be through bank raising, which could be undertaken earlier, to address

concerns of the residence, or introducing further control in the area. This would need to be examined further at the time when the groynes need to be further refurbished. The management of the frontage has to be based on good monitoring practice at this location and with more strategic monitoring of the overall evolution of the area and of the associated threat of sea level rise.

The frontage benefits from the existing width of the defence system and long term planning provides the opportunity to meet the various important objectives for the frontage.

At Marske there is little current threat to properties, although this will increase as the adjacent coastline erodes back. There are two areas where loss would be likely to occur over the SMP period; at Flat Howle and to the corner of the graveyard. While the properties to the Headlands would be at risk in the even longer term these are not seen as being lost over the next 100 years. If appropriately designed to take account of future retreat of the coast to either side, defence at Flat Howle and at the cemetery could provide local bastions such that the coast between would be allowed to develop more naturally. Defence of the frontage is considered appropriate and sustainable principally due to the natural buffer zone between assets and the cliff line. However, a strategic approach is needed to prevent an ad hoc linear defence approach, which would be more difficult to manage. The economics would need to be considered at a more detailed level than is possible in the SMP.

At Saltburn the linear approach to defence is seen as appropriate and manageable without significant impact on the adjacent coast line. The considerable loss of assets, loss of potential to develop the area to the benefit of the region and maintaining the coastal road, which could not sensibly be retreated without significant damage to the character of the area, provide good economic justification for holding the line of the frontage.

In summary the policies for this section are initially holding line to the eastern flank of Redcar but to consider medium term realignment, while maintaining the long term defence to the flood risk area. To hold the line at Marske, but in a manner that provides strategic long term control of the frontage, and to hold the current line of defence at Saltburn. Between these frontages the coast would be allowed to evolve naturally and areas of car parking be retreated accordingly. The rate of erosion of the frontage and the need and timing for intervention is very sensitive to the impact of sea level rise and this should be monitored.

MANAGEMENT AREAS

In terms of management of defences, taking into account quite direct interaction, it is appropriate to divide the zone into four principal management areas. These being:

- Heugh Breakwater to Little Scar
- Little Scar to Coatham Sands
- Coatham Sands to Mill Howe
- Mill Howe to Saltburn

However, there is still a degree of interdependency between these areas. There is a net drift of sediment along the Little Scar frontage as well as being key transport links between Seaton Carew and Hartlepool. As such there needs to be a degree of co-ordination between the Hartlepool Bay area and the area centred on the mouth of the Tees.

The retreat of the Coatham Sands with the need provide a transition between this and the Redcar frontage is important in management of both areas.

To a lesser degree there is association between the Redcar frontage and the section of coast to the east but, even so there needs to be consideration of the potential local impacts between the frontages.

Clearly, also, the monitoring of individual areas will provide a better understanding of how the whole zone is responding.

Policy statements or summaries are presented by management areas in the following sheets. These should be used with the potential broader interdependencies in mind.

4.5.2 MANAGEMENT AREA POLICY STATEMENTS (MA12-MA15)

Location reference:	Heugh Breakwater to Little Scar
Management Area reference:	MA12
Policy Development Zone:	5

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area is to maintain the general overall defence of the bay, this maintaining the core value of Hartlepool. Within this, detailed consideration needs to be given to minimising the need for additional defence along Block Sands in deciding to what degree the length of the Heugh Breakwater needs to be maintained. Consideration needs to be given to how the proposed development around Victoria Harbour, in particular in the area of Middleton Beach, can be used to allow development of a more sustainable defence line. In confirming the intent for management fo the Heugh Breakwater both the impact on the ecological interests of the area and tose of the local boat users and fishing industry need to be taken into account. In considering the latter it has to be understood that funding for works to the Heugh breakwater is unlikely to be secured from coast protection grant.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Hold the line to the whole Hartlepool bay frontage. Develop detailed plans with respect to the potential loss of the Heugh Breakwater. Develop defence to Middleton Beach in association with development plans.
Medium term	As above
Long-term	As above

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025.	2055	2105	Comment
12.1	Hartlepool	HTL	HTL	HTL	Detailed consideration of Heugh Breakwater.
12.2	Seaton Carew north	HTL	HTL	HTL	Monitor impact on designated foreshore area.
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

The policy from the SMP1 is taken forward in line with the more detailed consideration of the coastal strategy.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

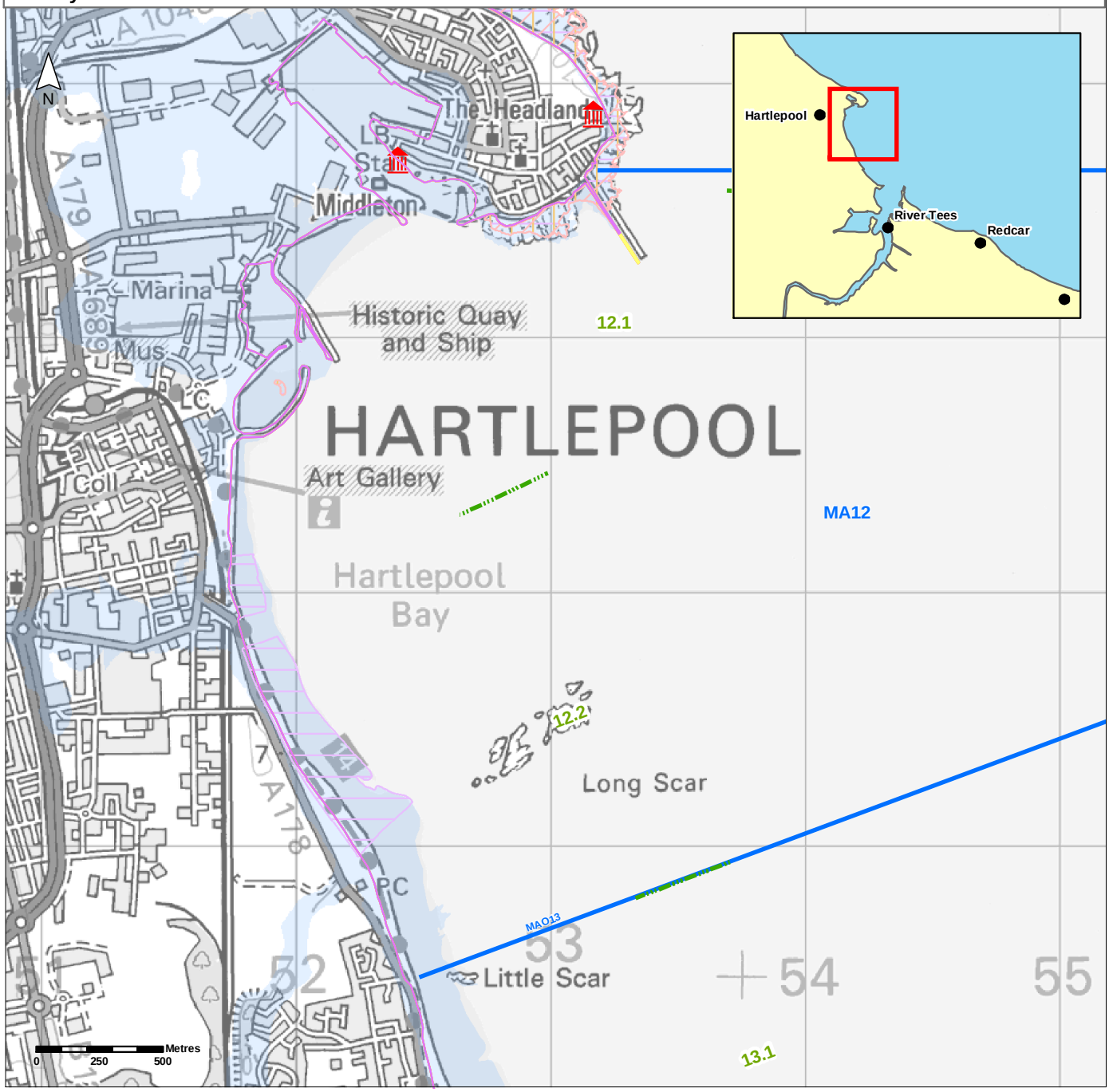
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	74,220	52,911	31,108	158,430
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	74,220	52,911	31,108	158,430
	Costs of Implementing plan £k PV	12,190	52	700	12,991
Costs based on strategy. NAI damages do not include amenity damages or damages to marina. Description of damage and benefits under preferred plan: • Maintain defence of Hartlepool. • Increased exposure due to reduction in length of the Heugh Breakwater.					
Heritage	Heritage value of the Headland maintained. Partial loss of Heugh Breakwater.				
Amenity	• Maintained use of Marina. • Potential loss in amenity value to Block Sands.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	Yes, at a local scale

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA12
Policy Units 12.1-12.2



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Hold the line to the whole Hartlepool bay frontage. Develop detailed plans with respect to the Heugh Breakwater. Develop defence to Middleton Beach in association with development plans.	Hold the line to the whole Hartlepool bay frontage. Develop detailed plans with respect to the Heugh Breakwater. Develop defence to Middleton Beach in association with development plans.	Hold the line to the whole Hartlepool bay frontage. Develop detailed plans with respect to the Heugh Breakwater. Develop defence to Middleton Beach in association with development plans.

Key:

Predicted Shoreline Mapping*
Preferred Plan
- 20 Years
- 50 Years
- 100 Years

- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, red knot and common redshank) and an internationally important assemblage of waterfowl.	
Sub Feature(s) Littoral sediment (Hartlepool Headland)	**Sensitivity** Loss of SPA and Ramsar designated habitat through natural erosion.	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores, intertidal sandflat and mudflat, shallow coastal waters and saltmarsh.
Potential effect of policy	The SMP policy and the Hartlepool Coastal Strategy have identified the potential loss of the Final Plan third of the Heugh breakwater. This decision has been deferred subject to monitoring. If such a loss occurred then the policy suite could lead to enhanced scour and/or wave exposure to the SPA and Ramsar features.	
Preventative Measures Scale of impact on SPA/Ramsar sub features needs to be identified before preventative measures can be established.	**Mitigation** Dependent upon the decision regarding the breakwater, mitigation measures will need to be appropriate to the scale of the impacts and in line with any preventative measures.	**Implications for the integrity of the site** Unknown at this stage.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA12

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
National	The headland at Hartlepool is designated Tees and Hartlepool Foreshore and Wetlands SSSI (wildfowl and waders). Hartlepool Submerged Forest SSSI (geological) is in Hartlepool Bay.	12.2 Negative impact of increased wave attack on intertidal peat deposits. Exposure of Submerged Forest SSSI may increase interest and risk of erosion.	Ensure scientific investigation is targeted to understanding geological interests in peat deposits before they disappear.
Local	None	N/A	None proposed

Action	By when	Responsibility	Cost £k
Heugh Breakwater. Review strategy to confirm policy for management. *Impact on designated area. Use of frontage and potential additional defence requirement. Impact on navigation*	2012	Private/ Co-ordinated by Hartlepool BC	30
Town walls. Detailed scheme appraisal report. *Economic value and protection of property. Potential opportunity for biodiversity. Important Heritage issues. Maintain navigation*	2008	Private/ Co-ordinated by Hartlepool BC	130
Middleton Beach. Advise on defence. *Ensure integration with redevelopment to provide sustainable defence*	2009	*Co-ordinated by* Hartlepool BC	5
Marina. Detailed project appraisal report. Develop recommendations of strategy. *High economic risk. Review sustainable development. Benefits associated with port. Possible biodiversity improvement. Interaction with Middleton development*	2010	Private/ Co-ordinated by Hartlepool BC	80
Schemes: • Town walls	2009	Hartlepool BC	500

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Little Scar to Coatham Sands
Management Area reference:	MA13
Policy Development Zone:	5

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: Maintaining the Gare Breakwaters maintains overall control of the frontages to north and east. Within this, there would be a retreat of the Seaton Dunes and an anticipated reduction in beach levels in front of Seaton Carew. This needs to be managed such that either when major works are required to the Seaton Carew defences or if the seafront is re-developed, consideration needs to be given to realigning the hard line of defences. Associated with this planning policy needs to be established which would not constrain future realignement of the defences. Associated with the natural retreat of the Seaton Dunes, there needs to be discussion with the Golf Course as to how their area may be managed to reduce landward pressure on the dunes. This may involve discussion of how land to the rear may be managed to benefit both the golf course and the important natural interests.

Further detail is needed in managing the potential flood risk to the Power Station, the local industrial areas and potential threat to the main road.

To the south and east of the Estuary, the policy is for no active intervention allowing natural development of the Coatham Sands and potential enhancement of habitat behind. The flood risk to developed areas to the west of Redcar needs to be considered with the intent of addressing potential flood risk.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Hold the line to Seaton Carew, while allowing natural roll back of the Seaton Sands Dunes and the North Gare Dunes. Allow the natural development of the Bran Sands and Coatham Dunes, within the strategic control of maintaining the South Gare.
Medium term	As above but to consider retreat of the Seaton Carew sea front. Detailed consideration of flood risk to the area to the south of the North Gare Breakwater. Land use management plan for the area behind Seaton Dunes.
Long-term	As above but ultimately maintain defence to Seaton Carew.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025.	**2055**	**2105**	**Comment**
13.1	Seaton Carew	HTL	HTL	HTL	But consider planned realignment
13.2	Seaton Sands	NAI	NAI	NAI	Possible future feed with dredged material
13.3	North Gare	HTL	HTL	HTL	
13.4	North Gare Sands	NAI	R	R	Controlled by structure to south
13.5	Bran Sands	NAI	NAI	NAI	Investigate use of dredged material
13.6	South Gare	HTL	HTL	HTL	
13.7	Coatham Sands	NAI	NAI	NAI	With detailed flood risk assessment of developed areas
Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention					

CHANGES FROM PRESENT MANAGEMENT

No substantial change to intent of the SMP1 policy. However the area is subdivided further to reflect specific approaches in defence to different sections of the coast. In particular, which SMP1 indicated the need for management of Coatham Sands, the policy in SMP2 is now for no active intervention.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

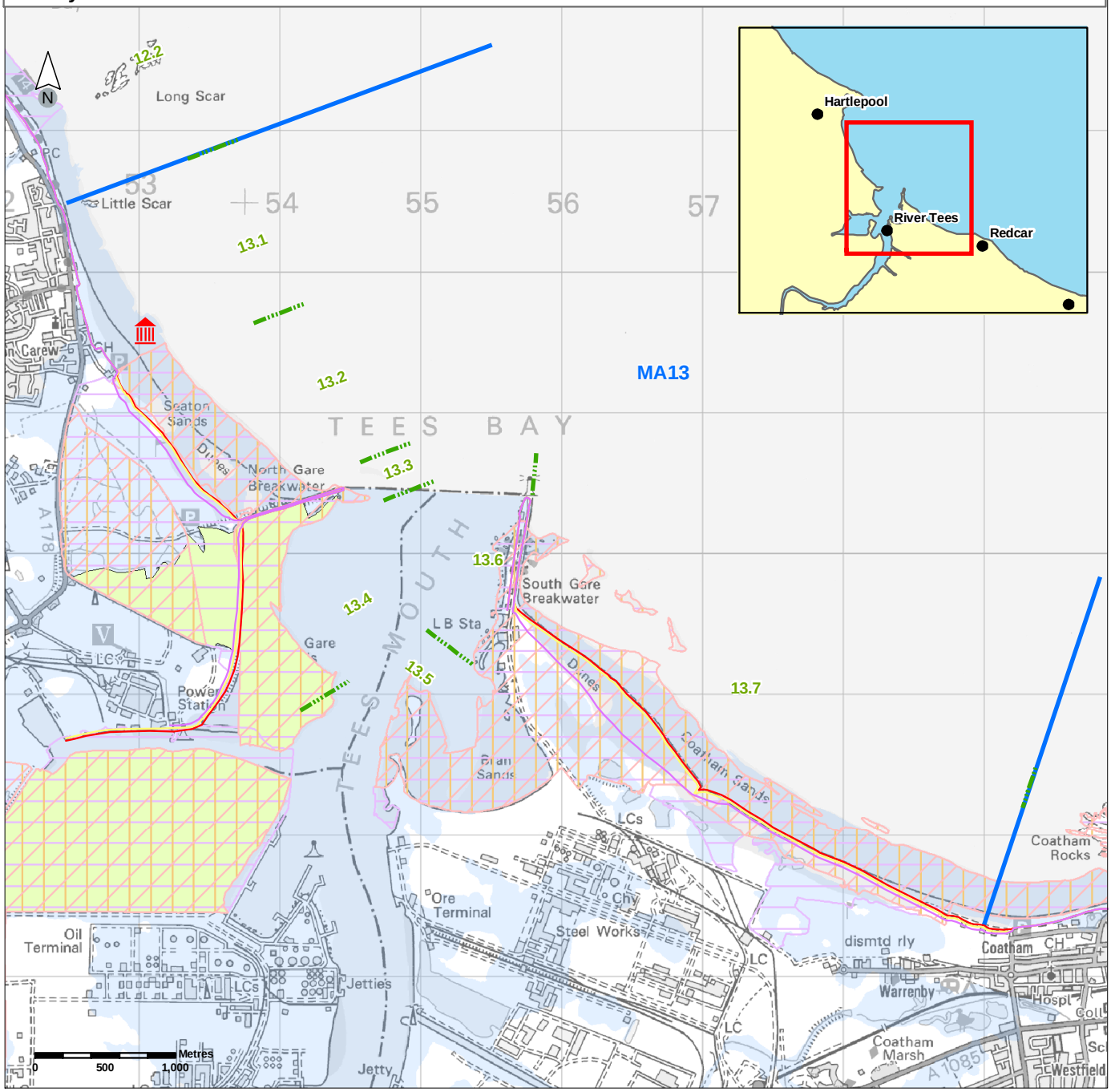
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	23,061	15,683	8,846	47.586
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	23,061	15,683	8,846	47.586
	Costs of Implementing plan £k PV	1,820	327	166	2,037
Costs include estimate for future maintenance and improvement to defences at Seaton Carew. Maintenance costs of the North and South Gare not included. Costs associated with improving defences to power Station not included. Description of damage and benefits under preferred plan: • Loss to Golf Course (not included in damages). • Potential loss to existing sea front at Seaton Carew.					
Heritage	No loss of heritage structures but the area is of potential archaeological interest and further investigation may need to be undertaken where coastal retreat exposed new foreshore.				
Amenity	• Possible reduction in value of Golf Course at Seaton. • Maintained beach use at Seaton Carew. • Watersports within South Gare supported. • Recreational value of Coatham Sands potentially enhanced.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	Yes, at a local scale
Impact of geomorphology and hydrodynamics	Yes, inherent in mainating the Gares

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA13
Policy Units 13.1-13.7



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Hold the line to Seaton Carew, while allowing natural roll back of the Seaton Sands Dunes and the North Gare Dunes. Allow the natural development of the Bran sands and Coatham Dunes, within the strategic control of maintaining the South Gare.	As per present day, but to consider retreat of the Seaton Carew sea front. Detailed consideration of flood risk to the area to the south of the North Gare Breakwater. Land use management plan for the area behind Seaton Dunes.	As above but ultimately maintain defence to Seaton Carew.

Key:

Predicted Shoreline Mapping*

Preferred Plan

- 20 Years
- 50 Years
- 100 Years

- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, red knot and common redshank) and an internationally important assemblage of waterfowl.	
Sub Feature(s) Supralittoral sediment (throughout Management Area)	**Sensitivity** Loss of SPA and Ramsar habitat (dune habitat considered important for breeding little tern)	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores, intertidal sandflat and mudflat, shallow coastal waters and saltmarsh.
Potential effect of policy	Maintaining the Gare breakwaters maintains overall control of the frontages to the north and east. Within this there would be a natural retreat of the Seaton Dunes. No active intervention to the south and east of the estuary will support the natural development of Coatham Sands.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

SPA and Ramsar Site Feature	Annex 1 bird species and regularly occurring migratory birds not listed on Annex 1 (little tern, red knot and common redshank) and an internationally important assemblage of waterfowl.	
Sub Feature(s) Littoral sediment	**Sensitivity** Loss of mudflat and sandflat habitat known to support important numbers of waterfowl.	**Conservation Target**
Potential effect of policy	The policy suite supports the natural development of the Seaton Dunes Coatham Sands and associated littoral sediment.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

	MANAGEMENT AREA: Description of Designation	Affect of Preferred Plan	Measures to offset affects /impacts Compensation/Mitigation/Alternative Solution
National	On the coast north of the Teesmouth are 3 designated SSSIs – Seaton Dunes and Common, Seal Sands (wildfowl and waders) and Tees and Hartlepool Foreshore and Wetlands (wildfowl and waders), along with Teesmouth NNR. To the South is South Gare and Coatham Sands SSSI (flora, invertebrates and birdlife).	13.1, 13.2 Neutral effects at Seaton Carew and Seaton Sands 13.4 Positive effects for nature conservation at North Gare Sands. 13.5 Potential use of dredged material at Bran Sands and re-inundation of the former brackish lagoon area at Coatham Sands would have positive effects.	Allow the dunes to roll back to provide a more coherent defence against flooding. Retreat and natural development of dunes and sand flats may not provide sufficient defence. Retired defences may be required.
Local	Seaton Dunes and Common LNR (Rural)	As above	As above

ACTION PLAN FOR MANAGEMENT AREA 13

Action	By when	Responsibility	Cost £k
Strategy for Seaton Carew, review of condition and develop management strategy. *High economic value. Poor condition of defences. Potential for more sustainable defence. Beach use. Amenity value. Long term redevelopment*	2009	Hartlepool BC	80
Management plan for Seaton Dunes. Co-ordinate land use and dune management. *High opportunity for biodiversity linked to designated areas. Amenity use of area. Associated flood risk*	2010	*Co-ordinated by* Hartlepool BC (Environment Agency)	5
Review flood defence strategy to Teesmouth. *High economic value. Advice against unsustainable development. Ensure integration with port development. Opportunity for biodiversity linked to designated areas. Maintain navigation and water sports*	2012	Environment Agency. (Hartlepool BC/ Redcar and Cleveland BC.)	50
Review flood risk to rear of Coatham dunes. Examine need for retired flood defence *Potential economic risk and risk to property. Advice against unsustainable development. Long term evolution of dunes with biodiversity opportunities. Transition between Coatham and Coatham dunes.*	2010	Environment Agency. / Redcar and Cleveland BC.	30
Management review. Review of defence measures associated with development at Coatham. *Integration of sustainable defences.*	2007	*Co-ordinated by* Redcar and Cleveland BC	5
Schemes: Management for Seaton Carew defences determined from strategy.	2010	Hartlepool BC	

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Coatham Sands to Mill Howe
Management Area reference:	MA14
Policy Development Zone:	5

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The Redcar frontage would be defended maintaining its value to the regional, but with potential loss of the sand foreshore. The potential for development to the west of Redcar would be maintained but in developing plans for the area opportunity should be taken to consider how a suitable transition is to be created between defence of this frontage and the natural development of Coatham Sands. This equally creates the opportunity to maintain a healthy beach, visual and amenity value. To the east of Redcar the policy would to maintain the overall defence to the East of Redcar but using the width of the Stray to allow a more adaptive management approach in the future.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Hold the Line at Redcar and to the development planned between Redcar and Coatham Sands. Maintain the line of defence to the East of Redcar with possible improved defence to low lying area behind.
Medium term	As above but realigning the eastern flank of Redcar, while maintaining flood defence to low lying area behind.
Long-term	As above but adapt defence to the western end of the Coatham defence to ensure a sutaible transition to Coatham Sands.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025	**2055**	**2105**	**Comment**
14.1	Coatham East	HTL	HTL	HTL	Consideration of a transition between the development area and Coatham Sands.
14.2	Redcar	HTL	HTL	HTL	Look to local management to maintain beach.
14.3	Redcar East	HTL	HTL	MR	Strategic control
Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention, MR – Managed realignment					

CHANGES FROM PRESENT MANAGEMENT

The area has been subdivided from the management unit proposed in SMP1. Policy for the Redcar frontage remains unchanged as does the frontage to the west but the policy to the east side now recommends realignment to allow better width for natural development and a more robust defence system.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	533	431	2773	3,115
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	533	431	2773	3,115
	Costs of Implementing plan £k PV	12,000	633	266	12,899

The initial draft strategy identifies damages amounting £11M due to flooding as a result of overtopping and as a result of amenity loss. This is under review as the strategy is taken forward.
Costs based on strategy with an estimated sum allowed for works to east and west of Redcar.
Description of damage and benefits under preferred plan:

- Potential loss of part of Caravan park to west of Redcar.
- No increased risk to Redcar.
- Improved resilience to defence of proposed development area.

No account has been taken of the additional benefit arising from the development to the west of Redcar. Protection of the Redar frontage on its own has been justified during the initial stage of the strategy development.

Further development of the strategy, carried out concurrent with the development fo SMP2, indicates higher potential damages and, therefore, benefits and higher costs. Costs are estimated as being of the order of £12,000k

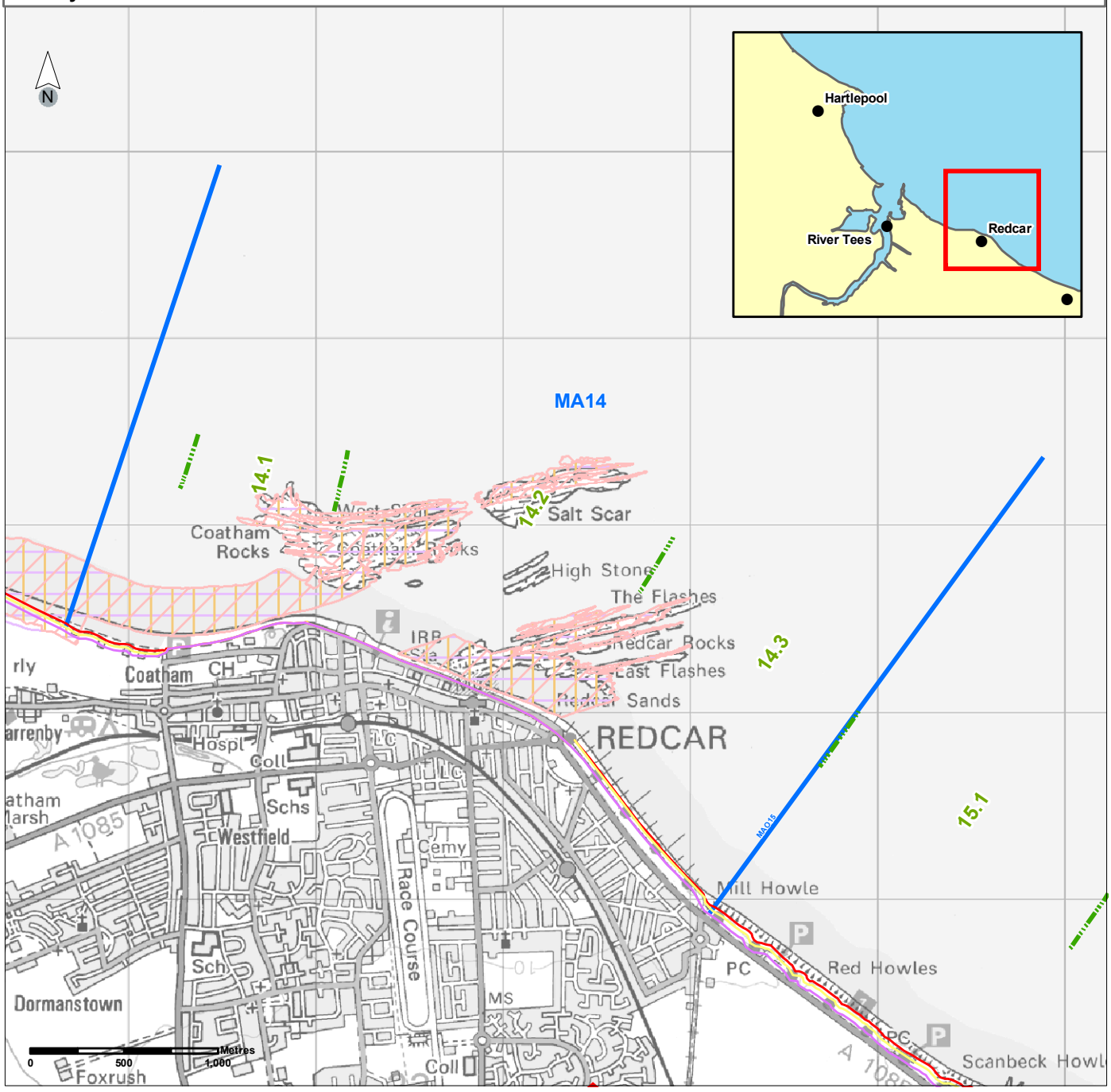
Heritage	No loss of heritage structures.
Amenity	• Potential loss of amenity value to Redcar • Maintained amenity value to Coatham Links. • Partial loss of to open area of the Stray

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	Local

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA14
Policy Units 14.1-14.3



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)		
From Present Day:	Medium - Term:	Long - Term:
Hold the line at Redcar and to the development planned between Redcar and Coatham Sands. Maintain the line of defence to the East of Redcar with possible improved defence to low lying area behind.	As above but realigning the eastern flank of Redcar, while maintaining flood defence to low lying area behind.	As above but adapt defence to the western end of the Coatham defence to ensure a suitable transition to Coatham Sands.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and Ramsar Site Feature	Annex 1 Birds and regularly occurring migratory birds not listed on Annex 1 (i.e. little tern, red knot and common redshank) and an internationally important assemblage of waterfowl.	
Sub Feature(s) Supralittoral sediment (Coatham Sands) *(Redcar Rocks are designated as an Earth Heritage feature)*	**Sensitivity** Loss of SPA and Ramsar habitat (dune habitat considered important for breeding little tern)	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species. Including rocky shores, intertidal sandflat and mudflat, shallow coastal waters and saltmarsh.
Potential effect of policy	The policy suite is to defend the Redcar frontage. This could lead to potential losses of sand foreshore, however, the intent of the policy is to look to local management options to maintain the beach and, therefore, maintain the SPA interest sub-feature.	
Preventative Measures Ensure that local management options to maintain the sand forshore are incorporated into engineering measures to defend the Redcar frontage.	**Mitigation** None	**Implications for the integrity of the site** Provided that the preventative measures described are implemented, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA14

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
National	South Gare and Coatham Sands SSSI (flora, invertebrate fauna and birdlife) and Redcar Rocks SSSI (geology).	No perceived effect	Allow natural roll back of dunes
Local	Site of Nature Conservation Importance	No perceived effect	None proposed

ACTION PLAN FOR MANAGEMENT AREA 14

Action	By when	Responsibility	Cost £k
Revised strategy and appraisal. Extend strategy to Redcar east and develop detailed schemes. *High economic risk. High risk to properties. Potential development issues. Integration with designated sites. Amenity use of Redcar and beach. Long term management of East Redcar*	On going	Environment Agency/ Redcar and Cleveland BC	300 -
Schemes: Improved protection to frontage	2009	Environment Agency/ Redcar and Cleveland BC	12,000

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Mill Howle to Saltburn
Management Area reference:	MA15
Policy Development Zone:	5

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The management intent is to maintain the overall natural development of the area while also maintaining defence character to the local areas of Marske and Saltburn. At Marske it is important to consider early how control of the frontage may be maintained without resulting in hard defence creep along the shoreline.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain existing defences at Marske. Hold the line Saltburn
Medium term	Review the strategy for defence at Marske with the intention of creating local bastions to maintain the natural headland. Hold the line at Saltburn. Manage the retreat of the areas between, in particular allow for retreating the car parks.
Long-term	Hold the Line at Saltburn and allow controlled retreat at Marske.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
15.1	Red Howles	NAI	NAI	NAI	
15.2	Marske	HTL	HTL	MR	Headland control
15.3	Marske Sands	NAI	NAI	NAI	
15.4	Saltburn	HTL	HTL	HTL	

Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention, MR – Managed realignment.

CHANGES FROM PRESENT MANAGEMENT

The SMP2 policies confirm those proposed by SMP1. The approach to defences at Marske would now allow greater adaptation of the coastline rather than a linear line of defence.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

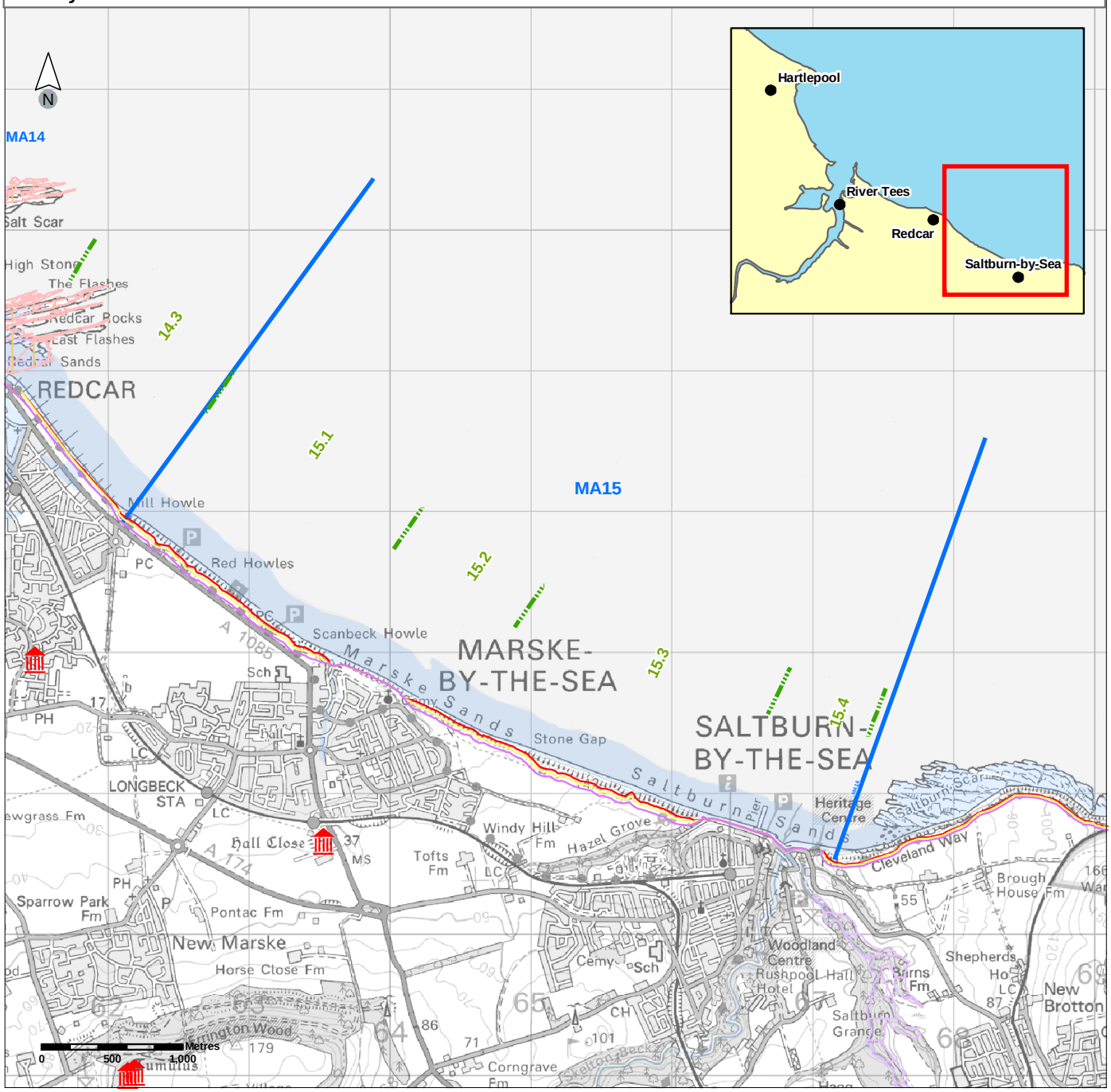
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	128	132	505	765
	Preferred Plan Damages £k PV	50	34	19	0
	Benefits £k PV	78	98	486	662
	Costs of Implementing plan £k PV	15	365	228	294
Costs assume works to Saltburn in year 35 and to Marske in year 50. No damages have been taken for overtopping at Saltburn. Description of damage and benefits under preferred plan: • No anticipated loss of hard assets. • Continued loss of agricultural land.					
Heritage	No loss of heritage structures but the area is of potential archaeological interest and further investigation may need to be undertaken where coastal retreat exposed new foreshore.				
Amenity	• Maintained beach and recreational value of the area. • Retain character and tourism attraction of Saltburn.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA15
Policy Units 15.1-15.4



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Maintain existing defences at Marske. Hold the line Saltburn	Review the strategy for defence at Marske with the intention of creating local bastions to maintain the natural headland. Hold the line at Saltburn. Manage the retreat of the areas between, in particular allow for retreating the car parks.	Hold the Line at Saltburn and allow controlled retreat at Marske.

Key:

Predicted Shoreline Mapping*

Preferred Plan
- 20 Years
- 50 Years
- 100 Years

- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA15

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	None	N/A	None proposed
National	None	N/A	None proposed
Local	Site of Nature Conservation Importance	None perceived	None proposed

ACTION PLAN FOR MANAGEMENT AREA 15

Action	By when	Responsibility	Cost £k
Develop strategy for Marske and Saltburn. *High economic loss. Risk to properties. Potential for biodiversity enhancement. Amenity use of area. Maintain water sports and access*	2009	Redcar and Cleveland BC	120
Schemes: no scheme identified			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.6 PDZ 6 Skinningrove

4.6.1 Policy Development Analysis

DESCRIPITON

Physical

The zone covering a length of some 6.5km, is dominated by the high coastal cliffs backing the wide foreshore platforms of Redcar Mudstone. Only to the eastern end does the Skinningrove Beck cut down through this cliff line as a narrow gorge, disgorging over a slightly wider valley at the coast. The cliffs rise quickly to the end of the zone at Hummersea.

Huntcliff forms the westerly headland with a steep vertical upper section and relic landslide to its toe. At the crest of the cliff is generally open land but with the nationally important mineral rail link running no more than 20m, in places from the cliff edge. The Cleveland Way route lies between the cliff edgeand the railway. The nature of the cliff changes approaching Skinningrove, with till tending to provide an upper surface to most of the cliff and in fact comprising the main cliff to the west of Skinningrove. Here the cliff has suffered major slumping. The shore over this Cattersty section is sand beach with an upper dry sand area with dunes. The old Skinningrove steelworks jetty protrudes 300 m across the sand foreshore at the end of Cattersty Sands and behind this the cliff comprises principally slag and rubble from the steelworks. Above the Cattersty cliff is open agricultural land apart from immediately behind the Jetty, there has been constructed a reservoir for the steel works. The east face of the jetty continues around the shore, at its inner end towards the village of Skinningrove, as a rock revetment. The revetment retains the toe to the clay coastal slope but also supporting the route of the Cleveland Way footpath. The revetment works have recently been upgraded to provide increased protection against overtopping.

Within the Skinningrove valley, the village resides on a low till platform with the beck running to the south and eastern side of the village. The settlement is protected on its seaward face by a low concrete block wall and this basic line of defence has been enhanced through the construction of a rock fishtail groyne to the eastern side of the beck. This structure has encouraged significant build up of material both in its lee and in front of the old sea wall. Recent works have been undertaken further upstream on the beck to stop fluvial flooding to the village. The foreshore to the valley is generally a sand and shingle veneer over boulder clay and rock. The sand gradually diminishes and the rock platform re-emerges beneath Hummersea cliff.

Environment

The whole zone lies within the Heritage Coast designation and is identified as part of an area of Special Landscape Value. The Cattersty Sands Dunes are designated as a SNCI. There is also a SNCI along the toe of Huntcliff. The National Trust own land at Huntcliff and to the east at Hummersea

Skinningrove is one of several small coastal villages within the Heritage Coast area and these are seen as important for their cultural and heritage context. Skinningrove is possibly more unusual in that although it supports a traditional small beach launching fishing industry, the main development of the village has been only over the last 150 years, based strongly around the industrial development in the area; particularly that of the ironstone mining and thesteel industry.

There are other heritage features associated with the coast, including the site of a Roman Signal Station and the Scheduled Ancient Monument (SAM) of the Huntcliff Guibal fan house on the Huntcliff Headland. In addition, the area contains many listed archaeological sites along the cliff tops. The mineral railway around the Headland is a vital transport link for the local but nationally important industries of the area.

The whole section of coast is part of the Cleveland Way coastal footpath and Skinningrove does act as an important access point to this and has a car park on the sea front servicing this need.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence.

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To support the cultural heritage of the village of Skinningrove, taking account of the needs of people who live and work on the coast.
- To reduce risk of flooding and erosion.
- To maintain the transport link for industry supporting the economic benefits of the area.
- To maintain use of the Cleveland Way

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:25yr	1:50yr	1:100yr	1:200yr
-2.13	2.68	3.18	3.47	3.6	3.68	3.79	3.86

Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 2.9m below Ordnance Datum.

Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between.

Source (extreme water levels): Skinningrove Coastal Defence Management Plan, Mouchel 2003.

Wave climate

Return Period (1:X years)	Wave Height Hs (m)*
1	7.5
10	9.7
50	11.2
100	11.9
200	12.5
1000	14.1

* For bearing of 15^{o}. Source: Skinningrove Coastal Defence Management Plan, Mouchel 2003.

Baseline Erosion Rates

Huntcliff	0.1m per year
Cattersty Cliff	0.3m per year
Skinningrove	Complex due to structures.

All the above rates are based on existing evidence and may increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

The area is highly exposed to wave action, with the dominant wave direction coming strongly from the NNW through ENE sector. The rock platform at Huntcliff provides a degree of protection to the cliff and the evidence of the relic landslide of great antiquity suggests that supply from the weathering of the upper face to the cliff is a far more significant process at present than erosion at the toe. This balance might change with sea level rise.

The bay between Huntcliff and Hummersea cliff is sufficiently set back to allow the development of a narrow sand beach. This has been enhanced by the construction of the Skinningrove Jetty. Even so, prior to this construction there was still a significant area of sand, signifying that the general coastal orientation is quite closely aligned to the net wave energies. The growth of the Cattersty Sands, however, indicates that there would be some net drift to the south east in the absence of the structure. The structure however not only acts as a groyne (i.e stopping direct movement of material along the foreshore, but also to a degree as a breakwater, providing shelter to the coast to the east. This has allowed sediment moving around the head of the Jetty, and more generally from the offshore, to be fed and held to the eastern side of the structure. This effect is by no means perfect, and waves from any direction east of north can tend to run down the Jetty inner face, tending to scour material in towards the village frontage. Certainly before construction of the fishtail groyne, there could be excessive movement of material along the now-setback seawall to the village, into the narrows of the Beck and further to the east.

Shoreline drift much beyond Hummersea is likely to be very small, however, due to the change in

angle of the coast. Skinningrove and Cattersty Sands tends, therefore, to be a sediment sink; even if of limited capacity and even if now strongly reinforced by the presence of the Jetty.

The Jetty is in perilous condition and may well fail, almost certainly in part over the next 10years. This will reduce protection to the village.

Unconstrained:
In the absence of man made structure the coast will erode. In the case of Huntcliff, it is principally weathering action to the upper cliff that is causing this and the toe slope will remain reasonably static. The crest of the cliff may, however, continue to erode. Over Cattersty Sands, the beach does provide a degree of protection to the cliff behind but in the absence of the Jetty this frontage is likely to erode further. Arguably the extensive slag tipping to the area behind the Jetty is virtually now a natural hard point, reinforcing the Skinningrove ridge. This will act to a degree to slow erosion of both Cattersty and the cliff line to the east. However, the weaker boulder clay slopes to the east will still tend to erode as would the frontage and platform upon which the village is built. This valley would tend to function more as a pocket beach such that erosion within the valley would be slow, with the beach material forming a natural defence. This would result in a slow roll back of the shoreline, dictated by the slow retreat of the cliffs to either side.

MANAGEMENT

Present Policy

SMP1	Policy
MU0 and MU1B	Managed retreat.
MU1A, MU1C,MU2A and MU3A	Do Nothing
MU2B	Hold the Line

Skinningrove Coastal Defences Scheme Strategy Study (2006)

The study and subsequent monitoring recommends maintaining the landward section of the Jetty as a control groyne, providing protection to the toe of the outer sections of the Jetty and consolidating defences to the village. As such the defence policy is:

- Cattersty Sands — Controlled retreat
- Skinningrove — Hold the line

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

The slow erosion of the cliffs alongSaltburn Scar poses no real threat to the outflanking of the Saltburn frontage; considered in the previous policy development zone. At Huntcliff, the slow erosion of the cliff may threaten the mineral railway possibly over the next fifty years. This time period is uncertain. In terms of the influence on the coast the broader headland will continue to impose shape to the coast to either side and still tend to impose a constraint on sediment processes such that it remains an appropriate division in assessing policy over the next 100 years.

The strategy study for Skinningrove has determined that in the absence of action to maintain the groyne function of the Jetty, there would be a loss to the foreshore of Cattersty Sands. While this would increase sediments in front of Skinningrove, helping to maintain the ability of the shoreline to function naturally, the loss of material to the toe of the cliffs would result in significant loss; initially in loss of the Steel works reservoir, but also in destabilising the slope to the east and eventually the slope to the west side of the village.

Over the village frontage itself, the fishtail groyne is likely to remain effective well into the period of the SMP; although the structure would deteriorate. This would allow erosion cutting back through the front of the village and also result in loss of the road to the south. Without the full influence of the fish tail and in the absence of the Jetty, the seawall to town is in advance of the natural coastline and would come under increasing pressure over the next fifty years. Prior to works in the 1990s this wall was already under pressure both from wave action and as a result of the beck being forced back against the line of the defence.

This scenario would result in substantial loss to the village and community as well as loss of the Cleveland Way. It seems probable that much of the lower village would just cease to function and losses in terms of the community and cultural values of the area would be more significant than the strict loss of individual assets.

There is limited scope for retreat of the coastal path and loss of this section would mean the route of the Cleveland Way would have to be taken some considerable distance in land potentially affecting its function as a coastal pathway.

MDSF Evaluation		*PValue Damages*
Erosion	9 properties lost	£228,000
Flooding	No coastal flooding	
Other information	The strategy study identifies £8.8M damages due to flooding, cliff instability and loss due to erosion.	

Assessment of key objectives	• While maintaining natural processes the scenario fails to maintain either specific areas of natural ecological interest and fails to deliver the values of the heritage coast. • It fails support the cultural heritage of the village of Skinningrove. • Flooding and erosion risk increases. • Fails maintain the transport link for industry supporting the economic benefits of the area. • It does minimise reliance on defence

With Present Management (Scenario 2):

The value and importance of the mineral railway is significant to the regional and national economy, as well as to the specific industries it supports and current policy is to maintain this value by not conducting any works or operations that may compromise it.

The policy over most of the rest of the frontage is for no active intervention, with the exception of Skinningrove. Here the policy is to maintain at least part of the Skinningrove Jetty, with also the intent to support the main structure in the medium term through placing rock to the toe. This will tend to retain material in front of Cattersty Sands but allow still allow some movement of material through to Skinningrove Village. The key issue is that such a policy acts still to provide an overall structure to defence of the village.

This management policy will result in some increased exposure to the village the longer term as the Jetty fails, but works are proposed and justified to strength the existing defences in the area of the village.

The scenario developed by the strategy will not have any significant influence of adjacent sections of the coast.

MDSF Evaluation		*PValue Damages*
Erosion	No erosion losses	£0
Flooding	No flood damages assessed.	£0
Other information	The revised strategy identifies a potential economic loss of £1.7M.	
Assessment of Key objectives	• The scenario reduces damage to and supports both the natural heritage and objectives of the heritage coast. • It supports the cultural heritage of the village of Skinningrove. • It reduces risk of flooding and erosion. • It maintains the transport link for industry supporting the economic benefits of the area. • reduces reliance on the Jetty, consolidating existing defence.	

DISCUSSION AND DETAILED POLICY DEVELOPMENT

Scenario 1 fails to really address two key issues for the zone, the mineral railway and the defence of Skinningrove, and these are areas of difference between Scenario 1 and the current policy defined in scenario 2. The implications of these are discussed below.

The mineral railway is of major importance to the region but is not a coast protection issue. In terms, therefore, of the SMP the preferred policy is no active intervention within this shoreline area.

In terms of Skinningrove Village, the strategy has demonstrated value in undertaking a series of actions over the next 2 years to consolidate defences existing defences and to support the seaward section of the Jetty. Without some other beneficial use being made of the Jetty, maintaining this structure with the function solely of coast protection is possibly not seen as being sustainable in the long term. The proposed works are seen as sustainable within this context and have been demonstrated to be economically justified, without any detriment to the broader shoreline.

It has been identified during consultation that consideration is being given to the development of the Jetty for watersports use. If this were to happen, it is unlikely that works would have a detrimental impact on the coastal works being proposed and could be designed to improve matters. It would still, however, be recommended that the long term strategy for coast protection to the village should be developed on the basis that the out section of the Jetty is not going to provide the additional wave shelter that it currently does.

MANAGEMENT AREAS

The Skinningrove Jetty impacts on the management of both Cattersty Sands and the Village of Skinningrove. As such these areas should be treated within one management area despite the difference in policy. While Huntcliff is important in how the coast behaves, the issues relating to this section are significantly different. On this basis the zone is divided into two management areas:

- Huntcliff
- The Skinningrove area, extending from Huntcliff to Hummersea cliffs.

Policy statements or summaries are presented by management areas in the following sheets.

4.6.2 MANAGEMENT AREA POLICY STATEMENTS (MA16-MA17)

Location reference:	Saltburn to Huntcliff
Management Area reference:	MA16
Policy Development Zone:	6

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The main issue on this frontage is the railway. This is not strictly a coast protection issues. While recognising the importance of the railway, the policy for this area is to allow natural development of the shoreline.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	No active intervention in terms of coastal defence.
Medium term	No active intervention
Long-term	No active intervention

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
16.1	Saltburn/Huntcliff	NAI	NAI	NAI	investigate potential threat to railway line.
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

In effect there is no change from SMP1 policy. The policy for the western management units is changed from retreat to no active intervention in that the previous policy related more to the need for creating more space for the retreat of the Cleveland Way, not actually controlling the retreat of the coastline.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

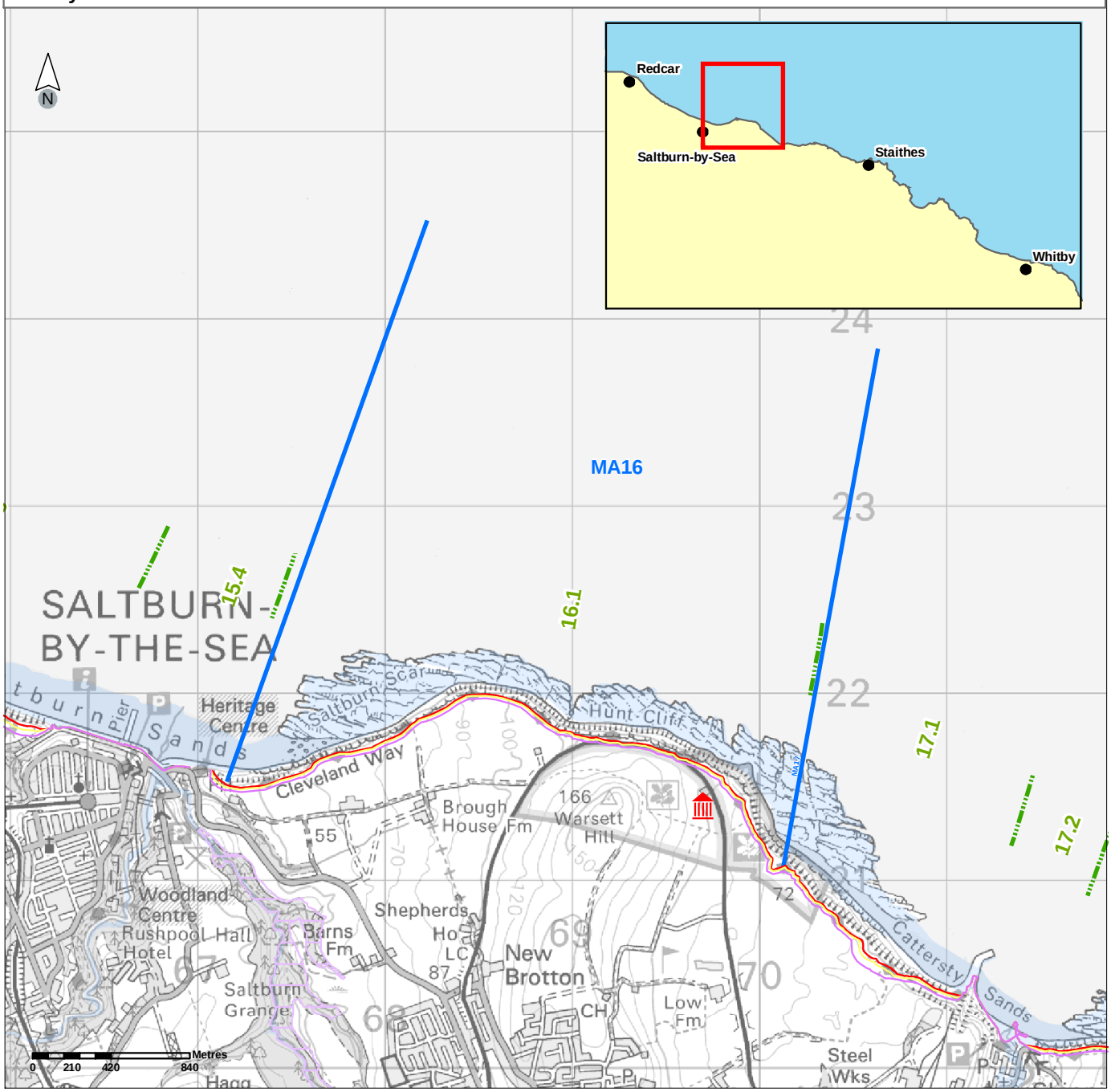
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	33	23	13	69
	Preferred Plan Damages £k PV	33	23	13	69
	Benefits £k PV	0	0	0	0
	Costs of Implementing plan £k PV	0	0	0	0
Damages due to loss of agricultural land. Description of damage and benefits under preferred plan: • Railway not addressed as a coast protection issue					
Heritage	Heritage structures not at risk during the period of the SMP2.				
Amenity	• Need to retreat the route of the Cleveland Way.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA16
Policy Units 16.1



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
No active intervention in terms of coastal defence. Consideration needs to be given to the threat to the railway.	No active intervention	No active intervention

Key:

Predicted Shoreline Mapping*
Preferred Plan
- 20 Years
- 50 Years
- 100 Years

- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA16

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
National	none	N/A	None proposed
Local	none	N/A	None proposed

ACTION PLAN FOR MANAGEMENT AREA 16

Action	By when	Responsibility	Cost £k
No actions			
Schemes: No schemes			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Huntcliff and Hummersea Cliff
Management Area reference:	MA17
Policy Development Zone:	6

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The aim of the plan in this area is to maintain the village of Skinningrove, but in such a manner that the impact on the natural coast is minimised. In doing this maintaining the inner section of the Skinningrove Jetty is seen as being important, providing a beneficial structure to the way in which the coast will evolve. Providing additional support to the out sections of the Jetty will not exclude sediment transfer to the village frontage and will provide additional protection. Defence at Skinningrove be maintained. The protection of the village would contribute to the objectives of the Heritage Coast.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain the the Jetty with rock. This maintains beach levels to Cattersty sands. Undertake improvement work to Skinningrove structures.
Medium term	Maintain the Jetty and hold the line at Skinningrove with no active intervention elsewhere.
Long-term	Hold the line at Skinningrove with no active intervention elsewhere.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025.	**2055**	**2105**	**Comment**
17.1	Cattersty Sands	R	NAI	NAI	retreat through maintaining inner section of Jetty
17.2	Skinningrove	HTL	HTL	HTL	Consolidate existing defence approach
17.3	Hummersea	NAI	NAI	NAI	
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

The only change from the SMP1 policies is in management of the retreat at Cattersty Sands. This is achieved by maintaining the inner section of the Jetty, rather than through works to the actual frontage.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

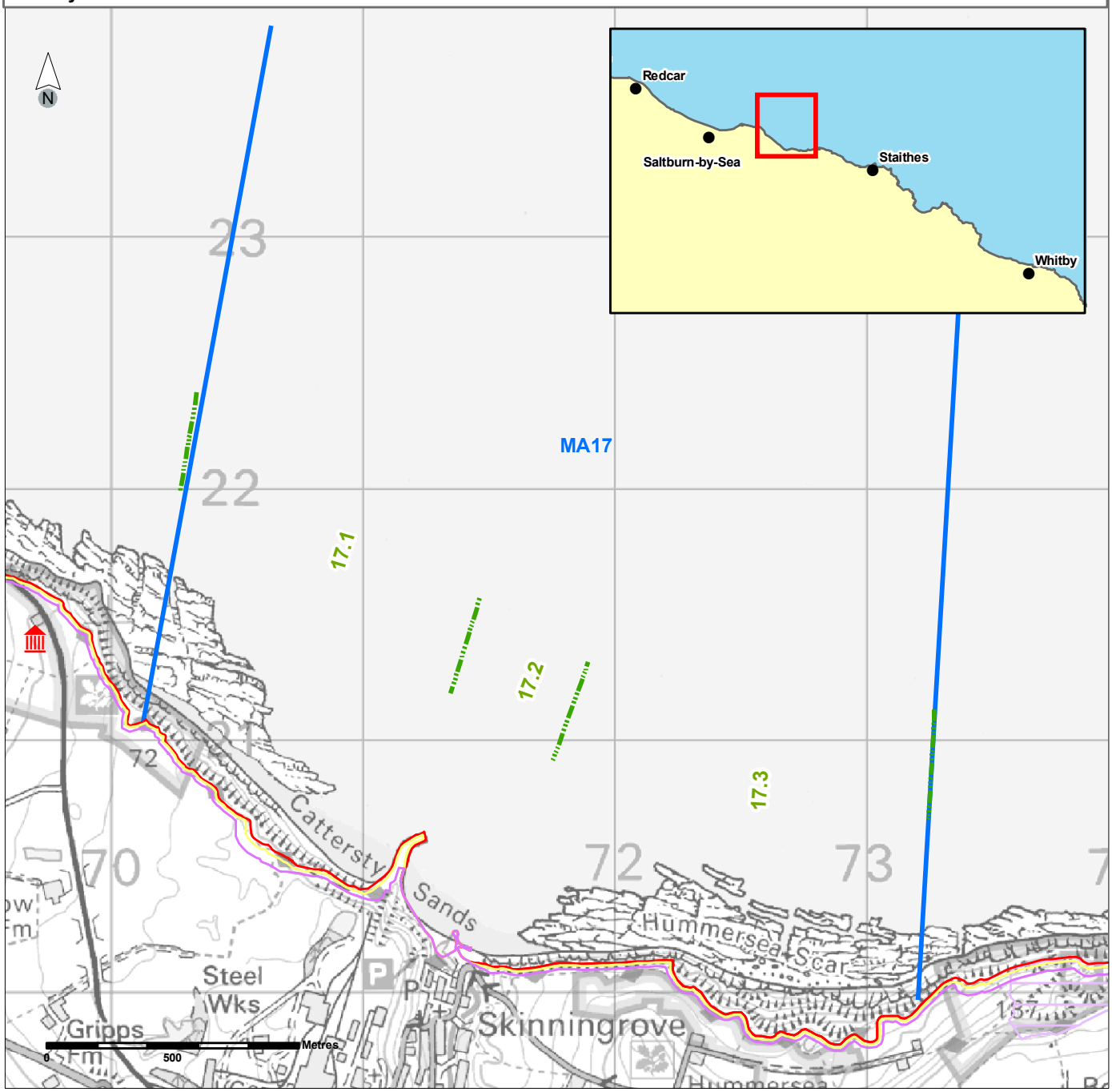
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	8,847	0	0	8,847
	Preferred Plan Damages £k PV	1,756	0	0	1,756
	Benefits £k PV	7,091		0	7,091
	Costs of Implementing plan £k PV	1,361	0	0	1,361
Costs and damages based on strategy (March 2006). Description of damage and benefits under preferred plan: • Loss of the outer section of the Jetty with increased exposure to the Village in the long term • Maintain the defence to the village					
Heritage	No loss of heritage structures during the period of the SMP.				
Amenity	• Maintain the route of the Cleveland Way				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA17
Policy Units 17.1-17.3



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)		
From Present Day:	Medium - Term:	Long - Term:
Maintain the jetty with rock. This maintains beach levels to Cattersty Sands. Undertake improvement work to Skinnigrove structures.	Maintain the jetty and hold the line at Skinnigrove with no active intervention elsewhere.	Hold the line at Skinningrove with no active intervention elsewhere.

Key:

- Predicted Shoreline Mapping*
  - Preferred Plan
  - 20 Years
  - 50 Years
  - 100 Years
- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA17

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
National	none	N/A	None proposed
Local	None, although dune systems present ore considered locally important.	Retreat of the line at Cattersty Sands has the potential to improve dune and beach function.	None proposed

ACTION PLAN FOR MANAGEMENT AREA 17

Action	By when	Responsibility	Cost £k
Scheme Development. Define specific works based on strategy. *Support for local community. Economic risk and potential loss of properties. Maintaining access and amenity.*	2008	Redcar and Cleveland BC	50
Schemes: • Refurbishment of defences	2009	Redcar and Cleveland BC	1400

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.7 PDZ 7 Hummersea Scar to Sandsend Ness

4.7.1 Policy Development Analysis

DESCRIPTION

Physical

The zone covers a length of some 18km comprising principally high vertical or steeply sloping cliffs, overlain by tills, with till slopes within valleys. A rock platform foreshore is near continuous over the length with variable degrees of old landslide material and cliff scree forming a toe to the cliff; depending on the cliff material, the structure of the cliff and exposure to scouring wave action. Only at Runswick is there a larger sandy bay, although there are smaller pocket beaches of sand in local areas. There are small settlements at Cowbar, Staithes, Port Mulgrave, and Runswick Bay, with only individual properties close to the cliff elsewhere. The general land use is agricultural.

At Boulby there are two properties close to the cliff edge. To the east, the Cowbar Lane runs close to the cliff in several locations running seaward of the two rows of Cowbar Cottages before cutting down behind Cowbar Nab as the only vehicle access to the north side of Staithes Village. The cliff at Cowbar Cottages (at the western end of Cowbar Nab) has been stabilised with works to the upper slopes and the construction of two lengths of revetment to the toe. Access to the main part of the village of Staithes is to the east of the Staithes Beck and runs northerly through to the southern part of the harbour. The harbour is enclosed by two recently armoured breakwaters and within these, on the northern and western side is the main village harbour front. Along this section is the public house, with other properties set slightly further back.

Immediately to the east of the harbour is the Penny Steel headland and beyond that the more distinct ridge headland of Old Nab. From here east the coast tends to run more steeply to the southeast; in comparison with the more ENE aspect of the coast to the west.

At Port Mulgrave there are the remains of the old harbour, with the principal remaining structures forming the eastern side. Where the western walls to the harbour were removed, there is now a shale beach, comprising debris from a series of landslides from the western cliff, that extends up above normal high water level. The area at the top of the beach is used by fishermen to store boats and equipment. To the rear of the harbour there is a high coastal slope which is formed with different levels of terraces, possibly suggesting former slumping or deeper seated failure of the slope. At the crest is a local road to a small number of properties. Most of the village of Port Mulgrave is located well inland of these properties.

Runswick Bay is formed between the headlands of Caldron Cliff and Kettleness and comprises a quite deeply indented sandy bay of some 2km in length, backed mostly by cliffs but also with steep till coastal slopes. The village of Runswick Bay is developed within the general valley formed by the Runswick and Nettledale Becks. As such, the village is set back within the lee of the western bay headland.

At Kettleness and beyond to Sandsend Ness the coast has been quite heavily influenced by old mining activities. These works are most evident at Kettleness and Sandsend Ness, but there has also been a history of open mining of the foreshore that has resulted in lowering of the rock platform in areas.

There are also current and historical underground mine workings in the Boulby area both inland and seaward of the coastline.

Environment

The whole zone falls within the National Park and Heritage Coast, where the ethos for management is to maintain the impressive natural character of the coast, but also to sustain the heritage and cultural values of the small communities in such a way as to ensure their continued functioning. Associated with this is the aim to maintain access and enjoyment of the coast for education, appreciation and awareness of the natural and human development of the coastal area. The Cleveland Way runs the full length of the zone and is an important element in meeting the above objectives.

Specific designated areas are the Boulby Quarries SSSI, the Staithes to Port Mulgrave SSSI and the smaller Runswick Bay SSSI to the north of the village, each associated with geological interest, particularly mining exposures, minerals and fossils. These are important for research and as a tourist attraction.

The small communities are thriving working villages, with fishing industries and as residential areas within the National Park; providing also an important aspect of the tourism industry. There are inshore life boat stations at both Staithes and Runswick supporting local commercial water use and the recreational water use of the area. The National Trust own land at Cowbar, at Port Mulgrave and to the north of Runswick Bay.

There has been a long history of mining over much of the area. The Boulby Potash Mine is currently the only remaining industry active in the area and is very important to both the national and regional economies.

Historically there was mining of ironstone, jet and alum and the coast has many important relics of this industry, reflecting an essential element of the historical development to the area. In some areas, open mining (quarrying) of the foreshore has affected the level of the rock platform and hence the response of the coast to erosion. Subsidence has been recorded in the area due to ironstone mining and there has been some study of this behaviour. The main element of this subsidence issue is believed to be associated with historical practice rather than recent mining activity and while there has been some research suggesting subsidence has affected coastal recession locally, this is not seen as a major factor in the broader evolution of the coast.

Kettleness is a village that has developed in association with the alum mining. The alum works feature is designated as a SAM. This is now advised to be in a perilous condition due to further movement of the coastal slope resulting from the landslide of 1829 that destroyed the village and alum works located on the foreshore.

KEY PRINCIPLES

- To contribute to sustainable development and support and integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence.

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To avoid damage to and enhance the natural heritage, within the context of the Heritage Coast objectives.
- To support the cultural heritage, particularly with respect to the early mining activities.
- To sustain the local communities, their culture, heritage and livelihoods.
- To maintain the route of the Cleveland Way.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:20yr	1:50yr	1:100yr	1:200yr
-2.15	2.65	3.15	3.61	3.7	3.85	3.99	4.1

Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 2.9m below Ordnance Datum.

Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between.

Source (extreme water levels): Cowbar Coastal Protection and Cliff Stabilisation Strategy, High Point Rendel (2000)

Wave climate

Return Period (1:X years)	Wave Height Hs (m)*
1	6.9
5	8.1
10	9
25	9.9
50	10.5
100	11.1

* Determined at 18m contour for wave direction bearing of 11^{o}.

Source: Cowbar Coastal Protection and Cliff Stabilisation Strategy, High Point Rendel (2000)

Baseline Erosion Rates

Boulby	0.1m per year
Cowbar	0.025m per year*
Penny Steel to Runswick	0.1m per year
Runswick Bay	0.2m per year slumping
Kettleness	0.1m per year

All the above rates are based on existing evidence and are likely to increase with sea level rise. A general factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

*Extensive monitoring and research has been undertaken by Durham University of this section of the coast. This work has been carried out concurrent with the development of the SMP2; results based on the initial 18 months monitoring having been published as a PhD. Thesis (M. Lim, 2006) and further discussion of the full 35 months research programme is presented in a report commissioned by the Staithes and Cowbar Association (personal communication with Mr. C. Mann and Dr. N. Rosser. Oct 2006). The findings of this research indicate both from the monitoring results and from further examination of historical evidence that erosion rates of the Cowbar frontage may be of the order of 0.025m/yr. The research provides an exceptional degree of accuracy in assessing erosion rates over the period of monitoring and this is supported by the result of the analysis of historical records. Even so in assessing policy, and given the relatively short time period of the monitoring in relation to the SMP, it is necessary to take a precautionary approach. As such, the continuation of erosion at this rate cannot be assumed to necessarily apply over the full period of the SMP. At present this is the best available evidence.

The research undertaken by Durham University is considered to be extremely valuable; enabling a better assessment of scenarios in the Cowbar area in Finalising the SMP2 but, equally, providing a better appreciation of cliff retreat mechanics which, as further knowledge is derived, will allow a more detailed approach to the assessment of risk in other areas of the SMP in the future.

Evolutionary Trend

Existing Processes:

The main shape of the coast is determined in part by the geological controls imposed by the various harder or more coherent sections of rock or by higher levels of rock platform. Even so, the whole section of coast is eroding.

Sediment drift is nominally from west to east in line with the dominant north to north east wave climate. There are areas of apparent sand movement in the nearshore area, with sand patches developed in areas of the nearshore. However, particularly over the more south easterly orientated coastline beyond Old Nab, at the shoreline, the headland promontories act to shelter the coast allowing trapping of the low sediment yield from the cliff. Runswick Bay is a more extreme example of this, acting predominantly as a sediment sink, with longshore movement of sediment effectively curtailed by Kettleness. There is some suggested onshore offshore movement in this area with general fluctuations of beach level in front of the village. This may be associated with large patches of sand in the nearshore area.

At Staithes there is little anticipated direct sediment supply from the west but the harbour breakwaters do allow what sediment supply there is to accumulate within the harbour. Some of this supply may be from the beck and it is indicated from consultation that there has been an increase in fine sediment within the harbour since the protection works were undertaken. This may be more associated with the closure of the eastern gap than with works to the mouth of the harbour but the particular cause of increased deposition is uncertain.

The old, partially dismantled harbour of Port Mulgrave acts in part to stabilise the till slopes behind.

At Runswick, the village is well situated in the lee of the Caldron Cliff and the high rock platform of the Cobble Dump. Even so waves from the north east tend to scour the defended frontage and impact on the slumping coastal slope to the south of the main village. The fact that general retreat of the toe of the coastal slope in this southerly area is low reinforces the view that sediment drift along the bay is very low and that there has been an historical balance between the forward movement of the toe due to the instabilities in the coastal slope compensating for the slow trend of coastal erosion.

Overall the strong natural control of the whole frontage indicates little interdependency between frontages although, as indicated, there may be interaction between this constrained drift system at the shore and the more dominantly southerly drift system in the nearshore and offshore area.

Unconstrained:

In the absence of the main man-made control features the coast would continue to retreat slowly. Further submergence of the rock platform due to sea level rise will result in greater exposure and erosion of the cliff toe and this over much of the area is seen as being a major component of cliff instability. Other factors influencing erosion are emerging from current research; these including chemical deterioration. Existing man-made features have little overall impact, effectively only influencing coastal evolution in local areas actually protected. However, past influence such as foreshore quarrying has resulted in change to the shoreline further complicating the assessment of erosion rates.

MANAGEMENT

Present Policy

SMP1	Policy
MU3A, MU3B, MU5, MU6A, MU6C, MU7B, MU8A and MU8B	Do Nothing
MU6B	Retreat
MU4 and MU7A	Hold the Line
Staithes Harbour and Cowbar Lane Strategies	
The strategies confirm the SMP policy for holding the line within Staithes harbour and due to the important access route to North Side the strategy for Cowbar recommends protecting the cliff line locally to the west of Cowbar. This latter recommendation is a change from the SMP1 policy and has been implemented.	Hold the line
Runswick Bay Strategy	
Following from the emergency works to the south of the village the strategy for the rest of the frontage recommends holding the line to the village.	Hold the line

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

Over most of the frontage this scenario of No Active Intervention is the existing policy and there has to be recognition that there will be a loss in terms of some individual properties principally at Boulby Cottages over possibly the next 50 years and potentially at Kettleness Farm beyond 100 years.

It is in the areas where there is a current hold the line policy that the differences between scenarios occur. Given a No Active Intervention policy at Staithes, while the harbour breakwaters are still seen as providing significant protection, other walls would fail with loss, over the 100 years, of much of the property to the southern side of the harbour. There is still uncertainty as to the retreat of the Cowbar Nab Headland, although recent monitoring has strongly indicated that erosion rates are less than previously thought. There is likely to be some thinning of the headland and, possibly, this could reach a point where the protection the headland provides to the harbour and village is reduced. Based on the improved understanding of the behaviour of the cliffs in this area, the full impact of this is likely to occur beyond the 100 year period of the SMP2. Even so, this longer term trend, and ultimate possibility of risk, has to be acknowledged in considering policy for the SMP2 period. Without further intervention, the trend will be for a gap to develop between the headland and the existing harbour structures.

At Cowbar Cottages, the most recent data on erosion would suggest that only part of the road may be lost over the next 100 years; given also that the existing works to the frontage are designed to provide protection over the next 50 years. It is accepted that this is a possible scenario, based on current monitoring. Taking a more precautionary approach (inherent to the long term approach of the SMP), but still assuming that the existing defence results in a significant reduction in erosion over the next 50 years, the coast to either side of the protected area will erode further. Without continued intervention (supporting the existing revetment) it would be anticipated that there could be relatively rapid failure of the revetment as this becomes more exposed over the latter part of the SMP period. In effect, under this No Active Intervention scenario, over the 50 to 100 year period of the SMP the frontage would revert to a natural eroding cliff line, with a tendency for the formerly protected frontage to be subject to greater pressure for erosion. The result of this might then be the loss of the road, and with it the access to the North Side of Staithes harbour, despite the low erosion rates at present being experienced. There therefore remains a possible risk to the road.

Further west, the council have made provision to retreat the coast road and provision for

further realignment needs to be allowed for, with this uncertainty in mind.

Clearly the management of this area has to be considered in relation to the management of Staithes, its harbour and the continued use of the North Side quay. As management develops over the period of the SMP, the above assessment reinforces the need for policy and implementation to be considered over the whole area, rather than in relation to individual frontages.

Further along the coast at Port Mulgrave, erosion is continuing. The old port itself is in poor condition but still retains a good degree of sediment to the toe of the coastal slope. The frontage also benefits from shelter from the coast to the north and west. The stability of this slope, as recorded in the SMP1, is still uncertain but there are no records of concern or significant movement. Although failures are evidently episodic and of a potentially quite large scale, the estimates of erosion at the crest of the cliff suggest that no properties would be at risk immediately. This would need to be confirmed through more detailed investigation. The old harbour works, however, are in a rapidly deteriorating condition and loss of these structures would allow rapid erosion of the beach area they retain. If this toe support is critical to the stability of the coastal slope, then this could result in earlier loss of property at the cliff crest.

With no intervention, a significant area of Runswick Bay village would be lost and according to the strategy study, this is also likely to trigger more major slope failures which would affect parts of the village further back. Therefore, despite the relatively sheltered position of the village frontage and despite there being little significant pressure for the coast to erode, substantial losses would occur under this No Active Intervention scenario as defences fail, principally due to undermining, due to erosion and scour.

Over much of the coast there would be loss of the Cleveland Way, and if this is to be maintained the path would need to be retreated. While continued access would need to be negotiated with land owners, there is not seen to be any physical barriers to the retreat of the path.

MDSF Evaluation		*PValue Damages*
Erosion	100 properties lost due to erosion or loss of access	£2,278,730
Flooding	19 residential and commercial properties potentially affected.	£6,253,000
Other information	Strategy for Cowbar coast protection scheme identifies damages amounting to £126M due to loss of Cowbar lane and the impact on the north side of the harbour. This is revised in line with new information relating erosion rates. Runswick Bay Strategy identified potential damages of £17.7M.	
Assessment of key objectives	• While gradually restoring the coast to its natural condition and in doing this meeting the natural environmental objectives there would be substantial loss in terms of access and support to use to the area. • Significant aspects of the cultural heritage would be lost. • The local communities would not be sustained. • There would be a reduced reliance on defence	

With Present Management (Scenario 2):
Present management policy focuses appropriately on the local communities, while maintaining the natural character and integrity of the majority of the coastline.

At Staithes the strategy has identified a good benefit in maintaining existing defences, although no allowance is made for future works in addressing erosion of the Cowbar Nab.

Continued monitoring is essential in developing confidence in the low erosion rates based on current measurement. Taking a precautionary approach, in the longer term (possibly in 50 years time), if erosion rates were found to increase, there would be justification for intervention. It has, therefore, to be assumed that it is sensible to continue to maintain the existing protection while further information is gained. Protection of the village would be in line with the overall objectives for the area. The continued erosion of the cliff line adjacent to the existing revetment at Cowbar would come under increasing pressure and to sustain the existing policy would require further intervention. There would also be a need to ensure that the integrity of the North Breakwater to the Harbour was maintained. Under the revised erosion rates this process of addressing these problems would only result in a slow encroachment on the natural coastline and may in practice be quite minor, if the rates directly determined by the monitoring are shown to be representative of the longer term evolution of the coast.

The strategy for Cowbar Lane and Cowbar Cottages was determined by a study and works have now been undertaken to implement this. The strategy allows erosion to continue further to the west with the intention to retreat the line of the road. The cliff stabilisation works has a good economic justification when compared against a do nothing option, based on the potential risk. Further demolition of cottages to make room for the access was rejected. The stabilisation works include both works to the crest at the road and construction of a rock revetment to the toe of the cliff. These works aim to provide a 50 year period of protection. If erosion rates are found to reflect the low rates currently experienced then it may not be necessary to undertake further protection but at present the intent would be to continue to protect. If rates are higher in the future, based on a projection of current rates such a policy is likely to be sustainable.

Looking beyond the period of the SMP2, and accepting further increase in sea level, the problems of erosion will increase. However, the rate of erosion is now considered to be such that adjustment to an existing defence policy would be possible, without introducing any major discontinuity in the coast. It has to be appreciated, however, that to maintain the current intent of the defence, would incur a continuing need to extend defences to stop outflanking. This scenario would, therefore, need to be reviewed as further information is obtained through monitoring. At present, under this Present Management scenario the envisaged adjustment to existing defences is considered to have only a local impact over the period of the SMP2 and, while potentially increasing beyond this period, it is not considered that such a scenario for management over the initial 100 years would impose a major constraint on management options beyond the initial 100 years.

The SMP 1 policy for Port Mulgrave is for retreat, although the implications or intention of this is not discussed, beyond a need for further detailed investigation of the frontage. There is likely to be only limited benefits in undertaking works to the area and it is assumed that the policy merely refers to management of loss over the longer period.

The Runswick Bay strategy recommends the construction of a breakwater to the north of the village. This would reduce the scour along the defences and allow more minor works to be undertaken in maintaining the walls. The breakwater would reinforce the natural protection of the frontage and is seen as being a basically sustainable approach, protecting the village and essential character of the area without significantly encroaching on the natural coast. The Strategy Study identifes the poor condition of defences and the need urgent action.

In all other areas there would be no active intervention.

MDSF Evaluation		*PValue Damages*
Erosion	due to erosion south of Runswick Bay.	£157,000
Flooding	No flooding assessed.	

Other information	The present strategy for Cowbar is to maintain defences for at least the next fifty years.
Assessment of Key objectives	• Defence focuses on local communities. Only at Cowbar has there been significant encroachment on the natural environment. With revised erosion rates it is not anticipated that the extent of defences would need to be significantly increased. Therefore, generally the scenario avoids damage to the natural heritage, within the context of the Heritage Coast objectives. • The scenario supports the cultural heritage, but there would be continued loss to specific cultural heritage in terms of old mining activities. • The scenario supports the local communities, their culture, heritage and livelihoods. • There is a slight increase in reliance on defence

DISCUSSION AND DETAILED POLICY DEVELOPMENT

Over much of the frontage the current policy is for no active intervention and this meets key objectives for the area. The key issues are the local communities and these are discussed below.

Staithes and Cowbar

While the defence of the main Staithes village is demonstrated to be justified and sustainable, the real issue arises with respect to access to the Cowbar cottages and access to the North Side of Staithes. There are three distinct elements with respect to this over the next 100 years:

- The erosion of Cowbar Nab and hence the general degree of protection to Staithes Village and the Harbour.
- The access to the North Side of the Harbour, which links to the long term sustainability of the Harbour and village.
- Retaining the Cowbar Cottages, which to a degree is distinct from the issue of maintaining defence to Staithes; although in terms of incremental benefits this then determines the most effective approach to maintaining the access to the North Side of the village. In considering this, the rates of erosion are quite critical in that they would determine to what degree the existing defence may be sustained in relation to the retreat of the adjacent cliff line. This issue is discussed first.

The aim, based on the current strategy, would be to defend the line of the road in front of the Cowbar Cottages over the next 50 years and the policy is then to be reviewed. Further information from the recent monitoring, provides a confidence in substantially reducing rates assumed by the strategy. If rates of erosion continue to be low then even though the intent of management is maintain access to the north side of Staithes, there may prove to be no further need for intervention. At present, however, there remains the risk and therefore the sensible approach is for a policy of holding the line. It seems probable in any event that the degree of erosion would be such that additional protection could be provided, further extending the life of the existing defences. The discontinuity between the protected length and that of the adjacent cliff would neither be so severe nor create such a step as to cause significant energy concentration.

At the western end of Cowbar Nab, continued erosion would tend to have created a gap between the North Breakwater and the cliff face. Relatively minor works, in relation to the value of Staithes Harbour, would be required to address this and in all likelihood the line of the breakwater could be extended back towards the cliff to maintain the defence to the harbour and the village.

To the west of Cowbar Cottages the cliff line would have retreated but not to such a significant extent that the defence in front of the cottages would become severely exposed. Again it is reasonable to assume, based on the erosion rates considered, that relatively minor works would be required to ensure continuity of the defence. There may be a need to retreat the road in local areas and allowance has been made for this to be undertaken.

In this way it is considered that the defence of the Cowbar Cottages, the North Side of Staithes Harbour and Staithes Village itself would be sustainable over the period of the SMP2 and would not unduly impact on the natural cliff evolution, nor would it impose an approach to risk management, beyond that period, which would constrain future long term

adaptation. Having provided, through the recent construction of the revetment and cliff stabilisation, a baseline of defence, it is considered probable that there will remain sufficient incremental benefit in terms of local benefit to carry improve these defences; this, despite the fact that the principle benefit lies in maintaining access to the North Side of Staithes.

Should erosion rates prove to be closer to those suggested directly from the monitoring (0.025m/yr), then it would be likely that the existing defences would require substantially less work to maintain their integrity in 50 years time. As such, the policy for holding the current defence line would be that much more probable.

If, in what seems now as being an unlikely scenario, erosion rates were found to be significantly greater than those proposed by the SMP, or indicated by the monitoring, the policy for holding the line beyond the 50 year period would need to be reviewed. In this event there would also need to be further consideration of how defence to the Staithes area as a whole should be managed, given the threat of outflanking of the Harbour structures and the general thinning of Cowbar Nab.

Through this high level assessment of the different erosion scenarios, the preferred policies for this area would be to maintain a policy of Hold the Line in front of the Cowbar Cottages, No Active Intervention along the Cowbar cliffs and Hold the Line to Staithes; this all over the first two periods of the SMP2, through to year 50. The realistic expectation would be to continue with these policies over the full 100 year period. This would of course be reviewed over time with continued improved information on retreat rates being provided through monitoring.

The present monitoring has been of value both in providing a more realistic assessment of current erosion rates, as well as providing an emerging understanding of how this local area and cliffs of this nature may evolve. The work is considered to be of significant strategic value in understanding coastal erosion nationally. It is recommended that this research is supported in the future in addressing the continued uncertainties associated with the area and the broader issues for cliff management.

Port Mulgrave

The policy in this area really depends on the degree of stability to the coastal slope and the dependency of this on maintaining material at the toe. The old harbour structures still retain a significant amount of material to the toe in an area, which appears to cover the critical area of cliff in terms of the road and property at the crest of the cliff. The old harbour still also supports a small fishing community. Works to reinforce the old harbour walls would be relatively minor at this time but would be difficult to achieve if there is further failure. In effect the walls retain a beach which itself helps protect the main length of the walls. Gradual loss of the end to the wall will result in further loss of beach, which in turn exposes more of the wall. Potentially, maintenance of the end of the harbour wall, therefore, is seen as being realistically sustainable. The critical issue then is whether there are broader benefits in maintaining the structure in terms of the cliff stability and this needs to be examined in detail before a long term policy can be determined. The opportunity to take strategic advantage of this will diminish quite rapidly over the next ten years with further failure of the harbour structure.

Regardless of whether there is strategic benefit, there would no significant disadvantage should locally privately funded works be undertaken to maintain the harbour structures. The

critical decision is whether public funding is justified. On this basis and subject to review following further investigation the policy of retreat is confirmed.

Runswick Bay

The village frontage is seen as being in a fundamentally sustainable position with regard to the overall geomorphology of the area. The strategy has confirmed a good economic benefit for continued defence and this would support the general objectives for the area. The choice of option; that of reinforcing the natural protection provided by the rock outcrop and headland to the north, works, in effect, to gain maximum benefit from natural processes, allowing a less intrusive approach to defence of the village, without significant impact on either the natural environment or adjacent defences. The SMP, therefore, supports the findings of the strategy and the preferred policy for the village is to hold the line over the next 100 years.

There are concerns with respect to mud slides and the accumulation of seaweed and debris at the southern end to the defence. This is an important issue relating both to the properties immediately to the south and to the tourism value of the whole area, but is fundamentally a local issue and not specifically relevant to the SMP. However, in implementing the strategy to the main frontage, consideration should be given to whether there is scope for modifying the shape to the recent emergency works to alleviate the concerns. It has, however, to be appreciated that the three properties in this southern area may be lost over the next 50 to 100 years. During consultation on the Draft SMP, representation was made by the Runswick Bay Association. There was concern that the SMP appeared to provide a less detailed analysis of the frontage than that provided by the earlier Strategy. In response to this the role of the SMP has to be understood in that it is taking a broader view of the coastline and in many cases a longer time perspective than specific Strategy Studies. Even so, in the case of Runswick Bay, the SMP confirms the findings of the Strategy Study and the policy for holding the line in front of the village supports this. Furthermore, the SMP recognises the urgent need for works as identified in the strategy and this is reflected in the action plan developed by the SMP.

Further around the bay, issues have been raised as to the potential for providing defence to local features such as the sailing club. This is not seen as being economically justified at a national level and is not seen as being sustainable over the next 100 years. However, minor works to alleviate immediate problems would not significantly impact on coastal processes. Any such works would be subject to normal procedures and consents.

At Kettleness, only works of a major scale would reduce the threat of erosion. These would not be justified and could have a major impact on the natural value of the coast. However, the predicted rates for this area are low and properties are not anticipated to be at threat over the period of the SMP. This should be monitored.

In other areas of the coast there will be a loss of some of the heritage interests. It is not considered viable to take action to prevent this. Archaeological interests should be investigated and recorded and the SMP maps of erosion provide a useful indication in setting priorities for such action, although the uncertainty associated with these erosion rates has to be acknowledged.

MANAGEMENT AREAS

The sections of the coast are relatively independent. Only at Cowbar and Staithes and more locally with respect to Runswick Bay and the section of coast immediately to the south are there significant interdependencies. On this basis the zone is divided into four management areas:

- Boulby Cliffs, which remains relatively independent of decisions at Cowbar.
- Staithes, including the coast between Cowbar Cottages and the southern limits of Staithes.
- Old Nab through to Cobble Dump, including Port Mulgrave.
- Runswick Bay and extending through to Sandsend Ness.

Policy statements or summaries are presented by management areas in the following sheets.

4.7.2 MANAGEMENT AREA POLICY STATEMENTS (MA18-MA21)

Location reference:	Hummersea Scar to Cowbar
Management Area reference:	MA18
Policy Development Zone:	7

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area is to maintain the naturalness and natural evolution of the coast in support of the objectives of the National Park and Heritage Coast. Technically it would be difficult to address the loss of property in this section and potentially over the period of the plan two properties might be at risk. The actual risk needs to be assessed from longer term monitoring.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	No active intervention.
Medium term	No active intervention.
Long-term	No active intervention.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
18.1	Boulby	NAI	NAI	NAI	loss of property
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

No change to present policy.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

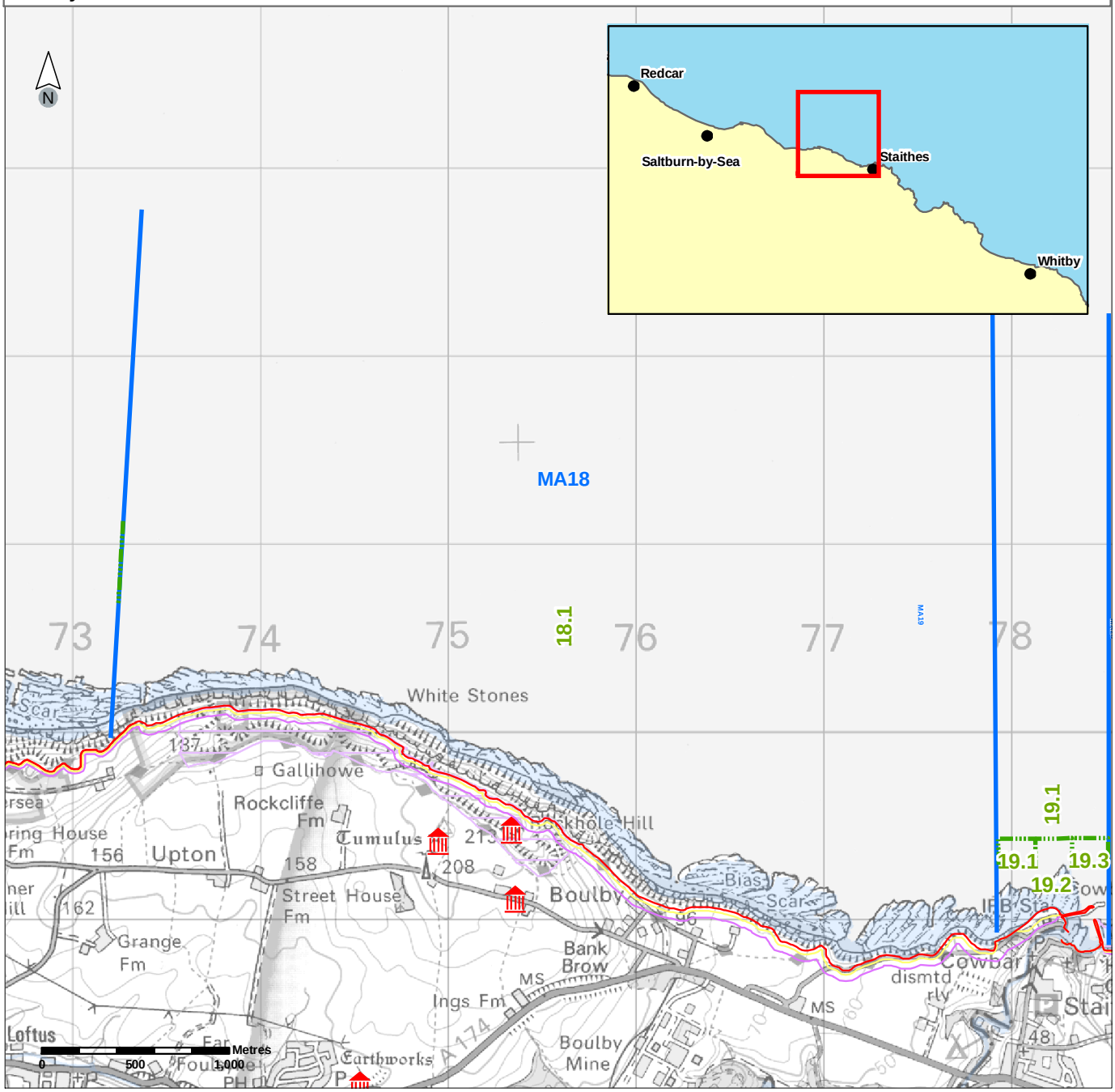
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	0	0	24	24
	Preferred Plan Damages £k PV	0	0	0	24
	Benefits £k PV	0	0	0	0
	Costs of Implementing plan £k PV	0	0	0	0
Description of damage and benefits under preferred plan: • Potential loss of one property at Boulby Village by 2105					
Heritage	No loss of heritage structures.				
Amenity	• Maintain natural coastline.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA18
Policy Units 18.1



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
No active intervention.	No active intervention.	No active intervention.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA18

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
	Boulby Quarries SSSI (Geological)	Policy will allow continued exposure of SSSI features.	None proposed
National	none	N/A	None proposed
Local			

ACTION PLAN FOR MANAGEMENT AREA 18

Action	By when	Responsibility	Cost £k
No actions identified			
Schemes: Potential need to relocate road (not coast protection)	2016	Redcar and Cleveland BC	

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Cowbar to Staithes
Management Area reference:	MA19
Policy Development Zone:	7

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The principle aim of the plan is to maintain protection to the village of Staithes. In the short to medium term no further works are envisaged in the area of the Cowbar Cottages beyond review and maintenance of the existing defence. As the adjacent cliff line retreats there will be a need to review this policy with the expectation that these defences would be reinforced. With respect to the Harbour, it is expected that further works would be required to maintain this structure as slow erosion of Cowbar Nab continues. There will be a need to review detailed aspects of defence to the Village as a whole, which would draw together an overall strategy for the whole management area.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	To hold the line in all areas currently defended. Monitor the retreat of adjacent cliffs and relocate the Cowbar Lane to the west of the Cottages as necessary.
Medium term	As retreat of the cliff to the east of Cowbar Cottages continues works may be required to reinforce the existing defences. In other areas existing defences would be maintained or replaced, subject to the need being identified by monitoring.
Long-term	Defence would be maintained beneath Cowbar Cottages and in maintaining the integrity of the north breakwater. Other defences to Staithes would be retained.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
19.1	Cowbar Cottages	HTL	HTL	HTL	Continued monitoring determining the need for further intervention.
19.2	Cowbar Nab	NAI	NAI	NAI	
19.3	Staithes	HTL	HTL	HTL	Develop a detailed strategy for local management of defences, taking in to account works at Cowbar.

Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention
* HR – Hold the Line on a retreated alignment

CHANGES FROM PRESENT MANAGEMENT

There is no change in policy from that set out in the various strategies for the area.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

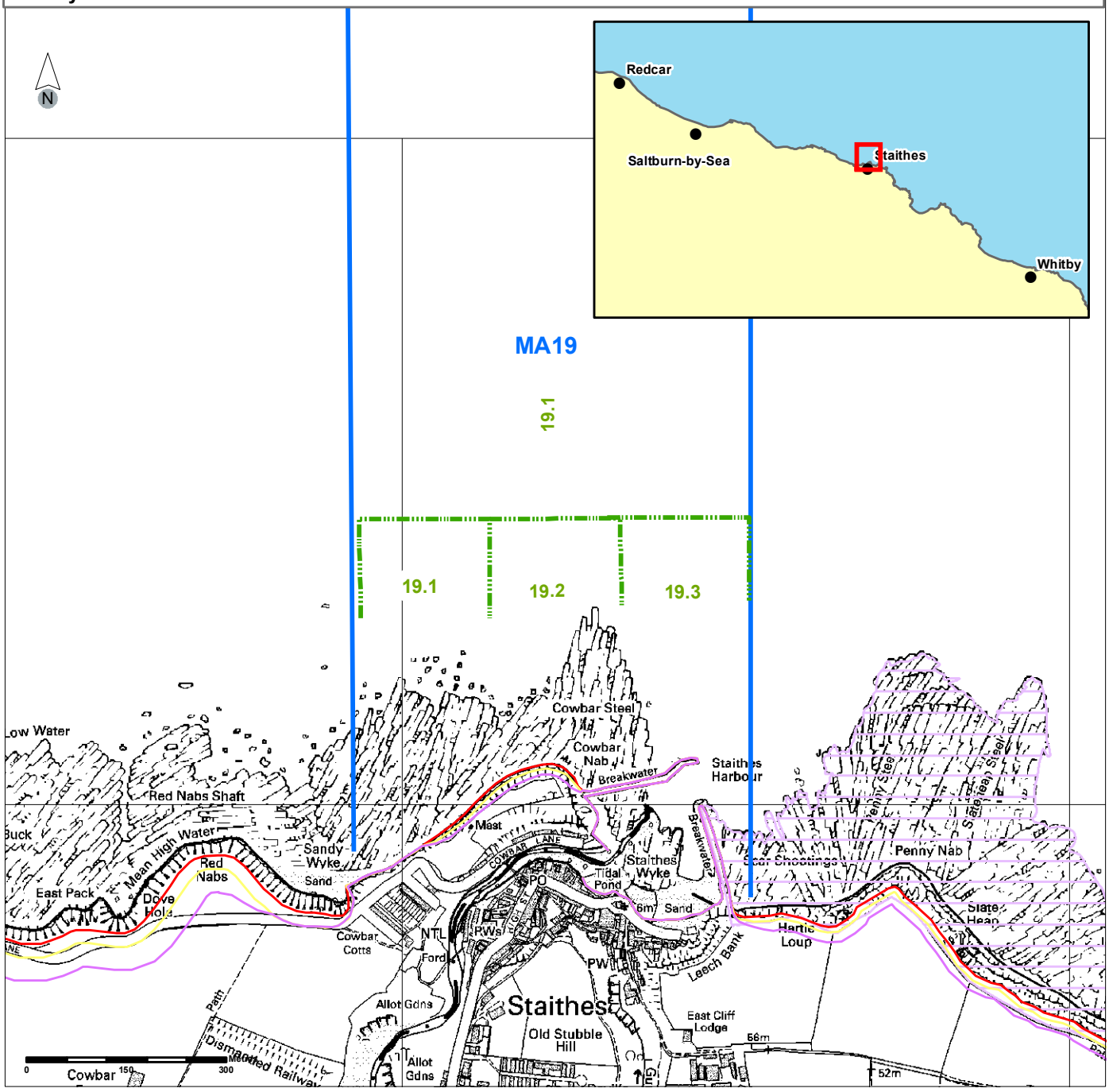
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	3,287	2,792	2,071	8,150
	Preferred Plan Damages £k PV	1,097	99	0	1196
	Benefits £k PV	2,190	2694	2071	6,954
	Costs of Implementing plan £k PV	420	10	7	444
Costs estimated for continued improvement to Staithes in year 5 and subsequent defence of all units in year 50. Description of damage and benefits under preferred plan: • Maintain access to the North Side of Staithes • Maintain protection to Cowbar Cottages. • Maintain defence of the harbour and village.					
Heritage	No loss of heritage structures.				
Amenity	• The line of the Cleveland Way may need to be retreated. • Tourism and water sport facilities associated with Staithes Village will be retained.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA19
Policy Units 19.1-19.3



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
To hold the line in all areas currently defended. Monitor the retreat of adjacent cliffs and relocate the Cowbar lane as necessary.	As retreat of the cliff to the east of Cowbar Cottages continues, works may be required to reinforce existing defences. In other areas existing defences would be maintained or replaced, subject to the need being identified by monitoring.	Defence would be maintained beneath Cowbar Cottages and in maintaining the integrity of the north breakwater. Other defences to Staithes would be retained.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA19

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
National	Staithes-Port Mulgrave SSSI (Geological). BAP priority habitat (maritime slope and cliff)	19.1, 19.2 - Potential loss of BAP priority habitat and some intertidal rock platform. Long term policy will result in arresting or slowing of erosive exposure of geology, possibly rendering SSSI units in unfavourable condition.	Targeted investigation of geology exposed by coastal processes should be carried out to improve understanding of the SSSI features before HTL policies are implemented in the long term.
	none	N/A	None proposed
Local			

ACTION PLAN FOR MANAGEMENT AREA 19

Action	By when	Responsibility	Cost £k
Review Staithes strategy. Review flood risk and set out long term management of harbour and piers. *Economic loss. Risk to properties. Heritage and community support in line with NYMNP objectives. Harbour use. Management of Cowbar lane*	2009	Scarborough BC/ Redcar and Cleveland BC	50
Schemes: Potential scheme to improve flood risk to Staithes Harbour	2012	Scarborough	500

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Staithes to Cobble Dump
Management Area reference:	MA20
Policy Development Zone:	7

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area is to maintain the naturalness and natural evolution of the coast in support of the objectives of the National Park and Heritage Coast. Despite the local use of Port Mulgrave, it would be difficult to justify continued work in this area unless associated with the threat to properties at the crest of the cliff. This needs further investigation early in the plans such that if intervention were necessary this could be considered in relation to National Park policies and any active management of the harbour area.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Detailed examination of the significance of Port Mulgrave in maintaining stability of the coastal slope. Otherwise no active intervention.
Medium term	Anticipated retreat of Port Mulgrave, with no active intervention elsewhere.
Long-term	No active intervention

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
20.1	Old Nab	NAI	NAI	NAI	
20.2	Port Mulgrave	R	R	NAI	Subject to further investigation
20.3	Lingrow	NAI	NAI	NAI	
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

The SMP2 confirms the present policy from SMP1.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

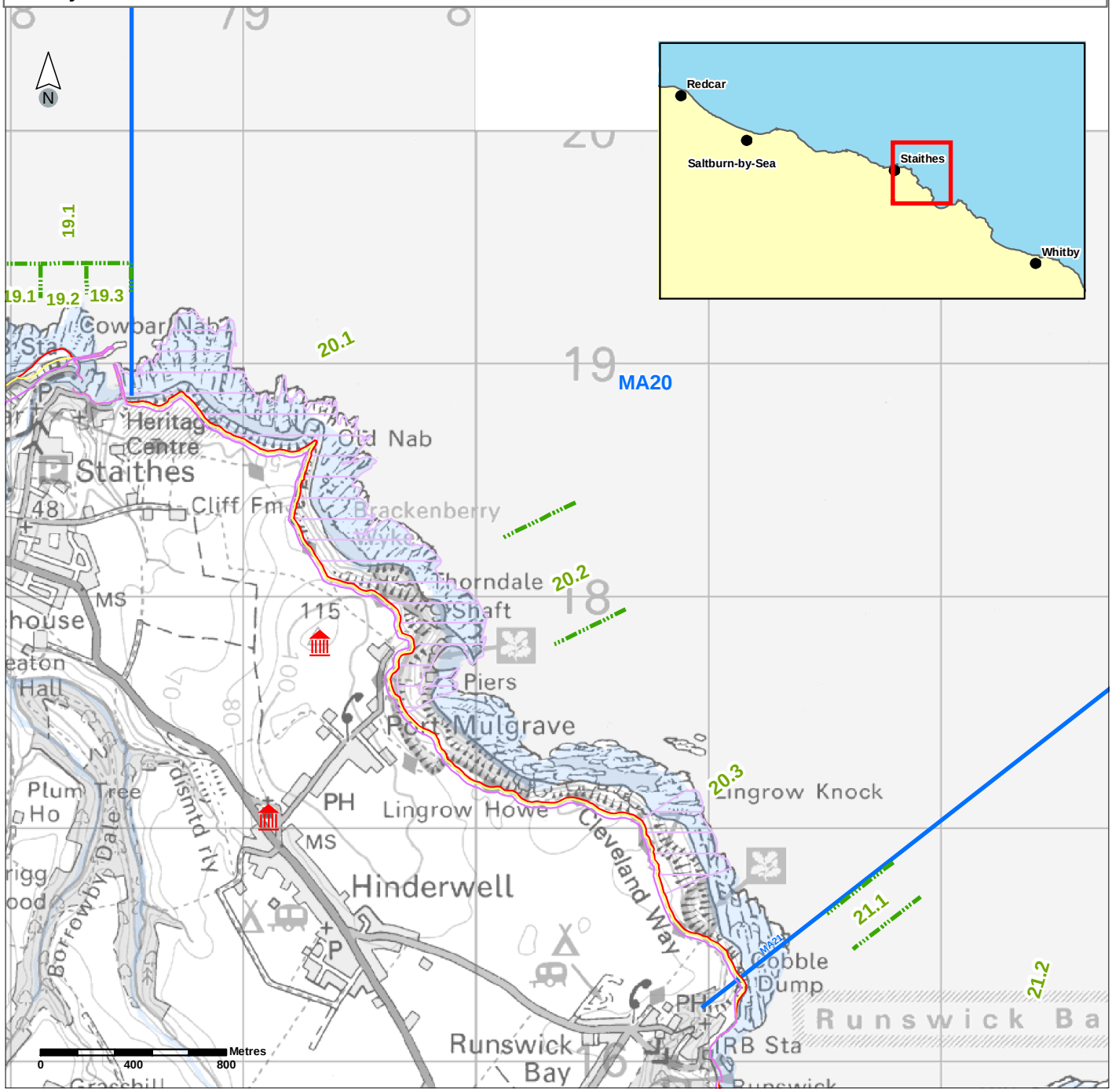
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	0	0	0	0
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	0	0	0	0
	Costs of Implementing plan £k PV	0	0	0	0
Description of damage and benefits under preferred plan: • Progressive loss of harbour area. • Potential progressive loss of properties at the crest of the cliff (2055), to be investigated.					
Heritage	Historic structures no affected.				
Amenity	• Loss of use of the port area. • Potential loss of paths within the cliff, with a potential need to retreat the line of the Cleveland Way.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA20
Policy Units 20.1-20.3



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Detailed examination of the significance of Port Mulgrave in maintaining stability of the coastal slope. Otherwise no active intervention.	Anticipated retreat of Port Mulgrave, with no active intervention elsewhere.	No active intervention

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA20

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
National	Staithes-Port Mulgrave SSSI (Geological)	20.2 Potential benefits for maritime cliff and slope at Port Mulgrave if RTL confirmed by further investigations. Potential short term reduction in erosion rates of SSSI but this will revert to close to previous rates in the medium term.	None proposed
Local	none	N/A	None proposed

ACTION PLAN FOR MANAGEMENT AREA 20

Action	By when	Responsibility	Cost £k
Investigation to examine slope stability and dependency on harbour area. *Potential development issues. Maintain navigation. Heritage and community support in line with NYMNP objectives.*	2010	Scarborough BC	50
Schemes: No schemes identified.			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Cobble Dump to Sandsend Ness
Management Area reference:	MA21
Policy Development Zone:	7

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area is to maintain the naturalness and natural evolution of the coast in support of the objectives of the National Park and Heritage Coast. Within this and in line with these objectives is to sustain the local community at Runswick Bay.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain and improve defences at Runswick Bay village in line with the strategy. In all other areas, no active intervention.
Medium term	Maintain defences to Runswick Bay Village. In all other areas, no active intervention.
Long-term	Maintain defences to Runswick Bay Village. In all other areas, no active intervention.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
21.1	Runswick Village	HTL	HTL	HTL	
21.2	Runswick Bay	NAI	NAI	NAI	Loss of property south of Runswick
21.3	Kettleness	NAI	NAI	NAI	
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

No change to proposed policies from SMP1.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

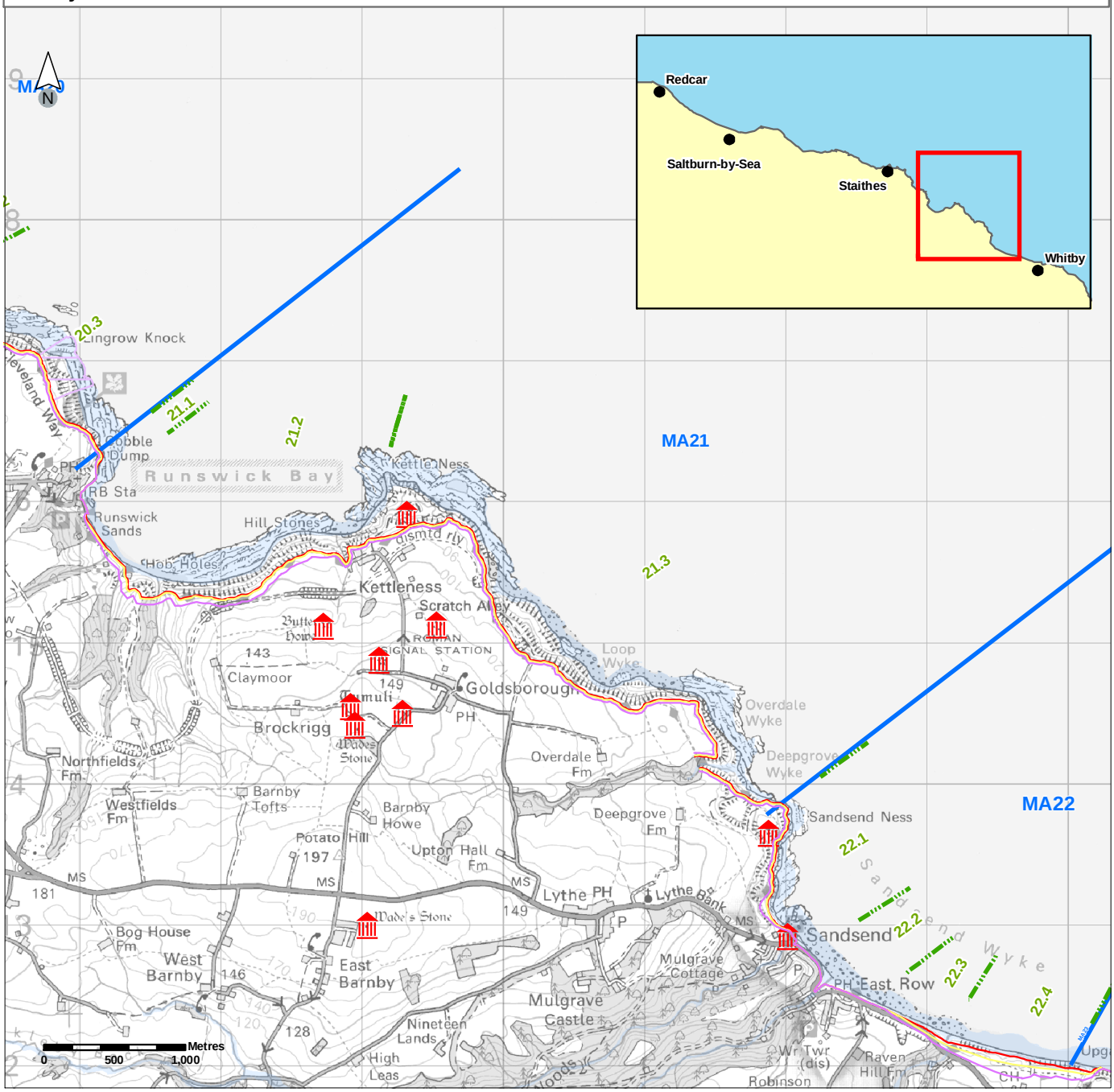
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	44	17,796	85	17,925
	Preferred Plan Damages £k PV	44	96	17	157
	Benefits £k PV	0	17,700	0	68
	Costs of Implementing plan £k PV	2,470	10	450	2,930
Costs based on strategy including for future works Damages assume strategy values included during medium term. Description of damage and benefits under preferred plan: • Loss of potentially two properties south of Runswick Bay Village in the long term, 2055 to 2105. • Loss sailing club frontage in the longer term 2055 to 2105. • Potential longer term loss of properties, beyond the period of the SMP2, at Kettleness. • Retain the main village area.					
Heritage	Significant potential loss of historic features including the Alum workings at Kettleness.				
Amenity	• Recreational and tourism facilities retained at the village. • Potential loss of the sailing club, needs to be assessed at a local scale. • Need to relocate the Cleveland Way but no substantial physical barriers to allow this to happen.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA21
Policy Units 21.1-21.3



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Maintain and improve defences at Runswick Bay village in line with the strategy. In all other areas, no active intervention.	Maintain defences to Runswick Bay Village. In all other areas, no active intervention.	Maintain defences to Runswick Bay Village. In all other areas, no active intervention.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA21

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
National	none	N/A	None proposed
Local	none	N/A	None proposed

ACTION PLAN FOR MANAGEMENT AREA 21

Action	By when	Responsibility	Cost £k
Scheme appraisal for defence of Runswick Bay. Develop recommendations of strategy. *High economic damages and risk to properties. Potential biodiversity opportunity. Heritage and community support in line with NYMNP objectives.*	2008	Scarborough BC	30
Schemes: Runswick Bay - Implementation of scheme in line with strategy	2010	Scarborough BC	2,500

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.8 PDZ 8 Sandsend Ness to Saltwick Nab

4.8.1 Policy Development Analysis

DESCRIPTION

Physical

The zone covers a length of some 7km from Sandsend Ness through to the other side of Whitby at Saltwick Nab. The frontage principally comprises Whitby Bay, extending slightly further to encompass the local headland to the Bay on the western side and through to the obvious natural and major change point in coastal orientation to the east. In many ways the zone is punctuated by the main harbour piers at Whitby, extending some 500m across the shore to the 1m CD depth contour. The bay is quite obviously in two sections divided both in character and shape by the area of rock outcrop at Upgang. The zone is described in three sections: the two elements of the overall bay and the area to the east of Whitby.

Sandsend Bay

To the west of Upgang, the bay is formed as a shallow curve from the control feature of the Ness through to the soft till infill cliffs in front of the golf course; with the village of Sandsend forming a slight knuckle in the western corner. This, even given the quite densely developed area of the village, is a relatively natural frontage, with a width of normally dry sand upper beach in the mouth of the East Row Beck and extending some distance further towards the eastern end of the village. The cliffs from Sandsend Ness through to the village have been heavily modified by mining activities and indeed it has been shown that the wide rock platform extending from the toe of the cliff has equally been changed by the extensive surface working for minerals.

The village effectively begins where the Sandsend Beck cuts to the coast, with the coastal road following down the steep Mast Hill joining the coast where it crosses the beck. The defence of the bridge and western corner of the road has been extended further west to provide a large car park servicing the village. This is now defended with a sloping concrete revetment extending some 200m to return into the area of the southern limit of the natural hard cliffs. In the crook between the cliffs and the car park is a very small area of upper beach.

There is an older more massive section of concrete wall running from the Sandsend Beck, along the main section of the village and returning up the western flank of East Row Beck. The road, which runs immediately behind the seawall, has in one section been widened by a cantilevered section over the crest of the wall, providing width for a footpath. Even so the width of the road is severely constrained by the established properties to the rear.

The road crosses the East Row Beck more than 100m back from the main frontline of the coast and well within the trumpet shaped inlet to the beck. Over much of this area is a healthy beach with the need for only low level defences. The road returns to the coast on the other side of the beck but for nearly 400m, as the road rises slowly to the east, a good upper beach is still able to form at the toe of a light concrete revetment. Behind this section of the road is an open area of land, with properties set slightly further back. Continuing further east, the road rises more steeply and the concrete revetment, now more exposed at its toe, forms a very definite function of retaining the coastal slope beneath the road.

The road kinks inland as it rises along the crest of the coastal slope Finally heading inland behind the Whitby Golf course. The rest of the shoreline through to Upgang, in front of the golf course is unprotected and an increasingly steep, slumping and eroding till cliff.

Over the whole length of the Sandsend to Upgang Beach frontage, there is a relatively wide sand beach with evidence of ridges and runnels and local perturbations in its uniform shape

due occasional low lying local areas of rock outcrop.

The Whitby frontage
The eastern half of Whitby Bay comprises principally, a graded coastal slope protected at its toe by a concrete wall and promenade, now upgraded with a rock revetment in front. Only to the eastern end does the coast slope steepen to cliff, protected on its lower face by defences. The Final Plan 100m to the root of the West pier is natural rock cliff.

At the Upgang end there is a natural gully, The Upgang Beck, which forms part of the Cleveland Way. This main coastal route does not run along the promenade to the east, rather taking a course along the crest of the cliff. The gully does, however, provide the western access to the promenade. At this westerly location the sand foreshore is wide, behind the nearshore Upgang rocks, and the revetment to the rear is slightly lower than elsewhere along the frontage. Although generally over this protected section there are properties to the crest of the slope, the initial 200m towards the golf course is undeveloped land. Some 400m east of the gully, the defences run on a length of outcropping rock at the toe of the slope and the coastline is slightly advanced, reflecting this slight additional control of the backshore. Over all this section, through to the harbour, the crest of the cliff has been developed with properties and supporting infrastructure close to the cliff edge. Over the steeper easterly section, the Spa is situated on the effective cliff face, with some associated protection at the upper section of the cliff face. From the area of rock outcrop through to the West Pier the foreshore generally widens due to sand build up against the pier structure.

The harbour piers, with their more recent extensions, build out from the cliff to either side of the relatively wide natural entrance to the Esk, creating a narrower entrance in deep water. Within these harbour arms, the Esk forms a small cliff enclosed bay; the river running to the western side of this. On the eastern side, at the mouth, is a sandy beach contained by an inner pier at the river mouth. This frontage acts as a spending beach, allowing wave energy, entering between the piers, to dissipate in this area. The western flank of the river is given over to harbour quays, while to the eastern side of the river, there is a mixture of residential and commercial properties. The core development of Whitby extends back either side of the river further up stream.

Abbey Cliffs
To the east of the river entrance(to the east of the East Pier) are the high near vertical Abbey cliffs. There is a wide rock platform in front of these cliffs and this, and the cliffed backshore, continues to the end of the zone at Saltwick Nab. Only at the Whitby end of this section is there any development close to the cliff edge with the coastguard station and mast within about 40m and Abbey farm set further back. A rock revetment has been placed to the toe of the cliff at the crook of the east Pier, extending protection to approximately 200m the cliff toe to the east.

Environment

While the zone, with the exception of the cliffs between Sandsend Ness and Sandsend Village, is outwith the National Park, the area to the west of Upgang and the coast east, beyond the Harbour Piers, fall within the Heritage Coast. Thus, in reality over the whole area there is this context of engendering enjoyment and access to a coastline of high natural value. While there is only an SSSI designation to the cliffs and foreshore to the east of Whitby, much of the western frontage and the valleys leading from the coast are SNICs, as is the valley of the Esk and the Upgang gulley. Rather than in conflict with this, the more highly developed area of the Whitby frontage derives significant benefit from this high value landscape and natural setting.

There are many important commercial interests such as the Harbour and the fishing industry this supports; these being of regional importance. There is also recreational water

use and this links through to the important recreational and tourism use of the beaches and the significant value of these in supporting Whitby as one of the key tourism centres of the region. In this, Whitby and Sandsend complement each other, giving essentially different aspects of this tourism attraction, with the Golf course and its natural coastline between.

The coastal road, linking these two centres, also provides the main road through to Runswick Bay, Staithes and Saltburn. This road is heavily trafficked with both local and regional usage. Possibly the fact that this road was originally developed as a toll route, meeting a need in times when there was far less traffic, reflects its importance as a strategic route today. However, the constraints on width through Sandsend does conflict with the village's setting and popular family use during the summer. The Cleveland Way continues its path along the old railway line at Sandsend Ness linking through to Whitby and beyond.

The Whitby Golf Club, situated between Whitby and Sandsend is an important recreational asset to the area.

Although both Sandsend and Whitby have significant cultural value, there are surprisingly few features of specific heritage and archaeological interest identified; not all may have been reported. There are Scheduled Monuments at Sandsend Ness and within Sandsend, and Whitby Abbey is clearly of national importance, and the Abbey and associated the area is part of the Whitby conservation area.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence.

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To maintain and support the regional importance of Whitby
- To maintain and support the village of Sandsend.
- To avoid damage to and enhance the natural heritage, landscape and setting.
- To support the cultural heritage, in particular the importance of the Abbey.
- To maintain the coastal transport link.
- To maintain the continuity of the Cleveland Way.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:20yr	1:50yr	1:100yr	1:200yr
-2.20	2.60	3.10	3.47	3.6	3.68	3.8	3.88

Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 3.0m below Ordnance Datum.

Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between.

Source (extreme water levels): Whitby Coastal Strategy, Sandsend to Abbey Cliff. HR Wallingford (2002)

Wave climate

Return Period (1:X years)	Wave Height Hs (m)*
0.1	3.71
1	4.79
10	5.79
100	6.73
200	7.39
500	7.81

* Determined at 8m OD contour.

Source: Whitby Coastal Strategy, Sandsend to Abbey Cliff. HR Wallingford (2002)

Baseline Erosion Rates

Sandsend Cliffs	0.1m per year
Sandsend	0.25m per year
Upgang Cliffs	0.25m per year
Whitby coastal slope	0.25m per year
West Cliff	0.2m per year
The Scar (Abbey cliffs)	0.1m per year

All the above rates are based on existing evidence and are likely to increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

Modelling undertaken as part of the development of the Whitby Bay coastal strategy indicates a weak net drift of sediment from west to east over the frontage. It is also recognised that under differing wave conditions this drift may change both in magnitude and direction. The drift analysis suggested that movement occurs over the whole width of the foreshore and indicates that, while the West Pier acts as a long groyne at the eastern end of the bay, beach sediments are likely to be taken offshore at this point. In attempting to balance the drift system and determining that the Upgang cliffs only provide a limited supply, the investigation deduces that there must be a significant supply from the nearshore area.

Furthermore, the study highlighted the considerable variation in levels at points along the shore and the potential for nearshore bars to develop. (At the Whitby end of the bay concern was expressed by the inshore fishermen that the development of nearshore bars of sand created hazardous conditions for fishing.)

Certainly at Sandsend, the high upper beach is known to be periodically eroded but can rapidly reform, suggesting that where the coast is set back there is the capacity for accumulation of material. Such features as the relatively consistent wider foreshore behind the Upgang rocks is further

indication of a very weak longshore drift system and far greater interchange between the upper and lower beaches.

At Sandsend the beach levels have dropped substantially over the last century, although from the analysis of beach profiles over the last decade, while fluctuating, levels overall seem to have remained relatively constant. The decrease in beach levels has been made very evident by the advanced position of the main village seawall and has continued to exposure of the toe to the car park defence. Other potential factors in this erosion have been identified, most notably associated with the extensive historic foreshore mining in the area of the rock platform to Sandsend Ness. A lowering of this essential low level protection may well have given rise to beach lowering at Sandsend; with greater stability being restored since mining ceased. Even so, the advanced exposed position of the sea wall restricts any proper recovery of the foreshore in front of the main village and this situation may well be exacerbated with sea level rise. The basic plan shape of the wall will tend to cause a shedding of energy and scouring of material to the east, tending to deposit sediments within the wider entrance of the East Row Beck.

Observations recorded through consultation suggest that there has been a significant change in beach behaviour since the removal of the timber groynes beneath the area of the Whitby Spa, within the eastern bay of the frontage. Here, it is suggested, that the removal of the groynes has resulted in greater variation at the upper beach, at the toe of the defences, and that, associated with this, there has been greater development of nearshore bars. This has had a significant impact on inshore fishing with waves breaking further off the coast creating dangerous conditions for small boats in this area, as noted earlier.

The general impression of processes is one of a relatively stable bay system with significant onshore-offshore interchange, but with a slight pressure on the coast to retreat and an indication of beach steepening, with a possible landward movement of the low water mark. In such an area, with significant variation of beach levels, monitoring is important but will be a long term process before the subtle longer term trends may be better understood.

South of the Piers, little beach sediment is evident over the rock platform with very little opportunity for beaches to develop at the toe of the cliff in such an exposed, high energy climate. There is movement in the nearshore zone, as evidenced by sand being transported within the harbour. This supply of material has been an important feature in allowing the beach within the harbour mouth to develop. Any loss to the beach or any significant increase in reflective defence here would reduce the ability of the area within the harbour to dissipate wave energy (reducing its function as a spending beach). This would have a significant impact on the wave quality within the harbour entrance.

Unconstrained:
In the absence of the main man-made control features the coast would retreat quite rapidly. At Sandsend the coast would cut well back behind the line of seafront properties. Less significant erosion is likely to occur to the eastern end of Sandsend and further east there would be a continuing cut back of the Upgang cliffs. Along the Whitby frontage, in the absences of the Piers, there may be more significant loss of beach and the coastal slope and cliffs would cut back. There would be an infilling of the Esk valley but with more substantial erosion of the cliff line beneath the Abbey. There would be little benefit to the east, with a slow erosion of the harder cliffs and a general loss of sediments across the rock platform.

The analysis is of course only theoretical as structures exist and, even if they were allowed to deteriorate, will continue to influence rates of erosion for some time after they fail. However, it is still a useful exercise in identifying that it is only the Harbour Piers which really have a strong morphological impact on the bay. In all other areas the bay merely deepens with erosion but in quite a uniform manner. Man's influence on coastal evolution is generally at a more local level and this is explored in the scenarios given below.

MANAGEMENT

Current Policy

SMP1	Policy
SMP1 divides the shore into 10 management units:	
MU8B and MU13B,	Do Nothing
MU10 and MU 13A	Retreat
MU9a, B and C, MU11A and B, and MU12	Hold the line
Whitby Coastal Strategy	
The strategy further subdivides the coast considering the performance and justification of each individual length of primary defence very much as specific units. The net result is confirming the policies defined by SMP1. At this individual level significant direct benefits are developed but even more substantial indirect benefits are obtained relating apparently strategic benefits to individual sections of defence.	As for the SMP1

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

Over much of the defended lengths of the zone the residual life of the main structures is considered to be of the order of 40 to 60 years. Slightly more critical is the defence to the car park to the west of Sandsend and a section of defence along the western Whitby cliffs. More urgent is the condition of defences to the immediate east of Sandsend and the harbour piers. Clearly under this scenario the central section of the frontage, in front of the Golf course would continue to erode. Over many of the sections of defence, most particularly at Sandsend, overtopping is seen as a problem. In addition it has been identified that there are potential slope instabilities mainly associated with the section between Sandsend and the Golf Course.

In examining this scenario, therefore, it is sensible to follow a sequence of events, considering how the coast would develop with time.

Initially the central undefended frontage will tend to erode back at a rate, such that there would be of the order of 2.5 metres loss over the next decade. While other defences will remain there will be continued overtopping, flood damage and disruption to the coastal road. As the erosion of the central frontage continues, the main coastal road at the western end of the Golf course is likely to be lost due to erosion-induced failure of the coastal slope. This road would be closed, significantly altering access between Sandsend and Whitby and quite possibly, unless improvements were made further north to the link roads, reducing traffic all the way through to Saltburn. This would improve the summer traffic issues in Sandsend but would also have a potentially detrimental affect on normal life in the village. There would also be a loss of services associated with the line of the road although these would be rerouted. It is extremely difficult to determine to what degree loss of the road would affect tourism. The beaches at Sandsend would remain, the car park would still be functional and the overall attractiveness to the area would be undiminished.

At the other end of the zone, the Piers (with an estimated effective residual life of 10 to 30, although it has been assessed that section of the Pier may fail earlier), if they had not collapsed would be near the point of doing so. Their loss would make use of the harbour extremely hazardous, would increase wave energy entering the harbour and associated with this there would bean increase in overtopping damages. These issues are being examined in a strategy study. At an SMP level it may be assumed that much of the important issues relating to the Harbour and the core of the town would be significantly damaged. On the open coast there would be a general migration of sand to the east, increasing pressure on defences over most of the length between Upgang and the Harbour.

Over the next thirty years there might well start to be failure of defences under the Whitby coastal slope due to this increased pressure. In effect, whether the timing is accurate or not, the current defence system to this whole area of West Cliff through to Upgang starts being undermined physically. Failure of these defences would result in significant retreat to the crest of the coastal slope such that a major proportion of the front line properties to the rear of the roads running along the crest would be lost over the 100 year period. Whether the Piers remain or not this would occur over time. The loss of the Piers would result in earlier failure and reduced beach levels.

In the western section of the bay, the erosion of the cliffs backing Upgang Beach would continue, quite possibly, however, there would not be an obvious reduction in beach width or level despite what is happening to the east. The coast would be retreating uniformly over its full width; the potential movement of low water towards the shore being matched by the retreat at the crest of the beach and the coastal slope. There would be further loss along the section east of Sandsend, causing further loss of the road, but this would be insignificant since the use of the road would have been previously lost due to the earlier slope failure. Gradually this erosion would spread further west as the defended section of the road was lost and this might be hastened by material no longer being held over such a long length west of the East Row Beck. Only as erosion spreads towards the beck would actual properties be affected; taking out those around the corner of East Row and those to the west of Meadow Road.

With the loss of material to the west, and widening and retreat of the East Row Beck entrance, more sediment would be lost from in front of the main village seafront. This would increase overtopping and eventually result in the loss of the main sea wall. As noted earlier, the indirect damages associated with the loss of the road would by this time be trivial since it would no longer be a main through route. More significantly would be the loss of access to East Row and all properties in this area would suffer substantial loss in value. The main losses to the sea front would be in the abandonment of the sea front part of the village. The car park to the east would have been lost earlier.

The issue of indirect damages in terms of tourism, recreation and amenity is a moot point. While existing use and expectation would be damaged, assuming that the debris of lost defences and assets were addressed, the area would still be an attractive location. There would be less facilities and potentially less upper dry beach area. It is unlikely that the erosion of the till slopes would exceed the general increased pressure to erode, in line with sea level rise, and, therefore, it is unlikely that there would be development of dunes or an upper beach at the toe of the eroding slope, but the area would be restored to a more natural condition.

This scenario would lead to major losses to the core developed areas both at Whitby and at Sandsend.

To the east of Whitby there would be little benefit derived from the increased sediment moving to the east across the mouth of the river. The failure of the Piers would however increase exposure of the rock revetment beneath the Abbey Cliffs and the continued slow erosion of the main cliff line would continue. There would be loss to the grounds of the Abbey; although the Abbey itself would remain intact over the SMP period, but the coastguard station would be lost towards the end of the period.

MDSF Evaluation		*PValue Damages*
Erosion	165 commercial and residential properties at risk	£2,325,000
Flooding	383 commercial and residential properties at risk, principally within the harbour area	£183,618,000

Other information	Strategy study indicates damages of the order of £237M based on summation of individual defences areas and linked to tourism and traffic disruption. This excludes damages within the harbour.
Assessment of key objectives	• Fails to maintain and support the regional importance of Whitby • Fails to maintain and support the village of Sandsend. • Potentially enhance the natural heritage, landscape and setting at the western end. • Fails to support the cultural heritage. • Fails to maintain the coastal transport link. • Largely maintains the continuity of the coastal path if this is retreated. • Minimises reliance on defence but at significant loss.

With Present Management (Scenario 2):
The findings of the recent strategy recommends and justifies the continued defence of Sandsend extending and increasing the size of defences further to the west to address the potential failure of the coastal slope and loss of the road at the western end of the golf course.

It also recommends maintaining and potentially improving the Harbour Piers and the extent and full justification for this will be examined in a detailed study to be commissioned soon. On the strong assumption that these structures would be maintained, beach levels to the west would also be maintained to a degree. On this basis, the strategy confirms the value in undertaking works to maintain defences along the West Cliff frontage, protecting the built assets to the crest of the cliff.

Considering each area in more detail in a similar manner to Scenario 1:

Sandsend to Upgang
The earliest sections of work would be to the toe of what is called the pinch point of the road at the western end of the golf course. The proposal within the strategy for this area is for a short section of rock revetment, which would be extended westward as the existing concrete revetment starts failing. As the frontage to the east, in front of the golf course, retreats so this end point would become more exposed and there would be an increasing need to either extend this revetment eastward or to return the defence in land. Effectively the whole justification of this defence derives from the avoidance of indirect damages associated with the road and the infrastructure adjacent to the road. Similarly, the justification for extending the revetment back towards Sandsend derives from the same basic avoidance of damages. Pressure on the frontage is likely to increase over the period of the SMP with sea level rise. While a rock revetment has the potential to reduce direct erosion of the beach through excessive scour, there is still a likelihood over the full period of the SMP that further works would be required to maintain this defence.

In front of East Row, the beach levels are currently higher than elsewhere along the frontage. Here the strategy is for replacement of the concrete revetment. Works here are justified in relation to the direct value of damages to properties that would otherwise occur, although again significant indirect benefits associated with the road and, in this case tourism benefits provide a much larger element of the justification. Although maintaining the line of the defence to the east would tend to reduce loss of sediment from the frontage, there will be increased pressure on the frontage which would imply the subsequent need for increasing the robustness of the defence.

Over the main village frontage, and extending to the car park, the strategy recommends construction of a rock revetment as overtopping increases and as defences deteriorate. More urgent works may be required to the western return wall to the car park. As in the

east, the use of rock aims to reduce scour maintaining a better quality of beach in the longer term. Although there is considerable direct benefit associated with the defence, indirect benefits associated with the road, infrastructure and amenity, form a substantial element of the justification. Between these works and those at East Row it is considered that sand will still tend to be trapped in the opening of the East Row Beck and while works will be needed here these will be under considerably less stress.

The overall current management policy for this area will result in protection of the key assets, maintaining the coastal transport link and general amenity of the area. However, the scenario will require extension of the existing hard defence line and an increasing commitment to defence particularly of the eastern section in the future. While this could not be seen as being unsustainable the increasing reliance on hard defence could be seen as altering an essential aspect of the frontages' character.

Whitby
The strategy recommends maintaining the Harbour Piers and although this will be assessed in detail there is a very strong prima facie case presented for this. This equally assumes that the area to the east inside the harbour will be maintained and that the quay walls to the west will be maintained and potentially raised in the future. It also assumes that protection will be maintained to the toe of the Abbey Cliffs. None of these works are considered unsustainable, given the important areas the overall defence system protects.

By holding the West Pier, this maintains current beach levels to the West Cliff frontage and assists in maintaining the defences along this frontage. The strategy demonstrates a good case for their long term presence. The strategy recognises that in maintaining this frontage there will be increasing pressure on the defence and recommends extension of the rock revetment generally along the frontage as necessary. This may marginally alleviate the potential for increased onshore offshore movement of the beach but would do nothing to address the problem identified by the inshore fishermen with respect to the frequent development of a nearshore bar.

Neither of the general strategies for the east or west sections of the bay gives specific thought to the transition between hard defence and the retreating coastline in front of the Golf course, beyond suggesting the need for a transitional zone in terms of policy.

The cliffs to the west of the zone have a current policy of no active intervention and apart from the Cleveland Way there is no justification for any other policy. Over the next fifty years and possibly sooner with respect to the section of path closest to Sandsend, this route would be lost. There is a path shown at the crest of the cliff and back slope but its status is unknown. There is, however, potential for retreating the Cleveland Way and this needs to be addressed.

The Cliffs to the east of Whitby will continue to erode slowly and this would be in line with the broader objectives of the Heritage Coast.

MDSF Evaluation	*PValue Damages*
Erosion	*No erosion damages*
Flooding	*No flood damages assessed*
Other Information	
Assessment of Key objectives	• Maintains and supports the regional importance of Whitby. • Maintains and supports the village of Sandsend. • There would be an increased encroachment on the natural coast and a changing character to the western frontage. The Scenario therefore fails to enhance the natural heritage, landscape and

	setting. • The cultural heritage is supported. • The coastal transport link is maintained. • Largely maintains the continuity of the coastal path if this is retreated. • Significantly increased reliance on defence.

DISCUSSION AND DETAILED POLICY DEVELOPMENT

Scenario 1 fails to address the needs of the community with only marginal improvement to the natural coast. There is strong justification for maintaining the defences to Sandsend and to Whitby as set out in Scenario 2. The two principal frontages are discussed below.

Sandsend

While there is a strong justification for continued defence of the main area of the village based on direct losses, the justification on the basis of indirect benefits has to be questioned, particularly with respect to the road. In the first instance, the loss of the road at any point would substantially reduce its use and the associated damages elsewhere along its length. In effect, because of this, the economic justification at SMP level has to consider the frontage far more as whole. The economic damage from the loss of the road is defined in the strategy as being of the order of £48 million determined over a 10 year period. Future losses of sections of the road would be far less given that it's value as a main coastal route is then lost. Defence costs associated solely with the road, as determined from the strategy, are of the order of £9 million (without discounting and not taking into account the costs for areas of the frontage protected for other reasons). While there is still a clear benefit in maintaining the road, the comparison between the £48 million of damages and the £9 million cost, provides a better judgement in assessing the need to extend the defences further to the east.

Arguably, before such an extension of defence was undertaken, under the Water Framework Directive, it would need to be demonstrated that there was no other less damaging approach to management of the coast effecting its natural environment and that if no other approach were possible that the works were of such public benefit that they should still be undertaken. Given the significant change in character required, and the subsequent long term commitment to defence involved, it is felt that these issues have to be addressed.

Alternative options such as local retreat, especially at the pinch point, should be considered in more detail, given that maintenance of the road will also require slope stabilisation on its landward side. In addition, given the congested nature of road through the village, scope for more major diversions should be discussed with the highway authority and National Park. Clearly the interpretation of legislation with regard to the water framework directive is not yet established and reference would also have to be made to the Environment Agency. While the road is recognised as an important asset to the village and in maintaining tourism as well as the community, avoiding further defence of this frontage would provide better opportunity in extending the natural character of the coast. This would create the opportunity for a potentially more sustainable position in the transition between the necessary hard defence of the village area and the coast to the east.

With respect to the village frontage, there appears to be good justification over the period of the SMP to maintain defences to the area. The strategy ruled out major bay wide options for management but did highlight the potential benefits in raising beach levels over the whole section. This might clearly have benefits in terms of the important beach use. Consideration should, therefore, be given to alternative options for holding the line. Typically, there may be benefit in introducing a short breakwater just to the north of Priest's Sike, thereby reducing wave action on the car park, encouraging sediment build up at the northern end of the site and potentially reducing erosion affecting the most critical section of the Cleveland Way. There may also be scope for introducing a rock structure towards the northern end of the

main village wall, again stabilising the beach to the north and east while not significantly impacting on the distribution of sediment along the rest of the frontage. While it is felt that such approaches may be considered to minimise the impact of the proposed rock revetment, the SMP concludes that the defence of the Village frontage is important and is sustainable and that the policy should be to Hold the Line.

To the west of Sandsend, the policy can only sensibly be for no active intervention (notwithstanding the possible opportunity to encroach within this area in providing appropriate defence to the village).

To the immediate east of the village, the policy is to hold the line in the short term, looking purely to maintain the existing revetment but there should be a view to potential to retreat in the medium to longer term; subject to the further investigation of issues with respect to relocation of the road. This policy of retreat should be closely worked in to the management of the western end to the village so as to properly create a sustainable transition between the area where protection is needed and the intent to create a more natural coastal approach to the west.

The policy for the Golf Course frontage, in line with that described in the strategy would for no active intervention. In taking this approach, the estimated lines of retreat would indicate that the actual club house would be secure over the period of the SMP2. However, there would be significant loss to the golf course itself and as a consequence to the amenity value of the area.

Whitby

In the case of Whitby, the overall defence system works with the Piers providing essential protection to the Harbour and also supporting a more sustainable defence to the Whitby sea front. For the Whitby frontage the SMP can confirm the policy for holding the line both to the open coast and within the entrance to the Harbour. However, the following comments need to be made.

Within the Harbour the spending beach to the west of the entrance is seen as providing an important function. Defence of the properties to the rear of this will probably need to be enhanced as sea level rises. Such improvement to defences should avoid, as far as possible, increased erosion of the beach, as a result of increased wave reflection off hard defences. There may need to be consideration of raising the inner pier and altering its shape to allow a more substantial beach to be developed to maintain the beaches ability to dissipate wave energy.

On the open coast, between the Harbour and Upgang, consideration should be given to reducing the scour effect and onshore-offshore movement of the upper beach. While the strategy has ruled out the idea of major offshore breakwaters or the need for replacement of the simple timber groynes, further consideration should be given to the plan shape of future enhancement of the proposed revetment to assist in trapping of material at the crest of the beach allowing greater dissipation of wave energy.

At Upgang there needs to be a transition zone between the hard defence and the eroding coastline to the south. At present, the defence runs beyond the area of property at the crest of the cliff. Any transition and effective softening of the break between the two approaches to management should look initially at making use of the non-critical defended area rather

than further encroaching on the natural frontage. There may, in this way be opportunity for biodiversity gains in developing the gully as a partially sheltered area in which sand and dune could develop at this transition. Certainly planning should not allow further development in this area purely because the cliffs are defended. As such this short section of the frontage is more appropriately given a policy of retreat.

Finally for this zone, the policy to the east of Whitby would also be for no active intervention.

MANAGEMENT AREAS

Although there is interaction between the different sections of Whitby Bay, in terms of the likely impact of the preferred policies, the main area of the bay can be considered in two management areas:

- Sandsend Ness through to Upgang Beck
- Upgang beck to Whitby Abbey, this area recognising the important issues of erosion to the cliff beneath the Abbey and the direct influence of the Harbour East Pier in associated management of this short section if cliff.

Clearly there are some local interdependencies between these two areas at a local scale, in particular in the way in which the area to the east of Upgang beck is managed.

The cliff line further to the east acts effectively independently of the management of the Bay and is, therefore, defined as a separate management area;

- Whitby Abbey Cliffs to Saltwick Nab

Policy statements or summaries are presented by management areas in the following sheets.

4.8.2 MANAGEMENT AREA POLICY STATEMENTS (MA22-MA24)

Location reference:	Sandsend Ness to Upgang Beck
Management Area reference:	MA22
Policy Development Zone:	8

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The intent of the plan for this area is to maintain both the assets associated with the village of Sandsend but also the overall important character of the area. In developing this joint aim there is concern that beach levels in front of the village may drop and the main problem will be loss of the recreational asset of the beach as well as the increase in overtopping which would also occur. The strategy has indicated through consideration of linear defence the justification for maintaining defences but from the broader perspective of the SMP other more strategic approaches should be considered. This may mean that there is some merging of boundaries between policy units. In particular this needs to be considered with respect to management of the eastern section between the village and the road. It is recommended here that consideration must be given to re-routing the road. Even so the unit needs to be treated as a transition zone between the hard defence of the village and the no active intervention for the cliffs along Upgang Beach. Allowing the cliffs in this section to erode will have a significant impact on the golf course, increasing over the medium term. The need for how this may be mitigated falls outside the scope of the SMP, but clearly needs to be considered over the next 20 years.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain all existing defences to the village and the road. Consider options for re-alignment or re-routing of the road to the east of Sandsend. Review the defence strategy with a mind to increasing beach levels.
Medium term	Implementation of defence strategy. Abandonment of road to east (subject to further study).
Long-term	As above.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**21055**	**Comment**
22.1	Sandsend cliffs	NAI	NAI	NAI	Consideration of works associated with the unit to the east.
22.2	Sandsend Village	HTL	HTL	HTL	
22.3	Coastal road	HTL	R	R	Subject to further investigation of options for the road.
22.4	Upgang Beach	NAI	NAI	NAI	Adaptation of the Golf Course
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

The key changes in policy from the SMP1 are between Sandsend and Upgang. The policy had been for hold the line along East Row and retreat in front of the Golf Course. The new policy is for retreat to the immediate east of Sandsend and no active intervention in front of the Golf Course.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

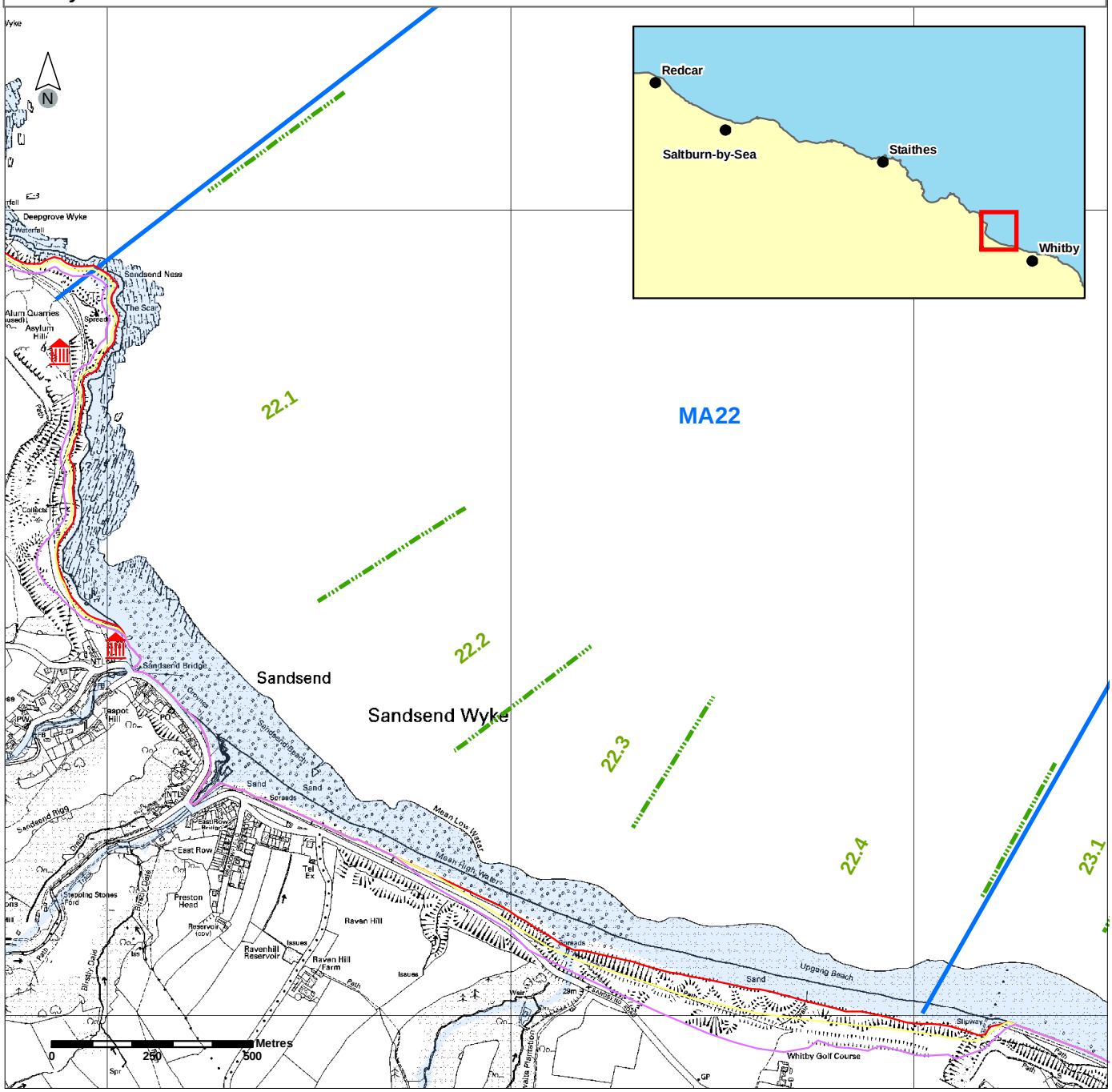
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	0	442	558	1000
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	0	442	558	1000
	Costs of Implementing plan £k PV	38	2,109	456	2,603
Costs based on strategy but amended to take account of potential change in policy. Damages do not include overtopping flood risk nor do they include amenity and traffic costs. Description of damage and benefits under preferred plan: • No account is taken above for the potential loss associated with the road as this would need to be addressed through re-alignment or re-routing. • No account taken in reducing overtopping damages. • There is no envisaged loss to property in Sandsend • There is potential economic loss associated with tourism. • There is a loss in operation of the Golf Course					
Heritage	There may be some potential loss of heritage sites between Sandsend Ness and the Village. This needs to be investigated.				
Amenity	Loss of the direct road access. Potential loss of beaches				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	Yes

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA22
Policy Units 22.1-22.4



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Maintain all existing defences to the village and the road.Consider options for re-alignment or re-routing of the road to the east of Sandsend.Review the defence strategy with a mind to increasing beach levels.	Implementation of defence strategy. Abandonment of road to east (subject to further study).	As per medium term.

Key:

Prediction Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA22

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
National	none	N/A	None proposed
Local	SINC	22.3 Negative impact on SINC site – loss of up to 300m+ of maritime cliff and slope habitat.	Slope stabilisation proposed as short term solution. Assessment of implications of realigning the coastal road should be completed in the future and a detailed Land Use Planning strategy should be devised to driver positive change from a forward-planning point of view.

ACTION PLAN MANAGEMENT AREA 22

Action	By when	Responsibility	Cost £k
Sandsend - Strategy Review. Highway investigation and review possible realignment of coastal strategic route. *Potential for more sustainable defence. Longer term economic damage and risk to properties. Impacts on environmental value. Information to feed back to coastal strategy Heritage and community support in line with NYMNP objectives*	2009	Scarborough BC/ NYCC	60
Schemes: All major works planned for 20 years plus			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Upgang Beck to Whitby Abbey
Management Area reference:	MA23
Policy Development Zone:	8

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: Coast protection maintains important areas of the town and harbour areas. While there may be a general loss of beach under the present linear approach to defence, assuming the Piers are retained, this pressure for erosion will not be sufficient to make continuing the policy of holding the line unsustainable. There is a planned strategy study considering the appropriate course of action required to sustain the breakwaters. This may require work in the short term and in order that this may be achieved sensibly, this overall policy of holding the line to the area of the Piers is likely to extend a short distance along the Abbey Cliff. Beyond this the intent is to allow natural evolution of the cliff line. In other areas the existing strategy for the frontage has assessed that works, beyond monitoring, will not be required until after year 20. When considering these works it would be appropriate to take account of the concerns of the fisherman with respect to the suggestion that increased reflection and lower beaches beneath the Spa are causing increased occurrence of hazardous sand bars in the nearshore area.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain existing defences. Investigate and implement measures to address the concern over the Piers. Review works at Upgang Beck with a view to retreat in this area.
Medium term	Improve defences along West Cliff
Long-term	As above.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025.	2055	21055	Comment
23.1	Upgang Beck	HTL	R	R	Transition form hard defence
23.2	West cliff	HTL	HTL	HTL	
23.3	Harbour and Abbey cliffs	HTL	HTL	HTL	
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

SMP2 generally confirms the policy of SMP1 and the strategy. Only at Upgang Beck and in the area to the east of East pier are there minor amendments. In the former case the policy is to retreat the line immediately east of the Upgang Beck, providing a transition between the hard defence and the no active intervention to the west. To the east of the East Pier the former SMP policy indicated retreat. There is a section here that now has a rock revetment toe to the cliff. This is seen as an important aspect of maintaining the integrity of the Pier whilst also providing a degree of support to the area of the Abbey. Beyond this short section, which is treated within this management area, the policy is one of no active intervention rather than retreat. This is summarised in the following Management Area MA24.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

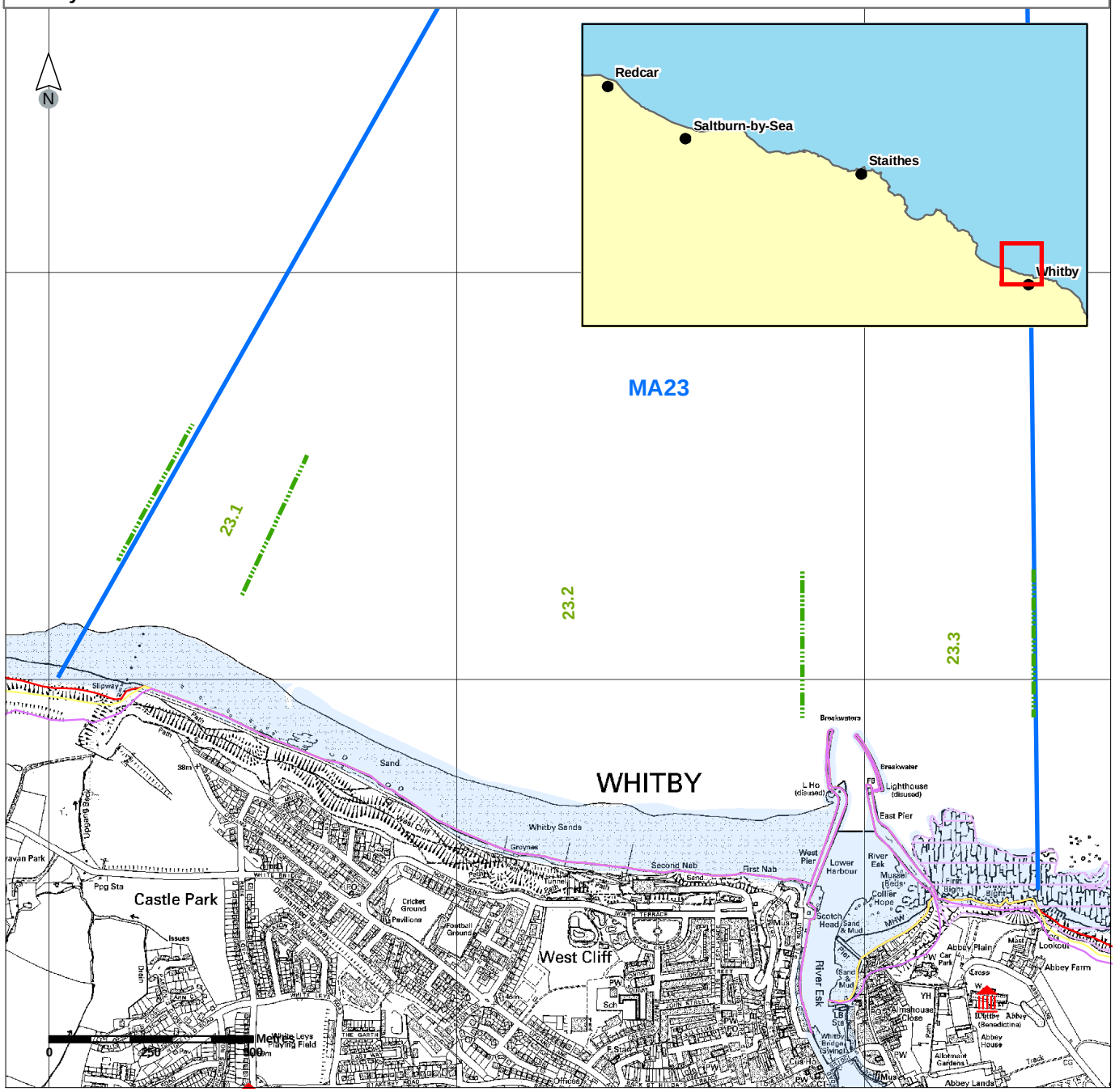
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	89,588	61,443	34,187	185,218
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	89,588	61,443	34,187	185,218
	Costs of Implementing plan £k PV	16,076	1,881	135	13,416
Costs and damages will be reviewed by strategy. Description of damage and benefits under preferred plan: • Protects property to West Cliff • Maintains use of the Harbour and maintains reduction in wave action flooding the harbour area. • Maintains Abbey Headland					
Heritage	Protection of heritage structures to Headland.				
Amenity	Reduction in beach levels				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA23
Policy Units 23.1-23.3



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Maintain existing defences. Investigate and implement measures to address the concern over the Piers. Review works at Upgang Beck with a view to retreat in this area.	Improve defences along West Cliff	As per medium term.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA23

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
National	Whitby – Saltwick SSSI (Geological)	22.7 Extension of defence along line of cliff has the potential to reduce the erosive effect of natural process on geological exposure features of the SSSI.	Active attention should be given to improving understanding of geological resource prior to any works.
Local	SINC at mouth of River Esk	22.5 Possible creation of transition zone at Upgang Beck may provide some biodiversity improvements (dune and maritime soft cliff and slope habitats)	The implementation of this policy may offset some of the impacts of habitat loss at 22.3.

ACTION PLAN MANAGEMENT AREA 23

Action	By when	Responsibility	Cost £k
Whitby - Appraisal of Whitby Harbour Piers, examining condition of Piers and development of management approach. *High economic loss and risk to property. Links to management of foreshore. Maintain navigation and water sports*	On going pending funding.	Scarborough BC	225
Strategy study examining flood risk within Whitby harbour. *High economic loss and risk to property. Important issues in relation to sustaining recreational and commercial centre of Whitby.*	2008	Environment Agency/ Scarborough BC	
Schemes: Whitby Harbour Pier improvements	2010	Scarborough BC	16,000

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Whitby Abbey to Saltwick Nab
Management Area reference:	MA24
Policy Development Zone:	8

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area is to allow natural erosion of the cliff.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	No active intervention.
Medium term	No active intervention
Long-term	No active intervention.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**21055**	**Comment**
24.1	The Stray	NAI	NAI	NAI	
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

Policy changes from retreat to no active intervention over the west section of the area.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

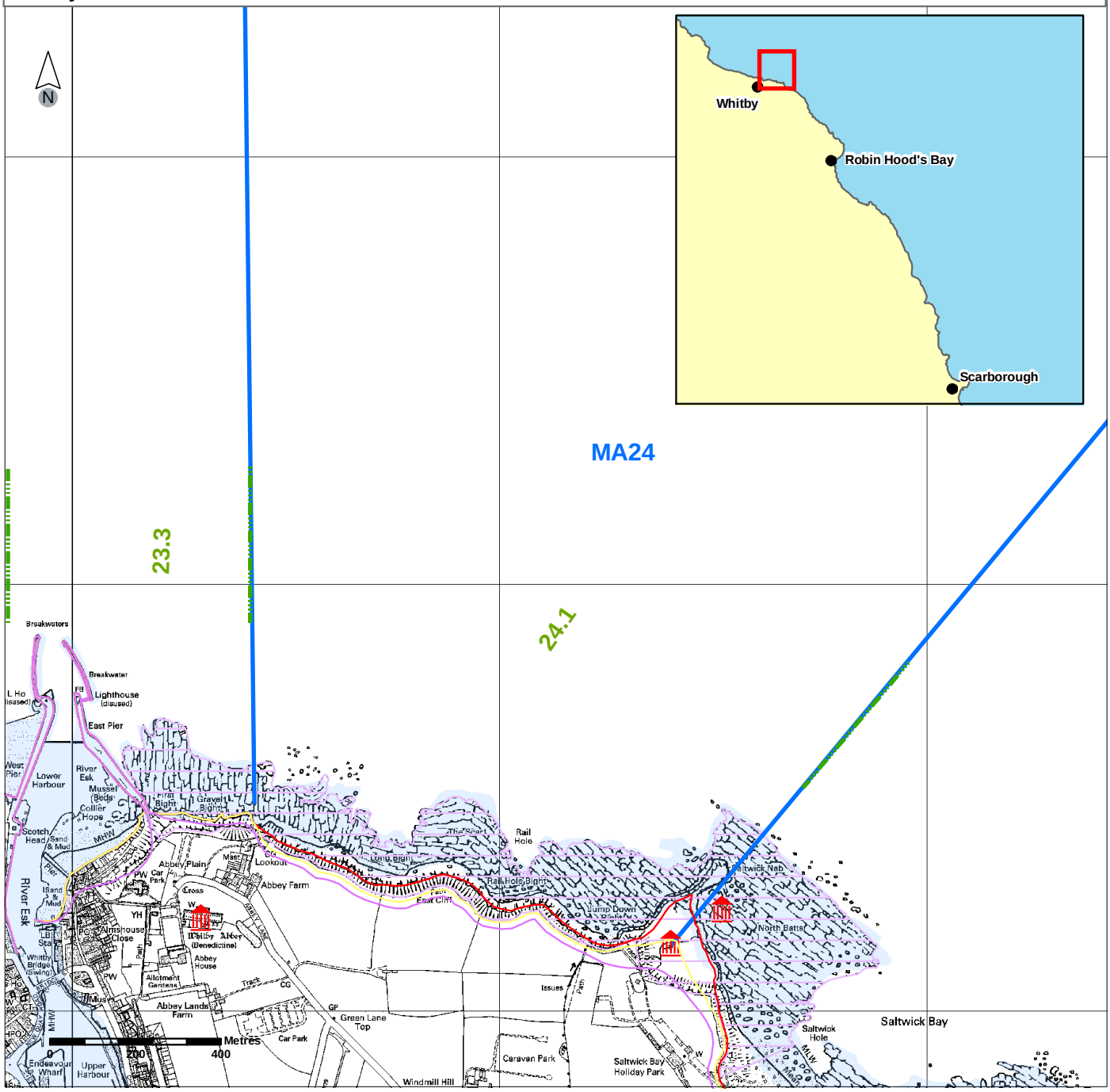
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	0	0	0	0
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	0	0	0	0
	Costs of Implementing plan £k PV	0	0	0	0
Description of damage and benefits under preferred plan: • No Damages.					
Heritage	No loss of heritage structures.				
Amenity	Cleveland Way would need to retreat in line with erosion				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA24
Policy Units 24.1



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
No active intervention.	No active intervention.	No active intervention.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
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SAC
Scheduled Ancient Monuments

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA24

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
	Whitby to Saltwick SSSI	Allows natural processes to continue	None proposed
National	none	N/A	None proposed
Local			

ACTION PLAN MANAGEMENT AREA 24

Action	By when	Responsibility	Cost £k
Negotiate retreat of the Cleveland Way	2025	NYMNPA/ Heritage Coast	
Schemes: None			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.9 PDZ 9 Saltwick Nab to Hundale Point

4.9.1 Policy Development Analysis

DESCRIPTION

Physical

The zone covers a length of some 23km. The coast is orientated generally along a north northwest to south southeast axis. There is a slight shoulder at Ness Point, just north of Robin Hood's Bay, the effective bite out of the coastline that is the bay itself, running again to a shoulder at Ravenscar and continuing down to the slightly more abrupt promontory of Hundale Point. Here the coast again changes orientation to fall away more sharply to the south, towards Scarborough. Within the zone the physical character may be described principally as three sections; from Saltwick Nab to Ness Point, Robin Hood's Bay and then Ravenscar through to Hundale Point.

In the first of these, the coast comprises steep cliffs above a generally wide rock platform foreshore; although this diminishes to become a narrower boulder strewn fringe to the coast south of the Whitby Lighthouse, re-emerging at Oakham Beck and continuing down to the shoulder of Ness Point. This change reflects changes in the underlying geology and in the detailed development of the coastal shape and overall orientation. Only at Saltwick is there a narrow sand beach to the toe of the cliff, indicating the potential for sand movement along the frontage and more probably the potential interchange between the shoreline and the sandy seabed in the nearshore zone. To the crest of the cliff the hinterland is a relatively flat plateau, cut by small stream valleys which overflow the cliffs as falls, rather than cutting deep gorges. Land use is typically agricultural with no significant settlements close to the coast. Only at Saltwick is there a caravan park approaching the cliff edge but even here the site is slightly set back. At Whitestone Point are the old Whitby Fog Station and Whitby High Light Lighthouse. Both these structures are close to the edge of the cliff, and monitoring of cliff erosion and potential land movement has recently been started by British Geological Survey (BGS) as part of the Coastal Geoscience and Global Change Programme.

Robin Hood's Bay does not really exhibit the coastal process driven attributes of many of the other bays such as seen further north at the Tees or Whitby, or further south at Scarborough or Filey. The bay is almost as if the open coast has just been set back. Although Ness Point and Ravenscar clearly form the limits within which this set back has occurred, they do not in any real sense control the shape of the overall bay between. The definition of the bay is, therefore, primarily determined by the differential hardness of the coastal face. As might then be expected there is little in terms of beach sediments, although very locally there are small sandy beaches at the toe of the cliff. Predominantly the foreshore comprises exposed rock scar. At the northern end the coast comprises a steep but sloped scree covered cliff face down to the rock platform. At the abrupt northern corner of the bay a more nearly vertical cliff face is exposed reducing in height towards the south and overlain with glacial till; above which is the upper village of Robin Hood's Bay. As the vertical toe cliff reduces in height, so the till behind has, through past slope failure, formed a steep but well vegetated series of terraces. The road to the lower part of the village runs close to the crest over this section and a rock revetment has recently been constructed along the toe of the lower cliff.

The densely developed lower village is built on shoulders of land to either side of the Kings Beck valley; the easterly, seaward, shoulder is protected at the coast by a high concrete wall, running through to the slipway at the southern end of the village. The westerly, inland, area of the village is constructed at the base of a sloping till slope, rising to high cliffs to the rear. Here, protection has been provided directly to the Quarterdeck, or the southern-most nose of the village; forming a slight promontory to the coastal shape, and, by a recently constructed rock revetment, stabilising the till slope further to the south.

The steep till cut slopes continue to the south, with the basal vertical rock cliff re-emerging at Boggle Hole. Here the Mill Beck cuts a gorge through till and rock to emerge as a steep-sided heavily wooded valley at the coast. There are properties set back within this valley.

The near vertical toe cliff, with the upper sloped till deposits continue along the face of the bay through to the topographically complex headland of Ravenscar. Settlement is limited to small clusters or individual properties, such as Stoupe Bank Farm and Stoupebrow Cottage Farm on the southern shoulder of the Stoupe Beck valley and the old Alum works at Low Peak. The village of Ravenscar and the Ravenscar Hotel are situated on the high headland of Ravenscar.

The coast to the south of Ravenscar is typified by a lower rock cliff with a width of slumped, terraced

and well vegetated slope to a higher cliff behind. This complex coastal slope consolidates to a more vertical cliff at Heyburn Wyke and along the coast south to the lower cliffs of Hundale Point at the southern limit of the zone. The only settlements, in this southern section, are set quite well back from the cliff and the immediate hinterland is principally agricultural. Over the whole of this section, there is a rock strewn foreshore over a narrow width of rock outcrop, with the nearshore area falling steeply away to deeper water.

Environment

The majority of the coastline including the whole length of Robin Hood's Bay is designated SSSI. The coast from just south of Robin Hood's Bay Village to just north of Hundale Point is designated as a SAC. The whole section of coast falls within the jurisdiction of the National Park and is part of the Heritage Coast. The coast is therefore essentially important for its natural character, its ecology and most especially for its geological significance. In addition to the broader designations are the specific features defined by GCR sites of which there are seven along this part of the coast. The National Trust own a considerable area of the coast at Saltwick Nab, to the north of Robin Hood's Bay and much of the coast from Ravenscar through to Hundale Point.

The Cleveland Way coastal path runs the whole length of this section of the coast and Robin Hood's Bay is the western termination of the east to west Coast to Coast route from the Cumbria coast.

In this overall natural context is the village of Robin Hood's Bay. Its character and cultural heritage form an important aspect of the coast, important both to the tourist industry of the whole regional and as a vital and sustainable coastal community. An additional part of this heritage and culture is the archaeology reflected in the Palaeontological interests but also in the more recent mining interests, such as found in the scheduled monument at the Low Peak Alum works.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence.

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To sustain the community of Robin Hood's Bay.
- To advise on possible timing of loss to local archaeological features.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:20yr	1:50yr	1:100yr	1:200yr
-2.20	2.60	3.10	3.47	3.6	3.68	3.8	3.88

Determined at Whitby. Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 3.0m below Ordnance Datum. Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between. Source (extreme water levels): Whitby Coastal Strategy, Sandsend to Abbey Cliff. HR Wallingford (2002)

Wave climate

Return Period (1:X years)	Wave Height Hs (m)*
0.1	3.71
1	4.79
10	5.79
100	6.73
200	7.39
500	7.81

* Determined at 8m OD contour at Whitby.

Source: Whitby Coastal Strategy, Sandsend to Abbey Cliff. HR Wallingford (2002)

Baseline Erosion Rates

Saltwick Nab	0.7m per year
Northern Coast	0.1m per year
North Cheek	0.1m per year
Robin Hood's Bay Village	0.3m per year
Robin Hood's Bay	0.3m per year
Ravenscar	0.2m per year
Beast Cliff	0.1m per year
North of Hundale Point	0.1m per year

All the above rates are based on existing evidence and are likely to increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

The shape of the coast is held by its geology with the positions of the various bays and headlands determined by their differential hardness. Only significantly within Robin Hood's Bay are there major areas of glacial till exposed at the toe of coast and even here their erosion is constrained by the harder rock foreshore or by the basal harder rock cliff. While it is primarily the coastal exposure and wave exposure which is driving the slow retreat of the frontage, there is little overall geomorphological coastal processes limiting or shaping the long shore plan evolution. This may be seen in the very sharp changes in plan shape, as seen between straight sections of scree covered cliff to the north of Robin Hood's Bay and the abrupt change in orientation and different character in the cliff running south along the village frontage. In effect, the bay is open to the dominant wave direction such that the main wave energy runs straight along the northern cliff face, removing little of the scree, and impacts almost directly on to the face of the village frontage. Clearly in elevation, or sectional profile, of the cliff line, geomorphological influences are significant, the most significant being in the potential for landslides; affected by drainage or lack of drainage to the coastal slope.

Far more locally, within Robin Hood's Bay there is some geomorphological control influencing the shoreline. To the southern end, the Ravenscar Headland reorientates the coast such that any

potential net drift to the shore is quite possibly from east to west. The section of coast between the area of the village to the north and Ravenscar to the south is generally in net alignment with wave action, and would with greater actual drift of sediment along the coast as a whole, act as a sink. In fact there are intermittent sections of sand above the rock platform and local sections where slightly harder (less erodable) sections of the frontage allow the formation of very shallow bays.

There is believed to be movement of sediment over the nearshore zone, with a net trend of sediment movement to the south. There is little evidence of significant sediment transport along the actual shoreline, although clearly there is the potential. The small areas of highly intermittent sand beach indicate this capacity to move material and for material to be retained by local shoreline features.

The overall consequence of this is that, to a large degree each section of coast may be seen as being quite independent in terms of coastal processes, although influenced by the relative hardness of adjacent sections.

The whole coast is retreating but, even with the continuing differential rates of erosion, over the period of the SMP, the significance in influence between sections of the coast will not change. It is, therefore, not the situation that allowing sections of the coast to retreat will tend to establish a more naturally stable plan shape.

Unconstrained:
In the absence of the main man-made control features the coast would continue to retreat. The only significant man-made works are at Robin Hood's Bay and here they are really only acting to reduce the rate of erosion of the toe of the cliff, acting to stabilise the upper slopes. If they were not present the coast line would continue to erode at the toe, destabilising the coastal slope above, with major landslips and retreat of the crest of the slope and, in the case of Robin Hood's Bay Village, loss initially of the access and progressive loss of properties and much of the lower village.

MANAGEMENT

Current Policy

SMP1	Policy
The SMP 1 defines the coast in 14 management units, the policies for these are:	
MU13B, MU14, MU15, MU17A and B, MU18A and B, MU19A, B, C and D.	Do Nothing
MU16A, B and C	Hold the Line
Robin Hood's Bay – Coast Protection and Cliff Stability	
The study examines the specific problems associated with the village and makes recommendation which have subsequently been carried out.	Hold the Line

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

Over much of the coastline this scenario also describes the present management policy. Only at Robin Hood's Bay are there defences. Under this scenario all sections of the coast would be allowed to erode, as at present or as defences fail.

Over the northern section of the zone there would be expected losses at Saltwick Nab in terms of the Saltwick Alum works scheduled monument and in terms of loss of land to the Caravan Park. These losses might be expected to occur between 50 to 100 years time. Works to protect either feature would be quite extensive. Further south the Whitby Fog Signal buildings are at risk as is the High Light. As above these would not be expected to be threatened in the next fifty years. This area is being monitored. There are no other specific assets at risk until Robin Hood's Bay Village, and under this scenario the coast will continue to slowly erode.

To the south of Robin Hood's Bay village there would potentially be loss of the properties at Stoupe Bank farm but only to the end of the SMP period, and at Ravenscar upper cliff instability may threaten buildings seaward of the Hotel. South of here no specific assets are likely to be lost. There would be loss in terms of heritage on the northern flanks of Ravenscar; to the Jet Holes and the Alum Works, but even here this is likely to be later in the 100 years.

It is to Robin Hood's Bay village that the principal threat exists. Under this scenario, in the area of the Quarterdeck, defences might deteriorate to such an extent over the next 100 years that the slope is destabilised and significant number of properties would then be lost. Potentially, earlier, the high concrete wall would reach the end of its functional life. Its failure would again result in significant loss to the lower part of the village, possibly even resulting in abandonment of this section of the village. The slope between lower and upper sections of the village is protected at its toe with a revetment; this is likely to remain functional over much of the SMP period so that, even under this scenario, this would allow the instability of the slope beneath the main access route to the lower village to be managed. The small gap in defence between the wall and the revetment is protected by the slight extension of the revetment and is not seen as causing any problems. There would be some loss to properties in the short to medium term in the area of Mount Pleasant through to Mount Pleasant North, but this would be relatively slow with no major slippage expected.

MDSF Evaluation		*PValue Damages*
Erosion	Loss of potentially 150 commercial and residential properties, the majority in the 2055 to2105	£1,960,000
Flooding	Potential flooding to commercial interests in village	£1768,000
Other information	Study suggests potential losses of the order of £20M due to probability of landslides above presently defended sections of Robin Hoods Bay Village	
Assessment of key	• Avoids damage to and allows natural evolution of the coast.	

objectives	• Fails to fully support the cultural heritage. • Sustains only in part the community of Robin Hood's Bay. • Minimises reliance on defence

Current Management (Scenario 2):

Under the current policy for defence little would change from the above apart from improvement to defences at Robin Hood's Bay Village. The works to the quarterdeck may need to be enhanced in the future but this could be carried out effectively. The concrete wall continues to suffer abrasion but can be repaired or strengthened. The value of this would have to be examined in detail at the local level but in principle this defence does act to provide an important element of defence to the village. The revetment to the north of the village may require some improvement over time but again this should be manageable. As such the defence of the village is seen as sustainable.

The value of further extending the defence to cover the northern end of the upper village is not proposed under this scenario.

MDSF Evaluation		*PValue Damages*
Erosion	9 properties lost	£260,419
Flooding	Not assessed under this scenario	
Other information		
Assessment of Key objectives	• Generally avoids further damage to the natural heritage. • Generally supports the cultural heritage but fails to protect key features in the long term at Saltwick Nab, at Whitby High Light Lighthouse and to the north of Ravenscar, all again tending to be in the longer term. • Generally sustains the community of Robin Hood's Bay Village. • No further defence proposed but still reliant on current defences.	

DISCUSSION AND DETAILED POLICY DEVELOPMENT

The key difference in scenarios is the question of defence to the Village of Robin Hood's Bay. In the recent studies there has been shown to be significant economic benefit in maintaining these defences and continuing to do so is not seen as being unsustainable. Continuing with the defence will require works to be done in the future but in comparison with the benefits associated with this, such works are not likely to become disproportionate. As such, present management policy is not so much transferring a problem on to future generations as maintaining an asset, a vital coastal community, which will add value for future generations.

While it is accepted that the fundamental objective applying to this section of the coast is to allow natural processes to continue, the equally important specific objective relevant to this section is to sustain existing coastal communities; this is felt to override the broader objective in this case. Having argued this, however, there are concerns that defence in this area should be based on the aim to sustain the village and its function as a single entity. This is what the existing defences aim to achieve. Therefore, further extension of defences to address the need of specific properties rather than The Village, would not be felt to be appropriate to the area in the context of the broader objective. There are properties to the northern end of the village which are likely to be lost during the period of the SMP (two possibly over the next 20 years, a further 3 by the year 2055 and a further 4 potentially at risk over the full period of the SMP). Both in terms of economics, but more fundamentally in terms of reducing the impact of defence on the natural coastline, these properties would not specifically be protected.

The same argument would apply over the whole of this section of the coastline. Unless there were significant regional or higher level benefits in intervening on the coast, the coast should be allowed to develop naturally. On the information provided to the SMP there are no other areas of this section of the coast which should be protected. This principle clearly needs to be applied with appropriate regard to scale of any proposed intervention. At a the very local scale, for example, in a specific location such as Boggle Hole, local works to maintain access or reduce flooding to the Youth Hostel, although most unlikely to be funded as Coast Protection, would not, it is felt, to be constrained by a policy of No Active Intervention for this section of Robin Hood's Bay.

MANAGEMENT AREAS

The intent of management is to maintain a natural coastline, with the specific need to protect Robin Hoods Bay Village as an exception within the underlying intent. As such the whole zone is seen as being one management area. Furthermore, within this context the policy unit for the village is considered as being perched within a single policy unit for the whole zone, rather than being as a unit dividing the coast.

A policy statement or summary is presented for the management area in the following sheets.

4.9.2 MANAGEMENT AREA POLICY STATEMENT (MA25)

Location reference:	Saltwick Nab to Hundale Point
Management Area reference:	MA25
Policy Development Zone:	9

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area is, in accordance with the strong environmental and natural heritage objectives for this section of the coast, to recommend no active intervention. At a more local scale the objectives set for the area have highlighted the importance of the coastal communities and, therefore, the SMP recommends a hold the line policy for the Village of Robin Hood's Bay, but only to the extent that it is the village rather than individual properties that is being sustained. At a far more local scale, it is recognised that private works may be proposed along the shore. Such works are unlikely to have any major strategic impact on the management of the coast but would have to be viewed in the contexts of the overall policy for no active intervention.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Hold the existing line of defence to the Village of Robin Hoods Bay. With No active intervention elsewhere. Monitor and address slope stability issues.
Medium term	As above
Long-term	As above

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025.	**2055**	**2105**	**Comment**
25.1	Saltwick to Hundale	NAI	NAI	NAI	
25.2	Village of Robin Hood's Bay	HTL	HTL	HTL	this policy is a local exception to the general policy for this larger section of the coast.
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

No fundamental change in policy beyond the possible change in overall intent that this area should be seen as principally an area of no active intervention, within which there is a policy for holding the line of protection to the village of Robin Hoods Bay.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

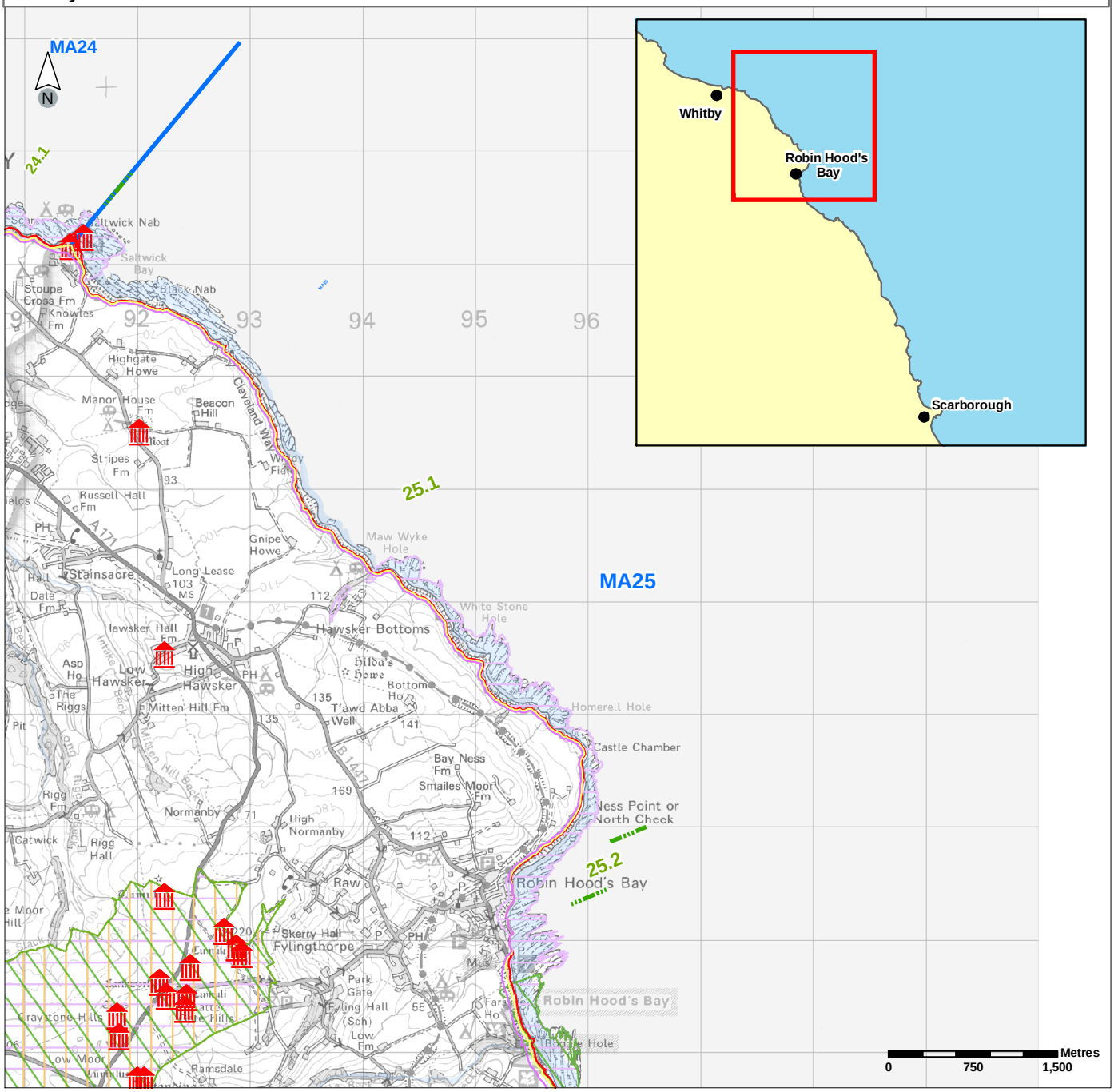
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	1,005	1,095	2,528	3,728
	Preferred Plan Damages £k PV	147	81	33	260
	Benefits £k PV	858	1,014	2,495	3,468
	Costs of Implementing plan £k PV	150	20	10	180
Costs based on strategy. Description of damage and benefits under preferred plan: • The plan provides protection to the village of Robin Hood's Bay but there would be loss of potentially 9 properties to the northern end of the village.					
Heritage	This section of coast has significant archaeological interests which are likely to be at risk towards the end of the SMP2 period. The features are not considered individually to be of specific value that would warrant protection.				
Amenity	The amenity value of the village is maintained. The value of the coast as an important natural heritage feature is maintained.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA25a
Policy Units 25.1-25.2



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Hold the existing line of defence to the Village of Robin Hoods Bay. With No active intervention elsewhere.	Hold the existing line of defence to the Village of Robin Hoods Bay. With No active intervention elsewhere.	Hold the existing line of defence to the Village of Robin Hoods Bay. With No active intervention elsewhere.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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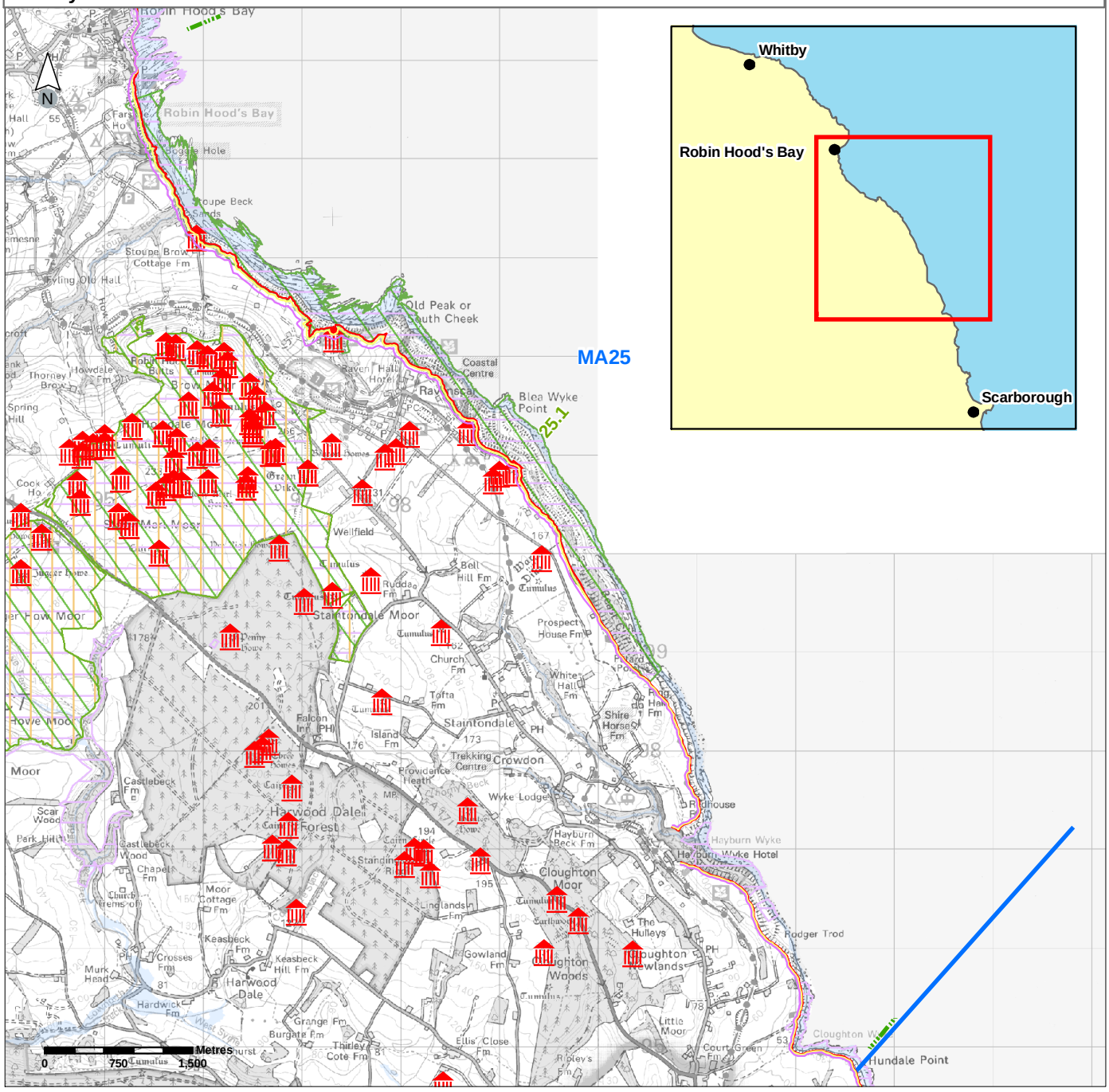
River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA25b
Policy Units 25.1



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Hold the existing line of defence to the Village of Robin Hoods Bay. With No active intervention elsewhere.	Hold the existing line of defence to the Village of Robin Hoods Bay. With No active intervention elsewhere.	Hold the existing line of defence to the Village of Robin Hoods Bay. With No active intervention elsewhere.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
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ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SAC Site Feature	Vegetated Sea Cliffs of the Atlantic and Baltic Coasts	
Sub Feature(s) Littoral rock (beginning at Robin Hood's Bay)	**Sensitivity** Net loss of SAC habitat.	**Conservation Target** Subject to natural change, maintain the vegetated sea cliffs of the Atlantic and Baltic coasts in favourable condition
Potential effect of policy	The overall policy suite within this Management Area supports the natural development of the coastline and particularly the sea cliffs. With only limited intervention to ensure that the village of Robin Hood's Bay is maintained.	
Preventative Measures None	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA25

	Description of Designation	**Effect of Preferred Plan**	**Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution**
National	Robin Hoods Bay (Maw Wyke to Beast Cliff SSSI) – Geological, maritime habitats and flora. Iron Scar and Hundale Point to Scalby Ness SSSI (Geological) Hayburn Wyke SSSI (Geological)	Continued presence of hard defences obscuring SSSI interests	None proposed
Local	none	N/A	N/A

ACTION PLAN MANAGEMENT AREA 25

Action	By when	Responsibility	Cost £k
Robin Hoods Bay - Develop Strategy for Robin Hood's Bay, further consideration of cliff stability . *High economic damage and risk to properties. Implications for development in risk area. Heritage and community support in line with NYMNP objectives*	2012	Scarborough BC	50
Robin Hoods Bay North of Mount Pleasant Study	2012	Scarborough BC	30
Schemes: Preventative maintenance as recommended by strategy	2010	Scarborough BC	150

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.10 PDZ 10 Hundale Point to White Nab

4.10.1 Policy Development Analysis

DESCRIPTION

Physical

The zone covers a length of some 12km, covering four very different sections. The northern of these, running from Hundale Point through to Scalby Ness, comprises generally steep cliffs overlain by till. In the section between Hundale and Creek Point there is little evidence of fine beach sediment, with a foreshore of rock scar and boulder scree. Where Creek Point holds the coast forward there is a small beach on the northern face of the cliff. Between Creek Point and Scalby, the coast is more east facing and is set back slightly, with several minor headlands, most notably Cromer Point, forming very shallow bays.

Along the foreshore, which is predominantly irregular rock outcrop, there are areas of sandy beaches held within these small bays. The most obvious of these bays is just to the north of Scalby Ness, where in the crook of the headland, and where the rock outcrop drops in level over two areas in particular, there are broader areas of sand beach with upper beach areas where the cliffs have eroded back slightly behind the general line of the coast.

The southern end of these bays is backed by a narrow ridge linking the main body of the coast to Scalby Ness itself. Immediately behind the ridge is the Scalby Beck, which approaches the coast to the north of Scalby Ness but then cuts south behind the Ness to flow out to the northern corner of North Bay. At the narrow neck linking Scalby Ness to the main cliff line, while the upper slopes of this ridge are eroding and slumping, there is a competent basal, harder rock core to the ridge. The hinterland to this northern section is exclusively agricultural land; any properties set quite some distance in land. There is a coastguard lookout station at Creek Point.

The next section is North Bay. The bay is formed by the cutting back of the high till coastal slopes between the Scalby Ness and Castle Hill headlands. The natural shape of the bay is very square, similar to a degree to that of Robin Hood's Bay; almost a large cove exposed to the dominant north easterly wave direction. At the northern end, this shape is held forward by the high rock foreshore platform, extending south from Scalby Ness. At the southern end the Castle Headland provides little actual wave protection, apart from the southeast and, without the influence of the rock platform, the cut back of the coast has been limited by the shoaling of the nearshore seabed within the control of the harder headland.

The Scalby Beck cuts through to the coast behind Scalby Ness and at the entrance to the beck the land has been built out as a platform at the toe of the coastal slope. This small area is heavily protected by a seawall and has been developed for use by the Sea Life Centre. The foreshore in front of the Sea Life Centre is devoid of a sand beach and the area of the North Promenade Bay, immediately south, has a very low and sparsely sanded beach. To the rear of the promenade, which, along with much of the hard defence of the bay, was constructed around 1890, is a steep coastal slope, along which runs the miniature railway. Behind the crest of the slope is the Scarborough Golf Course, with the Club House being the most forward of properties. There is further property set back about 100m from the crest. Behind the Sea Life Centre, the coastal slope is steeper and Scalby Mills Road, dog legging down the slope provides the only access to the development at the sea front. Within the entrance to the beck, there are properties very close to the crest of the slope and with the erosion due to waves entering the beck, this area is being considered as part of a local appraisal for further protection works.

There are plans to upgrade much of the coastal slope area just to the south of the Sea life Centre. Plans for this development are under review at present

Over the central section of the bay, the North Promenade continues through to Peasholm Gap with a terraced coastal slope behind back to Northstead Manor Gardens. The promenade over this section, protected behind a concrete seawall, is developed with chalets, with the Corner Café and visitor facilities at the southern end. At the gap where the main sea front road joins the coast is a slight promontory and slipways. The beach levels in this area have traditionally been higher than elsewhere along the frontage.

The southern end of the bay has been typified by lower beach levels, with the upper dry sand beach being lost and the foreshore comprising a flat sand intertidal beach backed by high sea walls. The

road, the Royal Albert Drive, runs immediately behind the seawall on a broad platform at the toe of the relatively steep terraced slopes of Alexandra and Clarence Gardens. Albert Road climbs from the promenade through Clarence Gardens to Queens Parade and the cliff top sea front properties which run the full length of this southern section of the Bay. Between the two Gardens the coastal slope steepens as a promontory at the Alexandra Pavilion. The Royal Albert Drive continues along the toe of the steep Holms cliff, on the northern flank of the Castle Head, running into Marine Drive around the Headland. The foreshore narrows with rock outcrops to the deeper water at the point. The whole bay creates the impression of important open coastal slope recreational land crested by traditional sea front development, with a narrow promenade and beach front at the toe.

The Castle Headland divides not just the physical behaviour of the coast but also the character of coastal use. Immediately within the southern lee of the headland is the busy harbour of Scarborough. The East Pier extends the influence of the headland enclosing the east and old harbour areas. Behind the harbour is the heavily developed Sandside promenade with residential and commercial properties rising up the coastal slope towards Castle Hill. The West Pier, enclosing the southern side of the Harbour, also acts to retain a wide sandy beach and upper dry beach berm curving along the shore in front of Foreshore road.

This area forms the main developed sea front of Scarborough, the southern end being at the Valley, beneath the very steep St Nicholas Cliffs. To the south of here the upper beach disappears as the coastal defences advance in front of the open coastal slope and Spa complex, with the intense development of the Esplanade above. The sand intertidal foreshore, however, continues in front of the Spa but then runs to the high rock outcrop in front of the old Bathing Pool and the newly protected heavily defended land slip area to the fore of the Holbeck Ravine. There is a small area of beach trapped between the old bathing Pool and the newly defended area, indicating the potential for movement of sand over the rock foreshore.

The Final section of the frontage comprises an emerging harder rock cliff rising to White Nab. The rock platform of the shoreline continues over the whole of this section and the coast is drawn out to the Nab. There is a narrow width of sand beach to the back of the rock along much of the length, only disappearing at the Nab itself. Above the Nab is the South Cliff Golf Course, with properties set back at the southern end. Only at the edge of the Holbeck ravine are properties significantly close to the crest of the coastal slope.

Environment

The very north of the zone falls within the National Park and the whole of the northern section, down to Scalby Ness is part of the Heritage Coast. With the exception of North Bay and the northern part of South Bay, the coast is designated as SSSI. This includes the foreshore and much of the cliff face of the Castle Headland. These designations relate primarily to the geological exposures with specific GCR sites to the north and at the Headland. There are however other elements of the SSSIs relating to coastal slope vegetation and especially to the south, important invertebrates. While the main town areas of Scarborough are excluded from national designation, the local plan highlights the importance of the natural environment as an integral aspect to the attraction and values of the town. Indeed, the Rotunda Museum celebrates the geological exploration of the area and is itself a major tourist feature of the town. In addition to the national designations much of the Castle Headland and the foreshore in front of the Spa is designated as sites of nature conservation interest (SINC). The Cleveland Way runs the whole length of the zone, including along the line of the sea front promenades.

There are also important heritage conservation areas. In addition to being important open recreational areas highlighted in the Local Plan, the Alexandra and Clarence Gardens, together with the area behind and to the north of the Spa, are designated conservation areas and the Spa, itself, is recognised for its architectural merit and an area important for its recreational, heritage and tourism value. Much of Scarborough's sea front is an outstanding conservation are. The whole of the crest of the Castle Headland is designated a Scheduled Ancient Monument (SAM) as being an Iron Age settlement and the Castle and areas around the Castle are of substantial archaeological value and interest.

Scarborough is a major regional centre. It has much intrinsic culture development associated with the port and the town around the port, as well as from the character developed during Victorian times. While there it is a much broader economic base, tourism, particularly associated with the sea front, the Spa, the Harbour and the Sea Life Centre, of vital importance to the Town, which draws upon and supports the high tourism value of the general area. An essential feature of this tourism is the traditional beach use and this, both within South and North Bay, are key local recreational aspects of the frontage. Consideration is currently underway for the development of the sea front in the area of the Harbour in support of this. Development is being considered to the northern half of North Bay and

the development of the Spa area is also under consideration.

The harbour is important for the fishing industry, as a commercial port and for recreational water use. The East Pier has recently been repaired and improved in association with the major coast protection works to safeguard the road and the cliff behind around the Headland. These works ensure protection to the road link between North and South Bay, which also forms a major aspect of the transport system into and through the town.

There is, therefore, considerable interaction and interdependency between all aspects of the environment; the natural environment providing the backdrop to the overall attractiveness of the town, the important vitality of the port in relation to the tourism of the sea front and the different character of the two bays and the coast to north and south providing a range of facilities and interest for tourism and the local population. This essential complementary completeness of the area is brought out as a key feature in the Local Plan.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence.

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To support the very specific cultural values of Scarborough.
- To support the economic development of Scarborough.
- To support the traditional beach usage, including beach access.
- To maintain the commercial and recreational use of the harbour.
- To maintain essential transport links.
- To support the use of the coastal path and local network of pathways through the area.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:20yr	1:50yr	1:100yr	1:200yr
-2.35	2.45	3.05	3.53	3.66	3.74	3.87	3.93

Determined at Scarborough. Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 3.25m below Ordnance Datum. Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between. Source (extreme water levels): Holbeck to Scalby mills Coastal Defence Strategy Study - Hydrodynamic Assessment. HR Wallingford (1998)

Wave climate

Return Period (1:X years)	Wave Height Hs (m)*
0.1	4.92
1	4.92
10	4.92
50	4.92
100	4.92

*Determined at Castle Cliff, Scarborough. Nearshore wave heights emanating from the east were determined to be depth limited to 0.6 of the depth of water at the refraction point. Source: Holbeck to Scalby Mills Coastal Defence Strategy Study - Hydrodynamic Assessment. HR Wallingford (1998)

Baseline Erosion Rates

Northern Section	0.1m per year
North Bay	0.2m per year
South Bay	0.3 m per year
South Cliff	0.2m per year

All the above rates are based on existing evidence and are likely to increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

The northern section between Hundale and Scalby continues to erode slowly. The frontage is thought to contribute little sediment to the system and sediment derived from the cliffs, or from any onshore-offshore exchange is felt to be trapped locally by the series of minor headlands. There may be some continuation of long shore drift to North Bay but this is thought to be quite minimal. There is, however, believed to be movement of sediment in the nearshore area and the net drift of this would be to the south. The relative narrow width of shallower nearshore waters would suggest that any stream of sediment is quite limited.

Evidence based on the position of high water suggests that the volume of sediment within both North and South Bay reduced during the early to mid part of the last century but has tended to increase since then. Certainly the hydrodynamic analysis study, undertaken as part of the strategy development for the area, comments that Scarborough South Bay would appear to be one of the few areas of the coast where there is active accumulation of material. The evidence of earlier beach change, particularly within North Bay does suggest that the construction of the sea walls along the north beach may have resulted in significant loss of sediment. This, given the orientation and nature of North Bay would be sensible.

North Bay is very open to the dominant wave directions. The extent of indent of the bay would very much dictate the ability of the bay to retain an upper beach. Presumably, when the walls were constructed, as part of their construction was the desire to reclaim the upper beach area so as to allow the development of the promenade and roadway. This advancing of the line of defence, together with the construction of a highly reflective wall would have significantly increased energy over

the remains of the upper beach resulting in material being drawn offshore and being redistributed along the shore by differential wave energy.

This process would tend to move material north in to the centre of the bay, into an area given some reduction in wave energy by the outcrops of rock in the nearshore area. The analysis of sediment drift undertaken as part of the strategy does suggest a weak northerly drift but it is uncertain whether this derives merely from the differential in wave heights or primarily as a result of wave direction. The lack of beach material to the northern end, south of the Sea Life Centre would suggest the latter and, in this location, the lack of a beach is primarily seen as being due to the unfortunate shape of the wall around the centre resulting in the development of severe scour along the face of this wall as it returns to the Northern promenade. This generates a the high energy concentration into the corner.

These high energy areas to north and south, plus the addition protection afforded to the central section from the Mascus and Betty Muffet Rocks has caused sediment to be pushed in to the centre and held as a higher beach. It may be expected that the recent protection works to Marine Drive (constructed over the period 2002 to 2005) and continuing around beneath part of Clarence Gardens will tend to dissipate energy in the southern corner of the Bay. This may have the result of allowing beach levels to rise in this corner. Whether this has the affect of destabilising the beach in the centre will depend on whether this high beach is retained by the level of the rock in the centre of the bay or more by a drift from the south.

If the rocks merely provide a reduction in energy, rather than actually pulling material into the centre, then there may be a loss to the central beach. Detailed monitoring is essential in gaining a better understanding to determine future management.

Quite probably waves hitting the Sea Life Centre wall, in addition to being diverted to the south, are also being directed to the north in to the entrance of the Beck and may have an impact of the erosion within the lower reaches of the gulley.

The processes in South Bay are in many ways quite different. The Castle Headland and as importantly, if not more so, the extension of the harbour, provides shelter from the dominant north easterly sector wave directions. Through both diffraction of waves and also wave approach from the southerly quarter, sediments are clearly moved into the lee of the Headland along the face of Foreshore road to the north, before being held by the West Pier. The movement of material is clearly demonstrated both by the need for the Council to engage in beach management; removing material from along the northern section of the beach and by the harbour's need for dredging.

Quite probably the coastline immediately to the south was being advanced by the slow failure of the coastal slope and this was being matched by a continual process of erosion. The net balance of this, at the time of building the Spa and its defences, was for the line of defence to be built forward of the more stable plan shape of the beach. As such, with the construction of hard defences, beach levels are likely to have dropped creating the low wide sandy foreshore in front of the Spa.

Drift over this frontage might be expected to be to the south, but to a degree the low foreshore is retained by the outcropping Black Rocks. The fact that beach levels are maintained, and may even be increasing does suggest a significant input form the nearshore area. Furthermore, the Spa defences may actually be retaining material to the north which might otherwise be lost to this short bay system.

Over both bay frontages there are considerable levels of overtopping. This was identified in the strategy as being of particular concern at Marine Drive (this having now been addressed by the new protection works), over the Royal Albert Drive area and at the Northern Bay Promenade and Sea Life Centre, and again along Foreshore road (where there is a significant impact on the properties to the main sea front) and along all of the Spa defences. In addition to these problem areas, over the North Bay frontage there has been identified the probable minor slippage of the coastal slopes. In general these slopes are retained by the sea walls and erosion of the frontage would result in more major slope failures.

Along South Bay more major risk of coastal slope instability has been identified in the area of the Spa and associated with Holbeck Gardens. In this latter location most of the sea wall is backed by a more stable low basal cliff. Therefore, while there is potential damage to the defences due to slope failure (and to properties at the top of the cliff) the slope failure is not seen primarily as a coastal defence issue.

To the south there is little threat of major coastal slope instability associated with erosion. There is

evidently a certain degree of southerly sediment drift but only a very limited volume of material is likely to feed along the shoreline to the south. In fact if anything this frontage acts as a sediment sink, retained as it is by the reorientation of the coast at White Nab.

Unconstrained:
Coastal defences, along with other coastal structures, in particular the Harbour, have a major influence on the coast, within the area of Scarborough.

Over the northern section of the zone, the coast is unconstrained and is continuing to erode slowly. Even to the north of Scalby Ness, erosion is unlikely to breach through to the beck because of the basal rock ridge. There is the potential for the ridge to lower and for there to be increased instability of the bank down to the beck. This could affect the flow in the beck.

While Scalby Ness and Castle Headland would continue to erode, these points would still act as the headlands defining North Bay. Within the bay, without defences, there would be a more stable upper beach providing a degree of protection to the coastal slope. However, this beach would have continued to roll back, causing further instability to the slope and retreat of the crest. With sea level rise it is uncertain whether the bay would ever reach a fully stable condition, although Peasholm Gap is likely to have developed as a sand infilled valley.

The beach to the south of the headland would be slightly set back and would be narrower over its whole length, but would still tend to be quite stable. However, the full length of the Spa area would have eroded considerably and, depending on the rate of slope failure, pushing the coastline forward, would at times have developed a narrow upper beach through to the rocks to the south of the Spa. Quite probably as material from slope failure was eroded the coast would have cut back, potentially as much as 100m, before a more stable shape was achieved. This would have tied back into the emerging rock cliff below Holbeck Gardens.

Overall, therefore the coast is held quite a degree forward of its natural position, by the long linear defence in North Bay and by the Harbour and the Spa within South Bay. While in North Bay there is still quite a degree of pressure on the defences. In South Bay the control imposed by the Harbour holds the coast forward in a relatively sustainable manner.

MANAGEMENT

Present Policy

SMP1	Policy
SMP1 divided the zone into eight management units. The policy for these is recorded below:	
MU19E,	Do Nothing
MU23	Retreat
MU20A and B, MU21A and B, MU22A and B,	Hold the Line.

Holbeck – Scalby Mills, Scarborough Coastal Defence Strategy

The strategy included hydrodynamic modelling and analysis of cliff stability and economics for the whole frontage. Three key aspects of coast protection, overtopping and slope stability were investigated for 15 individual defence lengths, with works to each identified over the next 35 years. The basic policy would be to hold the line, except in the case of the Spa and Spa access road recommendations were to advance the line. Works to protect Marine Drive, the Harbour and part of The Royal Albert Drive have been undertaken.

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

Over the north section of the coast between Hundale Point and Scalby Ness, erosion would continue. The only specific assets which would be lost would be the coast guard lookout station. There would be continued loss of agricultural land and this might amount to some 25m over the next 100 years.

To the south of Scalby Ness there is concern that cliff instability within the entrance to the beck could result in the loss of property at the crest of the cliff. The road to the Sea Life Centre might also be lost with significant loss in value to the centre. While the wall to the Sea Life Centre is likely to remain for some 20 to 50 years, there would be continued heavy overtopping with risk to those using the centre, the car park and other facilities in the area. Following failure, it is unlikely that the coastal slope directly behind would be affected over the 100 year period but the cliff to Scalby Mills may be further affected. This is subject to a more detailed review and appraisal.

The Northern Bay Promenade is currently under pressure due to the wave reflection of the Sea Life Centre wall. The promenade wall may fail within the next 10 to 20 years and would therefore not benefit from the longer term loss of the wall to the north. On failure the coastal cliff would retreat although the frontage would derive some benefit from the continuation of the promenade to the south. It is possible that only the Golf Club house would suffer loss during the 100 years of the SMP. There would be loss to the Miniature railway line to the Sea Life Centre. Further south the promenade is protected by high beach levels, but with the loss of the wall to the north, some of this protection could well be lost and there is likely to be peeling back of the wall over the next 20 to 50 years. This would affect the viability of the proposed development of the area. Over the whole of this length the retreat might be of the order of 25m within the period of the SMP. This might start influencing properties to the crest of the cliff towards the end of the SMP period but properties along the promenade would be affected much sooner. The strategy determined a loss of some £15m of property together with an impact on tourism, including the loss of the Sea Life Centre of some £11m per year over a 10 year period. Current overtopping damages are assessed as some £60,000 per year.

The Clarence Garden frontage sea wall may fail some time over the next 30 years, although there would be extensive overtopping as at present, which would become worse during this period. The level of overtopping already causes concern for safety and would result in disruption to traffic. With failure of the wall, there is some possibility that the cliff instability would be reactivated. This would affect the valued amenity area and is likely to cause

significant damage to properties to the crest of the cliff.

To the south, the Holms frontage and Marine Drive have been protected and it is assumed that these structures will have an effective life over the period of the SMP.

From the above scenario, with the next fifty years there would be substantial failure of defences over much of North Bay. This would allow some movement back of the shoreline, re-establishing a better position for the development of a healthy upper beach. However, the consequence of the retreat would be severe on traffic, on the access to the beach and in terms of loss of the access to the recreational space highlighted in the Local Plan. There would also be loss of facilities and the landscape and individual value of properties to the crest of the cliff. It is difficult to collate the overall damage costs from the strategy over the whole bay, as these have been determined on the basis of individual defence lengths. However, the economic damage and that to amenity and tourism would be considerable.

South of the Headland, the recent works to the harbour should ensure its influence over the next 100 years. As such, over that time it would be assumed that the beach in front of Foreshore Road will remain, despite sea level rise. Most of the defence structure is, similarly, likely to survive the period of the SMP, although without maintenance it would deteriorate over the period. Overtopping does cause a serious problem and this would worsen. This causes flooding to properties along the sea front.

The southern end of Foreshore road has to be considered along with the defence along the access to the Spa and to the Spa itself. Failure of the Spa defences, potentially occurring over the next 30 to 50 years would result in obviously a major amenity and tourism loss, but also the potential destabilisation of the coastal slope behind. This may initially move the actual shoreline forward, but with erosion this would be progressively cut back. There would be significant losses in terms of properties to the crest of the slope behind, assessed in the strategy to be in the order of £6 million.

The retreat of the shore to the south would mean that beach levels to the north are likely to drop and that the southern end of Foreshore road would come under significantly greater pressure. Failure of this wall would result in the loss of significant amenities along the sea front, including the amenity centre and theatre. It would also cut the main transport route to the harbour and the sea front. The area of the valley would tend to infill with sand, forming potentially a small dune system. The value of this, however, would be questionable given the urban setting. The strategy identifies the loss of amenity individually associated with the Spa and the Spa Access and Foreshore road as being in the order of £10 million per year for a 10 year period, together with losses associated with the harbour, for each individual area as being in the order of £20,000 per year. This gives a combined damage associated primarily with these two aspects in excess of £93 million. This seems high but does indicate the potentially high value of loss associated with tourism for the area as a whole.

Further south, the defences are in various states of disrepair and there was one minor failure to a section of wall during the preparation of the SMP2. Failure of most sections might be expected over the next 5 to 30 years. Their failure would result in some loss in terms of the promenade but the more significant damages would occur over time as the coast erodes back.

This would, in several areas, destabilise the coastal slope resulting generally in loss to properties to the crest. As indicated in the discussion of coastal processes, there needs to be a clear distinction made in terms of damages arising from the failure of the seawalls and the basic instability of the coastal slope due to over steepening and ground water instability. In some cases the sea walls are not acting as retaining structures themselves but rather are resisting further erosion of the rock cliff at the base of a slope. In such cases the timing associated with erosion of that cliff and the potential for triggering failure of the slope has to be distinguished from the potential for earlier and more general failure of an unstable coastal slope.

The Final structure in the section of South Bay is at Holbeck Ravine. Here the more recent structure is assumed to have a residual life over the SMP period.

South of here the slow erosion of the rock cliff would be assumed to continue with limited impact on the land to the crest of the cliff.

MDSF Evaluation		*PValue Damages*
Erosion	85 properties lost.	£1,532,000
Flooding	112 properties affected	£61,981,000
Other information	Tourism and transport damages not accounted for the above assessment. The strategy assesses damages of £236M.	
Assessment of key objectives	• Avoids damage to but does not significantly enhance the natural heritage value. • Fails to support the cultural heritage. • Fails to support the economical development of Scarborough. • Fails to support the traditional beach usage. • Fails to maintain the commercial and recreational use of the harbour • Fails to maintain essential transport links. • Minimises reliance on defence.	

With Present Management (Scenario 2):
North of Scalby Ness the on-going policy is for no active intervention.

This Scenario assumes that the various proposals recommended in the 1999 strategy study constitute the present policy for management of North and South Bays. Briefly this recommends holding the existing line of North Bay through a combination of techniques.

At the northern end this would involve the construction of a very wide rock berm in front of the Sea Life Centre. This would have the affect of both providing stability to the wall, reducing wave overtopping and reducing the impact on the frontage to the south.

Over the full length of the Northern promenade it is proposed to recharge the beach with sand and to increase the height of the wall, with the possible addition of a rock face to the sea wall. There is still considerable uncertainty as to the ability for the foreshore to retain increased beach levels and this option would require potentially significant effort in maintaining the recharge.

A similar approach is recommended to the Clarence Garden frontage. While works to the south, at Marine Drive and the Holms may result in a substantial reduction in energy at the corner, the proposed level of sand recharge is such that waves would still act against the sea wall and could rapidly erode the recharged beach. This might be addressed by the introduction of a rock apron at the wall but this would significantly impact on access to the shore. Overall, the costs of proposed works based on the economic assessment in the strategy show a good net benefit.

The intent of the works would address the concerns for the frontage without significant damage to ecology. At the southern end in particular, however, there would be the potential for further damage to the geological exposures. At the northern end at the Sea Life Centre there are concerns expressed by English Nature as to the impacts of the wide rock berm.

The current policy for the Headland and the Harbour is to hold the line, and for the duration of the SMP2 this is addressed by the works recently undertaken. It was noted during consultation that there was considered to be significant damage in terms of obscuring features of geological interest and while the works were considered to be of overriding benefit, the loss of integrity at this site should be recognised in terms of potential opportunity or possible loss elsewhere.

The 1999 strategy proposed work to holding the line at Foreshore Road and to provide a retired crest wall, addressing the serious concerns as to overtopping. The option to advance the line, reclaiming areas of stable beach was rejected because this could actually increase overtopping. The Strategy demonstrates a good benefit in holding the line and improving the standard of defence.

In front of the Spa it is recommended that over the next five years works are undertaken to advance the line of defence by some 30m, to improve access and open area to the Spa, and to provide additional stability against major deep seated slip failure of the cliff. The justification for these works relies heavily on the avoidance of tourism damages. While advancing the line may result in some improvement to beach levels to the southern limit of Foreshore Road it is not anticipated that this would affect sand movement to the harbour.

The works would necessarily include construction of a wave screen wall, as it is recognised that advancing the line could otherwise give rise to increased reflection and overtopping. The option of a rock revetment to the existing line was rejected due to the Council's policy that rock structures should not encroach along the shore north of the Spa. The new structures would not infringe on the rocks and would therefore not affect the SSSI.

Over the southern defended section the strategy recommends the use of rock revetments to hold the line of the defences. The justification for these works is based on the risk to properties behind but also to a degree on the tourism and amenity value of the area. Here there is concern expressed by English Nature that rock would advance over or impact upon the SSSI in the area

No works are recommended to the most southerly limit of the bay. The SMP1 recommendation of retreat for this management unit was based on the assumption that there would need to be a suitable transition zone between the defended and undefended sections. This is addressed by the major defence to the area in front of the Holbeck Ravine and it is assumed that the present management policy for the shoreline in this area would now be for no active intervention.

MDSF Evaluation	*PValue Damages*
Erosion	No erosion damages
Flooding	No flood damages
Other Information	The strategy identifies possible damages due to cliff instability
Assessment of Key objectives	• Some residual damage associated with recent works and potentially further loss of geological exposure. Without enhancement elsewhere this scenario fails to prevent damage to the natural heritage. • Supports the cultural heritage. • Supports the economical development of Scarborough. • Supports the traditional beach usage. • Maintains the commercial and recreational use of the harbour. • Maintains essential transport links. • Continued heavy reliance on defence.

DISCUSSION AND DETAILED POLICY DEVELOPMENT

The current policies for no active intervention to the section south to Scalby Ness and south of Holbeck Ravine are common to both scenarios and are in line with the principles and objectives for the coast in this area. The policy of no active intervention for these areas is carried forward in the SMP.

The rest of the frontage tends to highlight the dichotomy of sustainability arising from the inherited approach to the management of the coast during the period of Victorian development. While, with respect to the Harbour, the construction of the Harbour has worked well with natural processes to ensure the sustainability of the main sea front, many of the other works put in place over a century ago will now incur considerable resource in future management. At the same time, the development undertaken in association with these works; the splendid architecture of many of the seafront buildings lining the cliff tops, the promenades, the Spa and the tourism features of the frontage, together with the basic seafront infrastructure, provided, and still provides, the underpinning structure for economic well-being of the whole town. This is likely to provide an essential aspect underpinning the economic well-being of future generations. On balance, the economic appraisal undertaken for the strategy demonstrates that even over the next 100 years, the asset value of the frontage still outweighs the future commitment for defence.

The areas most under pressure, apart from the Headland which has now been addressed, are the Clarence Garden frontage and the Spa. In both areas continued defence is perfectly feasible and in both areas the consequences of abandoning the defence would have major repercussions for not just the immediate assets at risk but also adjacent sections of the frontage. In the case of Clarence Gardens the obvious strategic damages would be cutting the road which provided significant justification for the works along Marine Terrace and the loss of the valuable open area of coastal slope, which in many ways defines the character of North Bay. In the case of the Spa, abandoning the defence of this area is likely to impinge on the sustainability of Foreshore Road and would threaten again the transport link through the town as well as, this time, access to the harbour. In both areas, however, the SMP would recommend re-examination of the economic case for proposed works, clearly identifying the damages associated with the whole management of the frontage and the costs associated with individual sections of defence. In particular, some of the indirect damages need to be considered in terms of potential funding from other sources. A review of this is being undertaken.

Overall the policy from the Sea Life Centre through to the works at Holbeck Ravine is seen as being Hold the Line over the full period of the SMP. There is not seen to be any separate frontages where retreat or no active intervention would bring substantial reduction in effort of defence without also incurring both substantial direct damages and increased pressure on adjacent sections.

Commenting on the specific proposals, the aim along North Bay is both to maintain the existing defence line and maintain the quality of the frontage in terms of its promenade, facilities and beach. At the Sea Life Centre the option of the rock apron, while still outwith the SSSI to the north would create a significant footprint over the exposed rock platform. Furthermore, development of this structure could impact on the discharge from the beck and this would need to be examined. Alternative options suggested in the strategy are for a rock revetment in this area. This could be supplemented by extending a short nib or breakwater to the south, thereby offering that vital protection to the northern end of the North Bay Promenade.

The concept of beach recharge both along the North Bay promenade and the Clarence Road frontages are to be considered in greater detail. There is still considered to be significant uncertainty as to movement of sediment within the bay. The recharge option would rely heavily on the degree of protection offered the frontage by the nearshore rocks. Under severe wave attack and high water levels, these rocks may be significantly less effective and substantial movement of beach material may occur. It may be necessary in order to maintain beach levels, particularly at the southern end to introduce control structures. In defending or developing this frontage it should also be appreciated that any general advance of linear structures is very likely to increase loss of beaches and make defence more difficult, in effect, recreating the same situation and problems created initially by the Victorian defence policy to the area.

The defence of the Spa proposes to advance the line of defence. It is not considered that this will have any significant impact on the harbour. However the effectiveness of the wave screen will need to be carefully examined and further investigation would be needed in examining in detail the impact on the beach plan shape. Further examination of the economics for this development is required such that distinct benefits are identified between coast protection need and enhancement of amenity and tourism. As such, the policy for the Spa frontage is hold the line rather than advance; although acknowledging that, from present evidence, advance the line may act to the benefit other aspects of management of the frontage and may provide additional benefit in management of coast defence elsewhere. Advance the line is therefore, seen as an opportunity rather than a necessity.

Further south, consideration should be given as to the possible impact and infringement of the proposed rock revetment on the foreshore. While the toe of the existing defence is outside the SSSI it lies within the SINC. It may be better to reconsider improvement to the existing defence rather than the use of rock. Management of this whole area has to take account of the nationally significant bird population and potential impact on the rocky and seaweed-strewn shores, as well as both natural and man-made features providing roosting at high tide.

MANAGEMENT AREAS

The zone divides itself quite naturally into three management areas:

- The Burniton frontage, from Hundale Point to Scalby Ness.
- Scarborough North Beach, from Scalby Ness through to the Castle Cliff.
- Scarborough South Beach from Castle Cliff through to White Nab

Even so, there needs to be recognition that there are issues cutting across certainly the boundary between the latter areas. In particular, in considering potential damages there needs to be some recognition that tourism and access benefits are linked through the whole area. There may also be scope for environmental enhancement to offset impacts between these two areas.

Policy statements or summaries are presented by management areas in the following sheets.

4.10.2 MANAGEMENT AREA POLICY STATEMENTS (MA26-28)

Location reference:	Hundale Point to Scalby Ness
Management Area reference:	MA26
Policy Development Zone:	10

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the zone is to maintain the natural environment to the north of the Scarborough frontage.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	No active intervention between Hundale Point and Scalby Ness
Medium term	As above
Long-term	As above

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
26.1	Burniston	NAI	NAI	NAI	
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

No change with respect to SMP1.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

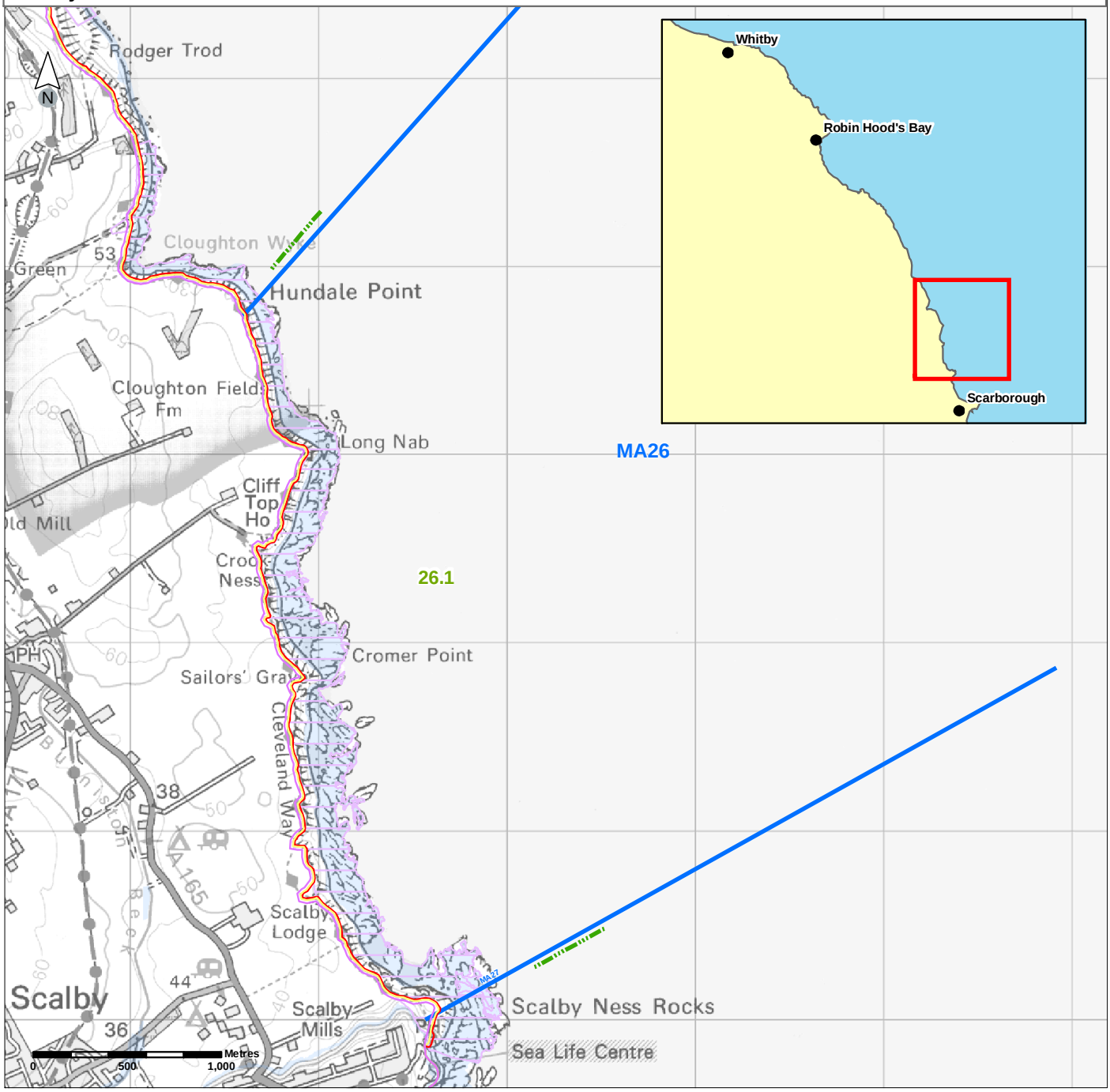
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	0	0	0	0
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	0	0	0	0
	Costs of Implementing plan £k PV	0	0	0	0
Description of damage and benefits under preferred plan: • No loss of hard assets • Some slow loss to agricultural land.					
Heritage	No identified heritage loss				
Amenity	Maintains the amenity of the natural coast.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA26
Policy Units 26.1



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)		
From Present Day:	Medium - Term:	Long - Term:
No active intervention between Hundale Point and Scalby Ness	No active intervention between Hundale Point and Scalby Ness	No active intervention between Hundale Point and Scalby Ness

Key:

Predicted Shoreline Mapping*
Preferred Plan
- 20 Years
- 50 Years
- 100 Years

- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA26

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	N/A
National	Iron Scar and Hundale Point to Scalby Ness SSSI (Geological)	None anticipated.	None proposed
	none	N/A	N/A
Local			

ACTION PLAN MANAGEMENT AREA 26

Action	By when	Responsibility	Cost £k
No actions			
Schemes: No schemes			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Scalby Ness to Castle Cliff
Management Area reference:	MA27
Policy Development Zone:	10

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall plan for the area is to maintain the defences to North Beach, maintaining the important coastal use for the frontage. The detailed approach to defence is under review and will be critical to maintaining the values of the area.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain and improve defences to the area.
Medium term	As above
Long-term	As above

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
27.1	North Bay	HTL	HTL	HTL	Detailed strategic appraisal of options required.
27.2	Castle Headland	HTL	HTL	HTL	
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

No change from SMP1

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

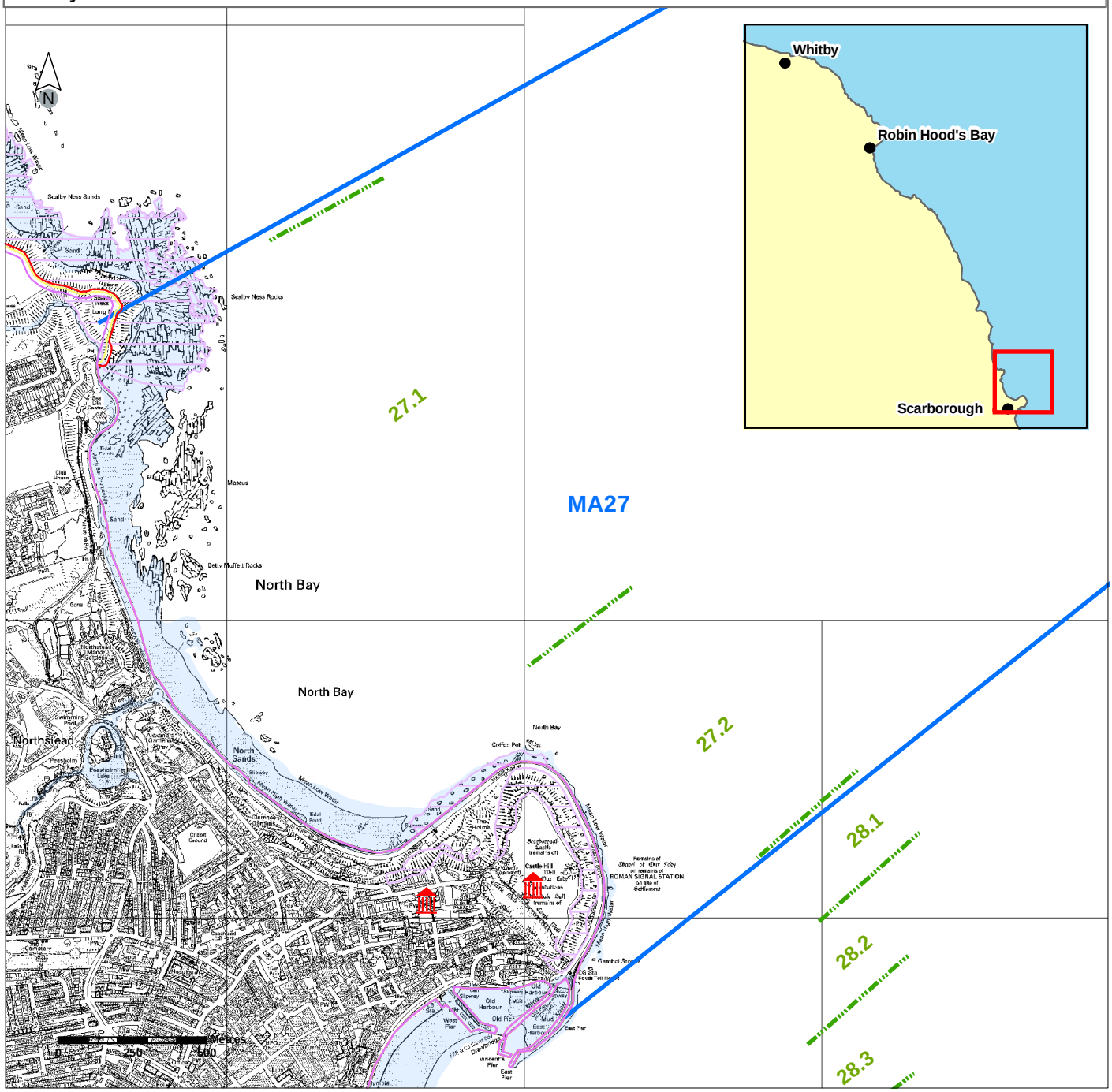
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	710	484	268	1,462
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	710	484	268	1,462
	Costs of Implementing plan £k PV	25,360	10	228	25,598
Costs based on revised strategy. Damages do not take account of traffic disruption and amenity loss. This has been re-evaluated in the review of the strategy and is now assessed at £641M Description of damage and benefits under preferred plan: • No loss of assets					
Heritage	No loss of heritage features				
Amenity	Amenity use of the beach and coastal area needs to be considered within detailed option selection				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA27
Policy Units 27.1-27.2



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Maintain and improve defences to the area.	Maintain and improve defences to the area.	Maintain and improve defences to the area.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA27

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
National	Iron Scar and Hundale Point to Scalby Ness SSSI (Geological) is present in the north of MA27. North Bay to South Toll House Cliff SSSI (Geological) is present to the south.	27.1 Potential impact of using rock apron on intertidal habitat and locally important bird habitat. 27.1 Negative impact on discharge from Scalby Beck.	Alternative engineering solutions to be considered.
Local	none	N/A	None proposed

ACTION PLAN MANAGEMENT AREA 27

Action	By when	Responsibility	Cost £k
Scarborough - Review Holbeck to Scalby Mills Strategy. *High economic value and risk to properties. Ensure integration with redevelopment. Incorporate strategy for Scalby Ness. Safety and use of promenade.*	On going	Scarborough BC	on going
Schemes:			
• Sea Life Centre – Rock berm and seawall repairs	2008	Scarborough BC	8777
• Peasholm Gap and Clarence Gardens - Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	2013	Scarborough BC	17000
• North Bay Cliffs – Seawall repairs and slope stabilisation	2015	Scarborough BC	4000

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Castle Cliff to White Nab
Management Area reference:	MA28
Policy Development Zone:	10

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area is to maintain the important character and economic value of the Scarborough frontage while minimising impact of the section of natural coast to the south.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Maintain defences. Address concerns of flooding to sea front. Investigate further works required to maintain defences to the Spa.
Medium term	Maintain defences Undertake works to continue protection to the Spa frontage
Long-term	Maintain defences

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
28.1	Harbour	HTL	HTL	HTL	Essential control point
28.2	Foreshore Road	HTL	HTL	HTL	Improve overtopping risk
28.3	Spa and access	HTL	HTL	HTL	Consider opportunity for advance
28.4	Cliff Gardens	HTL	HTL	HTL	Minimise impact on foreshore
28.5	South Cliffs	NAI	NAI	NAI	
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

The policy for the southern unit changes from retreat to no active intervention

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

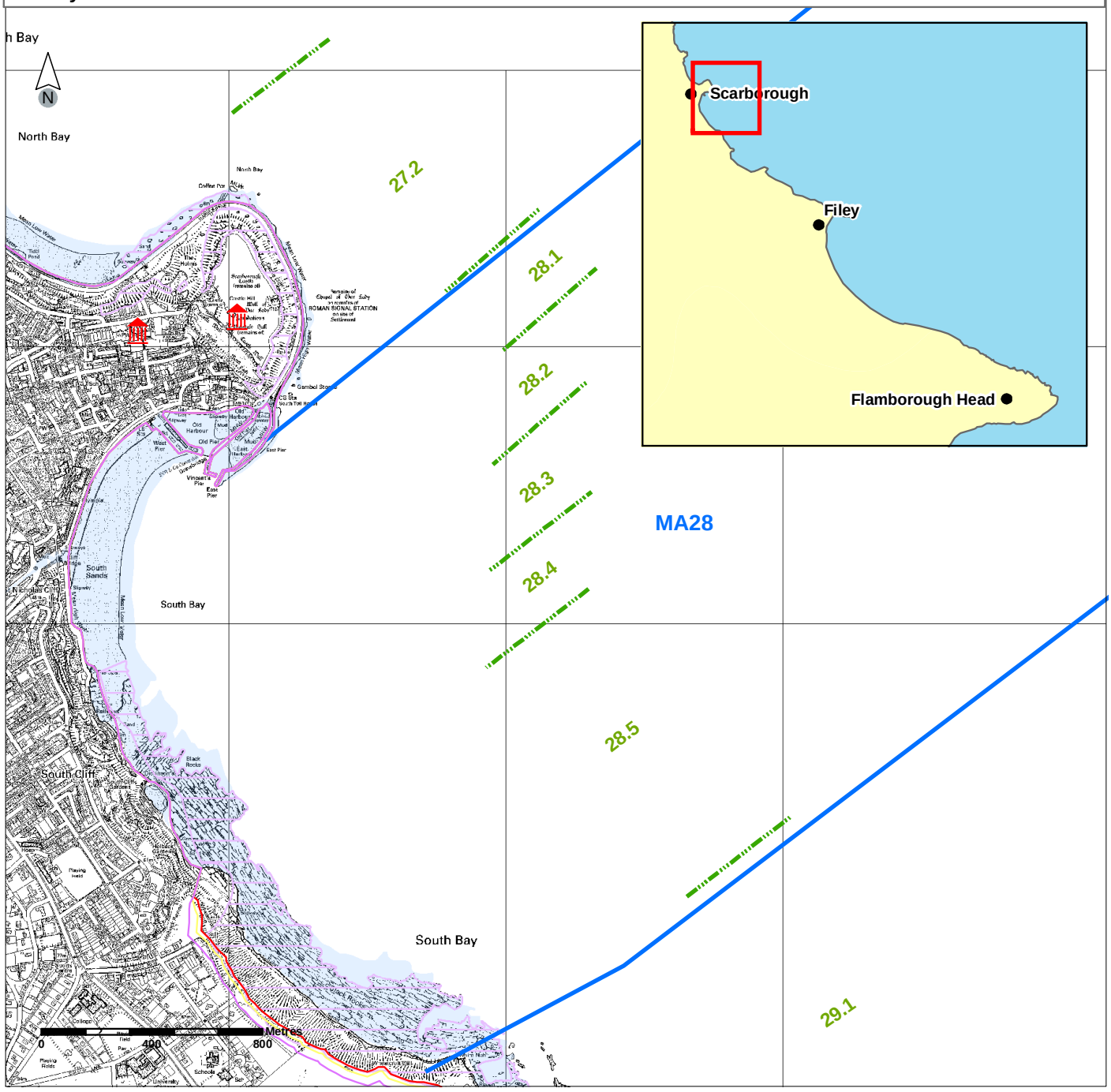
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	30,853	20,006	11,190	62,050
	Preferred Plan Damages £k PV	10,649	0	0	10,649
	Benefits £k PV	20,204	20,006	11,190	51,401
	Costs of Implementing plan £k PV	35,265	10	7	35,282
Costs based on strategy Damages with preferred plan include for flood risk until scheme is put in place. Damages do not take account of amenity or traffic disruption. This has been reviewed as part of the review of the strategy. Damages are now assessed as £515M Description of damage and benefits under preferred plan: • No damage to assets once schemes in place					
Heritage	Maintains cultural and heritage aspects of the sea front and Harbour				
Amenity	Maintains use of promenade and beaches. Maintains tourism facilities including the Spa				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA28
Policy Units 28.1-28.5



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)		
From Present Day:	Medium - Term:	Long - Term:
Maintain defences. Address concerns of flooding to sea front. Investigate further works required to maintain defences to the Spa	Maintain defences. Undertake works to continue protection to the Spa frontage.	Maintain defences.

Key:

Predicted Shoreline Mapping*

Preferred Plan
- 20 Years
- 50 Years
- 100 Years

- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA28

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	None	N/A	N/A
National	Cayton, Cornelian and South Bays SSSI (Geological, flora, invertebrate fauna and birds)	28.3 potential impact on SSSI foreshore 28.4 ongoing impacts to adjacent SSSI on foreshore 28.5 Potential negative impact on internationally important geological SSSI. Impact on intertidal habitat and bird feeding/roosting areas.	Design of protection should be sufficiently detailed to avoid footprint affecting SSSIs. Consideration of implications of climate change on policy required. Preference for solutions such as improvements to existing sea walls should be given.
Local	South Cliff Gardens	No likely impacts	None proposed

ACTION PLAN MANAGEMENT AREA 28

Action	By when	Responsibility	Cost £k
Scarborough - Review Holbeck to Scalby Mills Strategy, *High economic value and risk to properties. Integration with sea front and amenity. Maintain navigation and leisure issues*	On-going	Scarborough BC	On-going
Schemes:			
• Spa Chalet Cliff - Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	2008	Scarborough BC	7000
• The Spa – Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	2008	Scarborough BC	11700
• South Cliff Gardens – Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	2010	Scarborough BC	3600
• Foreshore Road and St Nicholas Cliff – Raise height of existing wall, drainage improvement Foreshore Road and slope stabilisation	2012	Scarborough BC	5200
• South Bay Pool – Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	2013	Scarborough BC	5500
• Rose Gardens - Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	2015	Scarborough BC	6700

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.11 PDZ 11 White Nab to Filey Brigg

4.11.1 Policy Development Analysis

DESCRIPTION

Physical

The zone covers a length of some 10km of principally natural cliffed coast line. The general alignment of the coast is quite uniform facing out towards the north northeast. Over the northern half of the zone, the frontage is characterised by steep but sloping glacial till slopes, changing, over the southern section, to high, near vertical rock cliffs, with an overlay of till, which becomes more prominent as the basal rock becomes lower running into Filey Brigg. The zone may be subdivided into four main sections:

- Cornelian Bay; formed between the rock promontory at White Nab and the narrow rock outcrop at Osgodby Point,
- Cayton Bay; formed in the lee of Osgodby Point and the start of the more resilient rock cliff at High Red Cliff,
- The more prominent section of Gristhorpe Cliff,
- The slightly set back, relatively straight cliff line of North Cliff and Filey Spa.

The dominant feature over the first of these areas, Cornelian Bay, is the high boulder-strewn rock outcrops within the intertidal area. This is virtually continuous over the frontage forming a reef set slightly in front of the shoreline. The actual shore line has a narrow sand and shingle beach, backed to the north by a very steep partially vegetated slope. The steep cliff to the back of the beach reduces in height towards the south and the more characteristically shallower, heavily vegetated slope of till takes its place.

At Osgodby Point, the actual point is being exposed as possibly little more than a rock pinnacle linked to the main cliff line by a till ridge. The northern flank of this ridge is being actively eroded. Most of the land to the crest of the slope is undeveloped open agricultural land. There is a sewage pump station to the crest of the slope behind White Nab, with an overflow outfall emerging at the toe of the cliff and running out over the rock foreshore. At the southern end of the Bay is the Knipe Point housing development with properties situated close to the cliff crest.

The housing development runs along the crest of the Cayton Cliff slope within the next section of the coast; that of Cayton Bay. This bay, or at least the northern shape of the bay, is strongly reliant on the control provided by Osgodby Point. The northern section is of a classic spiral curved bay in the lee of the headland, held forward at its southern end by the rock and boulder debris beneath Tenants' Cliff. Between Tenants' Cliff and Osgodby Point is the steeply sloping, very heavily vegetated till Cayton Cliff, with the Knipe Point housing development close to its crest on the northern side and the main coast road , the A165 and village of Osgodby to the rear on the western crest.

Tenants' Cliff is of a very different character, formed as a complex terraced landslip area in the strata of Oxford Clay Kellaway beds at the base, overlain by harder Massive Grits, forming the near vertical shoreline cliff and capped by glacial deposits. While the Cayton Cliff is subject to continuing surface landslips; potentially quite major at times, the Tenants' Cliff is seen as being initially more stable, held as it is at present by the build up of rock at the toe.

Just south of Tenants' Cliff is the only section of defence within the whole zone. These comprise a section of masonry revetment beneath the Old Pump House; this now being a residential property. To the south of here is a section of concrete walls in very poor condition. The main access to the bay runs through the cliffs at this point.

South of the concrete wall the till cliffs; the Killerby Cliffs, steepen, with evidence of general major sporadic slumping. As cliff failures occur, so the toe of the new coastal slope is being eroded. This pattern of cliff development continues over the southern half of Cayton Bay, with the till cliff gradually running out to the scree sloped harder cliffs of High Red Cliff. In the centre of this section of steep till cliffs, the cliff line and foreshore is brought forward by the presence of the near shore Calf Allen Rocks; a long series of outcropping rock some 400m seaward of the cliff line. Immediately behind these rocks, the till cliff, while still subject to large slumped landslip, has been able to adopt a slightly shallower slope. In contrast to the northern half of the whole bay, there is a narrow upper sand beach, reflecting the degree of shelter and impact on sediment drift the nearshore outcrops have on the wave direction and exposure.

Along the Killerby Cliff crest there is the only caravan park within the Bay; just south of the concrete wall, together with a string of properties and a car park. Set back, typically some 250m is the continuation of the coastal road between Scarborough and Filey. Over the whole of Cayton Bay is a broad sandy foreshore.

High Red Cliff forms the southern end of Cayton Bay and, while Red Cliff Point forms a headland at the northern end, the whole of the next length of coast forms a relatively straight section set some 300m in advance of the general line of the coast to the north or south. This section; the Gristhorpe Cliff, comprises a very steep, and in places undercut, cliff line with massive scree slopes down to a narrow sand foreshore behind a wide area of intertidal rock platform. At the crest over the whole section is a series of large caravan parks, one of which is situated very close to the crest of the cliff. The other caravan parks are generally set back some 150m to 200m behind the crest, with open ground in front. The section ends at Cunstone Nab, coincident with the loss of the rock platform.

The Final 3km of coast comprises a slightly lower cliff, still steep with intermittent areas of scree from rock falls and a narrow width of boulder strewn intertidal area to deeper water. Although there is evidence of sand in the nearshore area, nowhere along the section is there sand to the foreshore. At the crest is relatively flat open agricultural land, with the open parkland at the eastern end above Filey Brigg.

Environment

The Cayton, Cornelian and South Bays SSSI continue from zone 10 to cover the coastal slopes and foreshore of the northern half of this zone. This is continuous with the Gristhorpe Bay and Red Cliff SSSI to the south. There is a further SSSI at Filey Brigg. The northern SSSI's, especially, reflect the important geological value of the area, the palaeontological and vegetation interests and the notable assemblages of invertebrates. This latter, internationally significant feature of the SSSI is highly dependent on the slumped, cracked and moist clays formed and forming to the base of the various coastal slopes. With regard to the geological values, there are specific GCRS at Osgodby Point, High Red Cliff and Filey Brigg. The section between the southern SSSIs is a Local Nature Conservation area as well as being a Scheduled Ancient Monument Site important as an area of Iron Age settlement. There are over much of the southern half of the zone various Tumuli identified on maps of the area, suggesting that the area is one of potential archaeological interest, although these have not been specifically noted during consultation. Of far more recent origin are the series of Pill Boxes within Cayton Bay. From the strategy study for the area it is reported that these constitute one of the most complete examples of coastal military defence from the last century. Many of these structures are at beach level.

The National Trust own the Cayton and Tenants' Cliffs within Cayton Bay and an area set back from the coast further south towards Filey Brigg. Cayton Bay, in particular is important for water sports and this is supported by a commercial water sports centre set back on the land behind the bay. The bay is also designated a bathing beach. The Cleveland Way continues along the cliff crest and through the slopes of the Cayton Cliffs, ending at Filey Brigg. The area of the Brigg is an important tourism and visitor area.

Osgodby is the only major settlement within the zone and properties run along the landward side of the main coastal road, which is itself at the very edge of the back scarp to the Tenants' Cliff complex slip area. The Knipe Point housing development comprises nearly fifty properties very close to the crest or top scarp of Cayton Cliff. There is a further small clump of properties within the centre of Cayton Bay and, while associated with the row of properties close to the cliff in this area, the main part of this hamlet is set well back behind the main road.

The road along the crest of the cliffs at Cayton Bay is the main coastal route between Scarborough and Filey. The road is, therefore, of considerable regional importance. The road has in the past been moved landward when it was threatened by local failure of the rear scarp to the back of Tenants' Cliff between 1926 and 1938. There are plans to relocate the road further in land.

The entire length of the zone is designated in one way or other for its scientific or heritage value, principally gained from its natural coastal development and its almost surprising remoteness; given the proximity of the major centres of population of Scarborough and Filey. It has an atmosphere of casual use and recreational enjoyment, most especially within Cayton Bay; reflected in the National Trust's management of the Cayton and Tenants' Cliff areas and their overall policy of conservation of natural processes. This policy supports the various important natural conservation aims associated with the SSSIs and provides an important context for the use of the Cleveland Way. The main pressure points arise from the development at Knipe Point and the longer established settlement of

Osgodby. Within this context, access to Cayton Bay will be an issue on this eroding coastline.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence.

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To support and enhance the particular habitats associated with the slumping till cliffs.
- To minimise damage to the built environment.
- To maintain appropriate recreational use of the area.
- To maintain access to and along the bay. In particular maintain the use of the Cleveland Way.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:20yr	1:50yr	1:100yr	1:200yr
-2.35	2.45	3.05	3.53	3.66	3.74	3.87	3.93

Determined at Scarborough. Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 3.0m below Ordnance Datum. Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between. Source (extreme water levels): Holbeck to Scalby Mills Coastal Defence Strategy Study - Hydrodynamic Assessment. HR Wallingford (1998)

Wave climate

Return Period (1:X years)	Wave Height Hs (m)*
1	4.4
10	6.2
50	7.4
100	7.7
200	7.9

*Determined at Cayton Bay North. Source: Cayton Bay Coastal Strategy Study, October 2002.

Baseline Erosion Rates

Cornelian Bay	0.2m per year, with similar retreat of the cliff crest
Cayton Bay	0.25m per year, with uncertain impact on slope failure
Gristhorpe Cliff	0.25m per year
North Cliff	0.25m per year

All the above rates are based on existing evidence and are likely to increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

Notwithstanding the more local processes within Cayton Bay, backed by the softer till cliff line, the shape of the overall zone derives from the differential erosion of units of hard geology along an essentially straight section of coast line. This may be seen not just in the line of the cliffs but is reflected in and influenced by the outcrop of rock platform within the intertidal area. Cornelian Bay and the Gristhorpe Cliff effectively have reefs created in front of the cliff line. This is indicative of a harder basal geology but also then acts to dissipate wave energy at the toe of the cliff line, so that even where there is a softer till cliff, such as just to the north of Osgodby Point, the general line of the cliff is well in advance of the line of similar till cliffs within Cayton Bay. Over the southern most section where there is no rock platform, the length of North Cliff has eroded back quite sharply in comparison with the section to the north. This wider platform of rock has allowed the development of narrow sand beaches at the toe of the cliff. The orientation of the coast has quite well aligned to the net wave energy such that sediment drift along the frontage is expected to be quite low. However, high energy storms, associated with higher water levels may still be able to scour the frontage, with drift typically to the south. Anticipated sea level rise could result in a more general increase in erosion as the rock platform becomes more submerged.

Within Cayton Bay the softer material of the cliffs has been cut back to create an open sand beach frontage within the general line of the coast. At the northern end, Osgodby Point actually protrudes to provide shelter to the Cayton Cliff, causing diffraction of waves in its lee. Further south on the bay, although now open to direct wave attack by the dominant north-easterly sector of wave approach, the Calf Rock reef acts as a low submerged breakwater, retaining foreshore levels and reducing wave action at the toe of the cliff.

In the situation at Cayton Cliff, there is a strong possibility that Osgodby Point will become detached

from the coast and, while still acting as a sort of breakwater, the influence of the Point will be considerably reduced. Severe erosion along the Cayton Cliff toe might then be expected. The timing of such a development could well be within the period of the SMP and potentially within the next 50 years. Much would depend on the extent of the point, in term of whether there is a ridge of rock running back to the shore. However, the fact that the outcropping reef in front of Cornelian Bay is already distinct from the foreshore, and the fact that the till runs down as a slope to the level of the foreshore, suggest that the harder rock of the Point is a feature of the long shore reef rather than a ridge running in land.

The Cayton Cliff is already considered to be a relatively unstable heavily saturated slope, vulnerable to both local and more major surface slippage. At present the toe of the slope is at an unsteady equilibrium, with slope slippage tending to move the toe forward and coastal processes tending to erode the toe back to the crenulate shape of the bay. This process continually steepens the coastal slope and increases the opportunity for a major landslip affecting the scarp at the top of the slope. Minor drainage works have been undertaken in this area, but these do not substantially reduce the risk of a major land slip. Should Osgodby Point be breached, the basic equilibrium of the backshore would be disrupted and the extent of erosion would almost certainly cause major instability of the coastal slope and scarp at the crest. The breach would also tend to allow increased drift of the existing beach material from the southern section of Cornelian Bay, again causing instability of the till slope in this area; but also providing some increase in sediment drift into Cayton Bay.

The southern control of the crenulate bay is at the more resistant deposition of rocks and boulders beneath Tenants' Cliff. While still eroding the back cliff face, the process has less potential for erosion than to the north. This point along Tenants' Cliff will remain a key control feature within Cayton Bay regardless of any breach at Osgodby Point. The terraced coastal slope behind these cliffs has been assessed as being quite stable in the short to medium term, although further erosion of the cliff face could eventually result in further major land movement. The back scarp remains vulnerable to failure purely because of weathering.

The defended section has little influence on the overall bay processes and even in the longer term, although vulnerable to being outflanked, particularly to the south, it is possibly only in the latter half of the 100 year SMP period that the revetment would act to control bay development. The frontage will however come under increasing pressure.

Long term sea level rise will weaken the influence of the Calf Rocks and the southern section of the bay will tend to straighten. There would then be an increase in erosion over the section held more forward at present. Generally this overall section of the bay will continue to erode along the toe of the cliff until further major falls occur to the cliff face, with quite sudden losses in localised areas in the order of 10 or so metres. In addition to monitoring the average cliff recession, monitoring of the scale of local loss is important in defining a vulnerability zone at the crest of the cliff.

To the south of Cayton Bay general erosion will continue to the cliff line, again tending to be in terms of local quite significant falls occurring suddenly.

In terms of sediment supply, there is believed to be only a weak drift system from the north. It has been assessed that the main supply of beach material, certainly within Cayton Bay, comes from the eroding cliffs. As Cayton Bay erodes potentially more quickly than the adjacent cliff line, the bay will become increasingly a closed sediment system, with merely transfer between the beach and the nearshore area. Continued supply form the cliffs would become critical to maintaining a good foreshore.

Unconstrained:
With little man-made defence in the area the unconstrained situation would be substantially similar to the process described above. In the absence of the short section of defences, this section of the coast would erode, initially more rapidly but, since it lies in the transition between the Tenants' Cliff and the Killerby Cliffs, such erosion would not have a markedly different impact on the bay development.

MANAGEMENT

Present Policy

SMP1	Policy
SMP1 divided this zone into six management units, the first of these MU23, extending into the zone to the north. The policy for these were:	
MU24B, MU25 and MU26,	Do Nothing
MU23, MU24A and MU27.	Retreat the Line
Cayton Bay Coastal Strategy	
The strategy considered the coastal and cliff behaviour over Cayton Bay. The strategy recommended some minor drainage improvements to Cayton Cliff and around the properties at the crest of the Killerby Cliffs. These are not principally coastal protection and the policy is therefore for no active intervention at the shoreline. In the area of the Pump House, because of the need to maintain the access to the bay, the strategy policy is for retreat.	

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

The basic processes described above would continue under this scenario; the only significant local issue, in terms of defence would be in the centre of Cayton Bay, were the defences would be allowed to fail.

In several areas, principally within Cayton Bay there is still considerable uncertainty with respect to the more immediate stability of the cliffs and coastal slopes. In the medium, 20 years to 50 years, and long term, 50 years to 100 years, timescale it is, however, possible to make a more realistic assessment.

To the northern end of Cornelian Bay, the sewage pump station may well be affected, probably over the latter part of the SMP period, with a general retreat of the cliff line. At Osgodby point, in all likelihood the point will have been isolated from the main cliff line by year 50. In this event there would be severe erosion of the toe to Cayton Cliff and this would almost certainly trigger a major landslip which is likely to take out a significant section, if not all the properties of Knipe Point Drive. Even if Osgodby Point has not broken through, there seems a good chance, based on the evidence from the strategy, that a major land slip would have developed, causing loss of the front row of properties to the back of Cayton Cliff. Further detailed investigation is needed in this area to determine whether properties at the crest of the cliff are in more immediate danger over the short term.

There seems a high probability that sections of the coastal road associated with the Cayton Cliffs would be affected within the next 50 years, with the potential also of loss to some properties within Osgodby over the period of the SMP. This again needs to be investigated in more detail.

Over the next 50 years, while there may be local loss to the road due to instability of the rear scarp behind the Tenants' Cliff section, the strategy suggests that there will only be a low probability that erosion of the sea cliff would trigger more major instability of the complex landslide. The possibility for more major failure would increase over the SMP period but this is still relatively low.

The private defences to the Old Pump House may fail over the next 20 to 30 years, in the absence of any maintenance. This is likely to result in loss of the property, and associated buildings, quite rapidly after the failure of the defence. Associated with this failure and the earlier failure of the concrete wall to the south would be problems of access to the beach.

It is probable that over the latter part of the SMP period some, but in all likelihood not all, properties, along the Killerby Cliff would be lost. Which properties would be lost and which

not cannot be determined sensibly, and the extent to which properties would fall within a zone of vulnerability could only be determined from detailed monitoring of the typical extent to which sporadic cliff failure occurs over local individual areas.

Along the Gristhorpe Cliff there is a good chance that a large proportion of the most forward of the caravan parks would suffer loss over the SMP period, although this would tend to be in the latter years. Further south there would be a general loss of agricultural land. At Filey Brigg, while erosion would affect the recreational land and access along the Brigg may have to be closed, there would be no significant loss of hard assets.

Over the whole length the Cleveland Way would be affected quite severely and to maintain this important route, the path would have to be set back.

In terms of the natural environment, the natural development of the cliffs would continue and, while there may be loss in terms of exposure over the longer term of rock outcrops as sea level rises, the main geological exposures would remain. Clearly, failure of the Cayton Cliff slope could have a major impact on access and, therefore, the value of the area in terms of one aspect of National Trust objectives. However, the continuance of the natural processes would be fully in line with their national policy for coastal areas. This continuing process of erosion and coastal slumping, both at Cayton Cliffs and along the Killerby Cliffs, together with the natural drainage and issue of water through the clays, would be essential for maintaining conditions favourable for important invertebrate species.

MDSF Evaluation		*PValue Damages*
Erosion	33 properties lost due to erosion	£685,730
Flooding	No flood risk identified	
Other information	Strategy study indicates possible damages amounting to £664,000, taking account of probabilistic risk. No account made for impact on road.	
Assessment of key objectives	• Avoids damage to and potentially enhances the natural heritage. • There would be no specific loss to heritage interests and, therefore, it maintains the cultural heritage. • Fails to reduce risk to the built environment. • Creates problems in terms of access and failing to support appropriate recreational use of the area. • Minimises reliance on defence.	

With Present Management (Scenario 2):

The only substantial change to the above scenario is in the area of the Old Pump House. Here the reveted defence would be maintained but eventually allowed to fail. Here, also, it is proposed to undertake minor works to maintain access to the shore but in a manner allowing managed retreat as the coast to either side is cut back.

At Cayton Cliff, various alternative options were considered in the strategy and the proposed actions in this area were to undertake superficial drainage management of the cliff, with the intent merely of reducing local slip activity. At Killerby Cliff there were also recommendations to provide improved drainage to the crest of the cliff to assist stabilizing the coastal slope. Neither option is seen as being principally coast protection, although in the case of Killerby Cliffs this could be seen as mitigation of the on-going erosion. At Cayton Cliff, while the coastal processes will in the longer term erode the cliff toe, the slope is seen as being fundamentally unstable and works are seen primarily as a means of alleviating the current situation.

The drainage works are not believed to have any significant impact on the important supply and issue of water through the cracked clays to the cliff toe and are not seen to cause substantial damage to the SSSI.

In all other areas of the coast natural erosion would continue and this would neither significantly impact upon nor be impacted by the minor works being suggested.		
MDSF Evaluation		*PValue Damages*
Erosion	33 properties lost due to erosion	£685,730
Flooding	No flood risk identified	
Other information	No account taken for impact on road	
Assessment of Key objectives	• Avoids significant damage to the natural heritage. • There would be no specific loss to heritage interests and, therefore, it maintains the cultural heritage. • Fails to significantly reduce risk to the built environment. • Aims to maintain access and therefore to support appropriate recreational use of the area. • Minimises reliance on defence.	

DISCUSSION AND DETAILED POLICY DEVELOPMENT

There is no overriding value in introducing new defence over the main section of open coast. While the loss of the Sewage Pump House to the northern end of Cornelian Bay would have to be addressed over the longer term, the policy for Cornelian Bay, Gristhorpe Cliff and North Cliff, down to Filey Brigg can only sensibly be for No Active Intervention.

The principal issues, and differences between the scenarios, focus on areas of Cayton Bay. Considering first the Cayton Cliff, the strategy considered protection to the toe, major drainage works and Finally minor drainage works with monitoring. These three potential local scenarios are re-examined.

Scenario (a)

Description: Coast protection works.

Rationale: The aim would be to stop further erosion at the toe of the cliff, providing increased stability to the slope, typically through the construction of a rock revetment.

Implications: Works initially would be undertaken over some 450m at the back of the foreshore. While the works would provide some stabilisation, they would not address the fundamental problem of a potentially major land slip. Such a slip would tend to overwhelm the defence works. The works would, therefore, only have an affect of delaying loss of property. Furthermore, in the event of a breach developing to the rear of Osgodby Point, any works to the toe of Cayton Cliff would need to be substantially reinforced and would need to be extended further around the headland. Clearly it would be possible to reduce this need by defending the area to the north of Osgodby point prior to a breach. This would potentially add the need for a further 250m of rock revetment at the southern end of Cornelian Bay. Even with such works the fundamental problems of cliff stability would not be addressed.

Impacts: Technically as a short term measure works would be possible, although their long term value would be questionable, since over the longer term there would still be substantial loss of assets within the Knipe Point Drive development. The works would have a major impact on the SSSI, not just in general terms but in the impact the works would have on specific important species and habitat

Scenario (b)

Description: Slope Stabilisation.

Rationale: The principal problem is one of the heavily saturated steep slopes likely to result is massive failure. The aim would be to provide substantial drainage to stabilise the slope.

Implications: Various techniques could be undertaken but in principal a significant degree of the water flowing through the slope would be controlled. This would stabilise the slope in the short term. However, in the medium to long term the potential breach behind Osgodby Point would result in significant erosion to the toe and would result in the slope, even in its drained condition being over steepened, with significant risk of subsequent failure. Addressing this would require defences similar to those described in scenario (a), with a continuing need for quite extensive maintenance and an overall heavy commitment to defence.

Impacts: Technically over the long term there would be a commitment to further defence works inherent in this approach. While potentially manageable, it is probable that embarking on this course of action would be regretted in the long term. It is not therefore considered to be a sustainable approach to the problem. The works would have a major impact on the SSSI, not just in general terms but in the impact works would have on specific important species and habitat. The nature of the area would be substantial altered.

Scenario (c)
Description: Minor drainage works and monitoring. **Rationale:** The aim of this approach is to address immediate superficial drainage problems to the slope. No specific works would be undertaken to stabilise the slope but monitoring would be put in place to identify further more major movement. **Implications:** The works would not provide any long term improved stability against major failure. It is uncertain as to the degree of risk at present but the stability of the slope would be monitored to provide some degree of warning. The properties at the crest of the slope would be at risk almost certainly within 20 years but potentially far sooner. The monitoring would be designed to provide adequate warning of failure to allow evacuation. **Impacts:** No substantial works would be undertaken to the cliff and, therefore, there would be no damage to the natural environment associated with intervention. The species at the toe of the cliff would be basically unaffected. However, natural processes, in term of a major land slip would cause significant damage to the thickly vegetated slope and to the recreational use of the woodland. Once failed, both of these aspects could be re-instated.

Both scenario (a) or (b) would require significant investment in defences and this has been shown by the strategy to be in excess of the benefits derived. More importantly in terms of the SMP and long term management of the area, these two scenarios would have a serious detrimental impact on the designated environment and ecology. This would run counter to the spirit of what the SMP is attempting to achieve through sustainable coastal management.

The SMP, therefore, concurs with the findings of the strategy in recommending a non active intervention policy (accepting that neither minor drainage work nor monitoring is strictly coastal defence works). There is, however, concern over the effectiveness of emergency response monitoring in providing adequate scope for residents to adapt to the eventual loss of property. Quite separate from the need for an evacuation plan to be developed, it has to be recognised that, unlike flood warning, evacuation would be permanent. As such further investigations are felt to be required to better define the likelihood of slope failures and to provide a more realistic timescale during which residents can make plans. Within this no active intervention policy, and subject to findings of a more detailed investigation and other regulations, if it should be found that temporary works could be provided to the crest scarp to provide improved stability in the immediate area of the properties; this would not run counter to the policy for coast defence.

The other cliff stability problem is at Killerby. Here the nature of the cliff failure is different in that the cliffs tend to fail in discrete sections. Drainage is still considered to be an issue in the strategy and minor drainage improvements are recommended adjacent to the properties. The rate of loss of the cliff and the long term threat to the properties would not justify expenditure on defence at the toe of the cliff. In this area the policy is for no active intervention.

The Final issue area is at the Old Pump House. The concrete wall to the south is in such poor condition that to maintain defence in this area would require a new defence. The wall does provide an important access point to the beach and the loss of this formal access might result in more general use of the coastal slope as access, with potential damage to the natural environmental interests. However, despite this, the cost of reinstating the wall would not be justified. The debris of the wall should be removed as it fails completely. In front of the Old Pump House, the assessment of the defence is that with maintenance this wall could be maintained over possibly the next 50 years. This would not be seen as unsustainable, as discussed in the assessment of coastal processes above, however, the cost of works is

unlikely to be justified against the limited risk to assets. There may, however, be opportunity to use the basic structure of the Pump House revetment, improved to maintain a degree of control on erosion and offering better management of the access point. This would need to be examined further. On this basis the policy for the short section of the access would be to support maintenance of the revetment, while addressing the loss of the concrete wall in the short term, to examine possible enhancement of the Old Pump House wall, incorporating this within management of the access to the bay and, most probably allowing failure of the wall in the long term as the defence becomes outflanked. With this intent the nominal policy would be one of managed retreat.

MANAGEMENT AREAS

The zone divides into the more interdependent section of the Cornelian and Cayton Bays and the cliffed section further south. The two management areas are therefore:

- From White Nab through to the southern end of Cayton Bay
- From the southern end of Cayton Bay to Filey Brigg

Policy statements or summaries are presented by management areas in the following sheets.

4.11.2 MANAGEMENT AREA POLICY STATEMENTS (MA29-MA30)

Location reference:	White Nab to Cayton Bay
Management Area reference:	MA29
Policy Development Zone:	11

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area is to allow natural development of the coastline in line with the important conservation and recreational value of the area. Within this, however, minor works may be undertaken to the main unstable cliffs within Cayton Bay in terms of drainage improvements, but these are not considered to be principally coastal defence works and should not impact to the determent of the SSSI. Within the centre of Cayton Bay there is a need to manage access. This is seen as being best managed in conjunction with the medium term management of the Old Pump House wall.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Management of the failure of the wall within Cayton Bay and maintenance of the revetment within a general policy for no active intervention within the Bay as a whole.
Medium term	Management of the access to the bay, possibly associated with enhancement of the revetment within a general policy for no active intervention within the Bay as a whole.
Long-term	Management of the access to the bay within a general policy for no active intervention within the Bay as a whole.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
29.1	Cornelian Bay	NAI	NAI	NAI	
29.2	Cayton Bay	NAI	NAI	NAI	
29.3	Cayton Bay Access	MR	MR	MR	Within the broader policy unit of the bay
Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention, MR – Managed realignment					

CHANGES FROM PRESENT MANAGEMENT

The policy for the Cayton Cliffs has changed from one of retreat to one of no active intervention.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

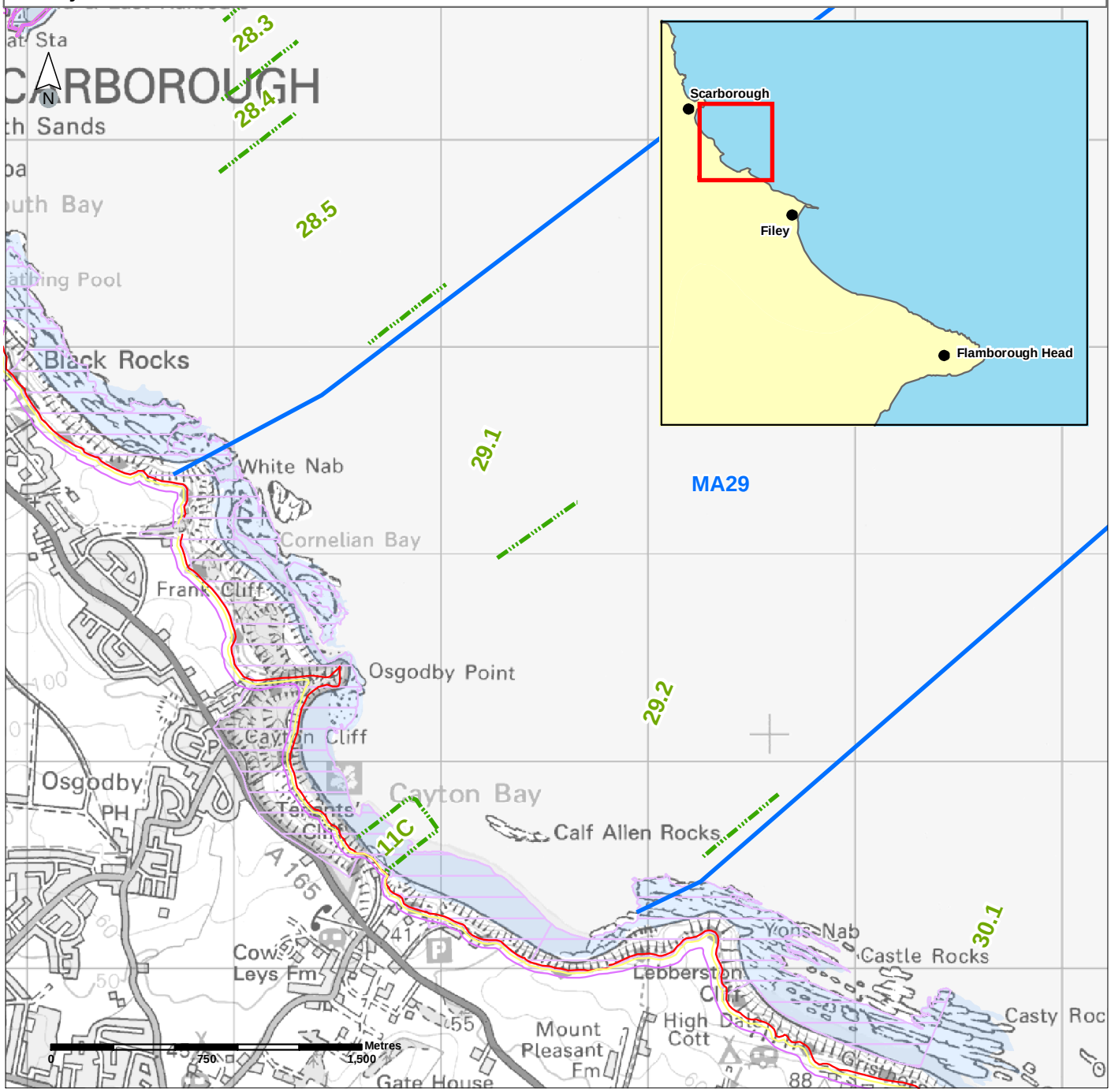
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	25	456	205	686
	Preferred Plan Damages £k PV	25	456	205	686
	Benefits £k PV	0	0	0	0
	Costs of Implementing plan £k PV	59	0	0	59
Damages may occur earlier due to cliff instability. Only costs associated with management of access taken as coast protection from strategy. Description of damage and benefits under preferred plan: • Loss of properties • Maintain access					
Heritage	No specific heritage losses				
Amenity	Maintain access to bay				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA29
Policy Units 29.1-29.2



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Management of the failure of the wall within Cayton Bay and maintenance of the revetment within a general policy for no active intervention within the Bay as a whole.	Management of the access to the bay, possibly associated with enhancement of the revetment within a general policy for no active intervention within the Bay as a whole.	Management of the access to the bay within a general policy for no active intervention within the Bay as a whole.

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA29

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	None	N/A	N/A
National	Cayton, Cornelian and South Bays SSSI (Geological, flora, invertebrate fauna and birdlife)	29.1 and 29.2 will allow continued action of coastal processes on the SSSI interests. 29.3 has the potential to positively affect the SSSI interests by removing structures that currently interrupt processes on a local scale.	None proposed. It should be noted that interim protection of Wheatcroft cliff at Cornelian Bay, part of the Cayton, Cornelian and South Bays SSSI, from scour at the Sewage Pumping Station outfall should be considered for removal in the medium term.
Local	Cayton and Cornelian Bay SINC	As above	As above

ACTION PLAN MANAGEMENT AREA 29

Action	By when	Responsibility	Cost £k
Cliff stability investigations	2007	Scarborough BC	80
Management plan, to review implications of managed realignment. *Risk to properties. Highway management. Important environmental issues. Access and amenity*	2008	Scarborough BC/ **NYCC/ National Trust**	10
Realignment strategy, develop managed realignment and access strategy plan. *Maintaining use of Cayton Bay. Advice on sustainable development.*	2012	Scarborough BC	30
Schemes: No schemes			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Cayton Bay to Filey Brigg
Management Area reference:	MA30
Policy Development Zone:	11

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area is to allow natural development of the coastline in line with the important conservation and recreational value of the area.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	No active intervention within the area.
Medium term	No active intervention within the area.
Long-term	No active intervention within the area.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
30.1	Gristhorpe Cliff	NAI	NAI	NAI	Provide advice to caravan Parks with respect to retreat.
30.2	North Cliff	NAI	NAI	NAI	Set back line of Coastal footpath
Key:	HLT - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

No change from SMP1 policy.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

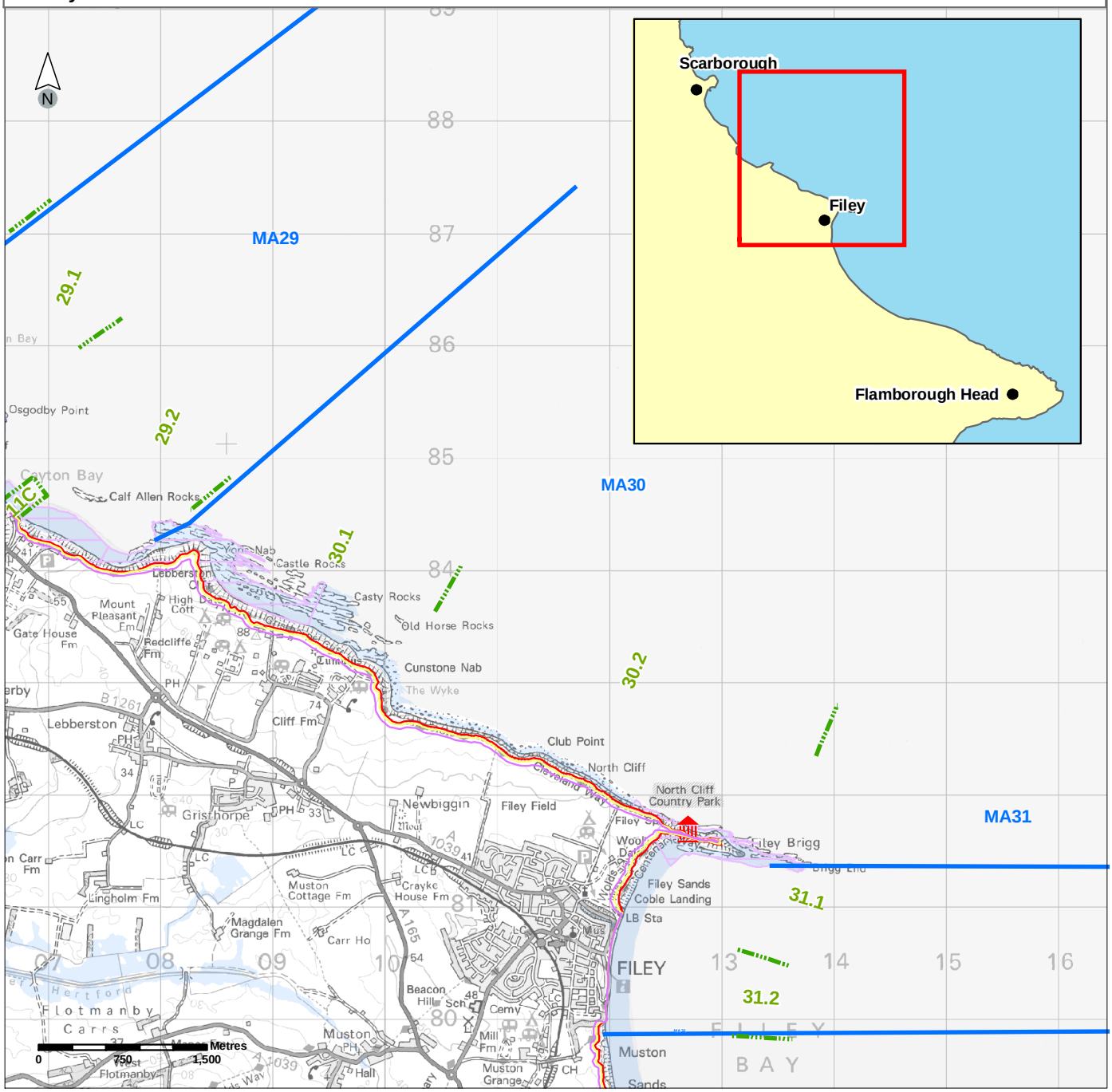
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	0	0	0	0
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	0	0	0	0
	Costs of Implementing plan £k PV	0	0	0	0
Description of damage and benefits under preferred plan: • Loss to caravan park in the medium term					
Heritage	Potential archaeological area. Potential loss				
Amenity	Maintains amenity use of area but with need to set back line of path.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA30
Policy Units 30.1-30.2



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
No active intervention within the area.	No active intervention within the area.	No active intervention within the area.

Key:
Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years
Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05
SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA30

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	None	N/A	None proposed
National	Filey Brigg SSSI (Geological and ornithological) Cayton, Cornelian and South Bays SSSI (Geological, flora, invertebrate fauna, birdlife)	30.1 and 30.2 maintain current coastal processes necessary to provide favourable condition of the SSSIs	None proposed
Local	Cayton and Cornelian Bay and Coastal Land east of Filey Road	As above	None proposed

ACTION PLAN MANAGEMENT AREA 30

Action	By when	Responsibility	Cost £k
Schemes: No schemes			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

4.12 PDZ 12 Filey Brigg to Flamborough Head

4.12.1 Policy Development Analysis

DESCRIPTION

Physical

The zone covers a length of some 21km from Filey Brigg through to the southern limit of the SMP at Flamborough Head. While in detail the coast may be subdivided into many different sections with different local characteristics, in terms of its broader physical description it may be seen as principally two fundamentally different sections: the classical spiral shaped bay; controlled by the promontory of Filey Brigg and held by the massive chalk cliffs south of Speeton; cut back in the soft till cliffs between, and the rugged chalk cliffs themselves running through to Flamborough.

Filey Brigg, an outcrop of hard Jurassic rock overlain by tills, extends nearly 800m almost due east and creates the abrupt change in coastal orientation at Filey Spa. To the northern side the coast runs almost west to east and is exposed to the dominant north easterly wave climate; south of the Brigg the coast is running north south over the northern section of Filey Bay. Over the initial 600m south of the Brigg is largely undefended steep glacial till cliffs, with a plateau above comprising generally open recreational land, cut in the centre by one of the steep narrow valleys typical of this section of coast line and the coast to the south. At the toe of this valley is a slipway and access point to the beach from the recreational land above. This short section of coast ends where Church ravine cuts to the coast, with the main settlement of Filey Town to the southern side of the ravine.

At the coast is the historically important Coble Landing, with its boat parking and launching areas and its general tourism facilities. The defence of this area is set some 50m in front of the natural coastal slope and comprises a major seawall. The sea wall, open promenade and lower platform to the town of Filey runs a further 1km. south, maintaining this width of 50m to 100m between the defence line and the main coastal slope to the back. To the rear of the platform, at the toe of the main slope, is a near continuous row of large seafront properties, with smaller clusters of properties and facilities associated with the typical holiday use of the frontage located along the promenade. Far from being a straight line of defence, the main section of seawall curves with the general curve of the bay and has small promontories creating very local bays, particularly at the southern end. While the beach; all the way from the Brigg, along the promenade and on some 5km to the south, comprises a consistently flat sandy foreshore of some 200m to 250m width, in the vicinity of the promenade there is significant variation in levels at the toe to the wall suggesting quite significant local interactions with the differing alignment of the defence. Immediately south of the promenade the coast cuts back some 35m to steeply sloped cliffs, with a smattering of rock revetment placed to stop outflanking of the return wall to the promenade.

The steep till cliffs continue for a further 1.5 km south of Filey, with a generally steep scarped toe, indicative of general slow erosion, and simple slumping, or landside to the cliff face. Within the section, and just south of the Primrose Valley ravine, there is a small collection of holiday chalets close to the crest of the slope. This is the start of a larger development of private housing and the major holiday and caravan park extending over 1km inland and continuing some 1km to the south along the coast. While the simple landslip cliffs extend 500m to the south of Primrose Valley, the character of the cliffs then change in front of Flat Cliff. Here there has been more major complex failure of the coast creating a series of narrow terraces from the high cliff behind through to a much lower, but still eroding slope to the beach. The initial 500m of this area has been developed since the 1900's as an estate of some 40 properties. There is in addition a sewage pump station providing service to both the community of Flat Cliff and the holiday park to the rear. The properties generally lie within, or more correctly upon this area of former major coastal cliff failure but the access road to the properties and the pump station lies with the transition between this and the more simple land slip section of coast to the north.

The southern limit of the terraced failure zone is defined by the Flat Cliff Gill. Beyond here the cliff form reverts to steeper simple slumping cliffs, in front of the village of Hunmanby Gap; which is set back to the landward side of the Reighton Gill valley, some 100m behind the crest of the coastal cliff, and then through to the Holiday Village of Reighton Sands. As at Flat Cliff much of the coastline in front of the Holiday Village comprises complex landslips forming a width of some 150m between the shoreline and the crest of the cliff. Immediately past this area, however, and still in front of the Holiday village is an area of large simple slips extending right up to the high cliff crest. Beyond this area is a section where slippage extends back over 250m from the shore to the rising hinterland at the transition between till and the emerging chalk cliffs.

The second main section of the coast comprises these high vertical chalk cliffs continuing through to Flamborough Head. Characteristically, there is a deposit of chalk boulders to the toe of the cliff with little foreshore width. In places there is virtually no foreshore width with deep water at the base of the cliff. Only within the bay at North Landing and the small bay immediately to the north of North Landing and Finally in the small bay to the north of Flamborough Head is there any evidence of a beach. At North Landing there is a short length of defence associated with the slipway and lifeboat house. Along virtually all this length there are only isolated properties anywhere near the cliff and only at North Landing and at Flamborough Head do these fall within an area potentially affected by erosion.

Environment

The full extent of the rock cliffs down to Flamborough Head is designated as a SAC. Extending further north is designated SSSI covering the large slippage area of cliffs to the south of the till backed bay at Reighton Sands. Filey Brigg is also designated an SSSI. While the main till backed bay has no international designations, all the undeveloped length, together with most of the wooded valleys are Local Sites of Importance for Nature Conservation (SNICs). The whole area to the south also falls within the Heritage Coast and while the Cleveland Way coastal path ends just north of Filey Brigg, there are footpaths along sections of the coast further south. The Flamborough Head Coastal Path also runs along the crest of the chalk cliff line.

The Filey frontage is part of a conservation area and there are many culturally important buildings to the town and to the seafront, not least of which is the feature of Coble Landing, which is a recognised important tourism feature. To the north of Coble Landing is an important access point to the beach associated with the slipway for the Filey Yatch Club. Over the main bay there are limited heritage sites but Flamborough Head is well populated with important sites including the Scheduled Ancient Monument of Danes Dyke running from the north to south coasts of the headland.

The main settlements are Filey, Flat Cliff, Hunmanby Gap and Reighton Gap. Associated with the areas of Flat Cliff and Reighton are also large holiday centres, including the extensive area of the Amtree Park development. These together with the high tourism value of Filey and the wide open sand bathing beaches around the whole bay make this one of the key visitor areas of the region, with close and important links to the National Park and the Scarborough Town centre to the north. These holiday parks are important to the regional economy.

There is, therefore, a close interaction between the evident landscape value, the internationally and locally important natural heritage, the traditional visitor attraction and cultural centre of Filey, and the economically important holiday resource and beach use of the area. Coupled to this is the significance of individual settlements as residential areas, with the infrastructure supporting these. In terms of the character of the area there needs to be a careful balance in all of these values, and that loss in this balance would result in loss throughout this overall system.

KEY PRINCIPLES

- To contribute to sustainable development and support an integrated approach to land use planning.
- To avoid damage to and enhance the natural heritage.
- To support the cultural heritage.
- To minimise reliance on defence.

KEY OBJECTIVES (a full list of objectives for this zone is presented in Appendix E)

- To maintain the high visual appeal and value of the natural coast.
- To sustain the Town of Filey and local settlements on the frontage.
- To support the cultural heritage.
- To maintain the quality of the bathing beaches.
- To maintain the economically important tourism resource.
- Maintain access to and along the coast.

PHYSICAL CHARACTERISTICS

Water levels

MLWS	MHWS	HAT	1:10yr	1:20yr	1:50yr	1:100yr	1:200yr
-2.30	2.50	3.10	3.57	3.72	3.81	3.95	4.04

Determined at Filey Bay. Levels are to Ordnance Datum Newlyn. Chart Datum is approximately 3.0m below Ordnance Datum. Source (tidal levels): Admiralty Tide Tables (2005) for main and secondary ports, with other values interpolated between. Source (extreme water levels): Filey Bay Coastal Defence Strategy, October 2002 (Halcrow)

Wave climate

Return Period (1:X years)	Wave Height Hs (m)*
1	5.1
10	7.2
50	8.1
100	8.1
200	8.1

*Determined at Filey Town (North). Source: Filey Bay Coastal Defence Strategy, October 2002 (Halcrow)

Baseline Erosion Rates

Filey Brigg	0.25m per year
North Cliffs	0.5m per year
Filey	0.25m per year
Muston Sands	0.25m per year
Hunmanby Sands	Cliff instability resulting in various widths of crest retreat
Speeton Sands	1.5m per year
Flamborough Head cliffs	0.1m per year

All the above rates are based on existing evidence and are likely to increase with sea level rise. A factor of 2.5 has been used to allow for this over 100 years. Where defences exist it is generally assumed that if they fail erosion rates would initially be greater, subject to other control features in the area.

Evolutionary Trend

Existing Processes:

The process and development over the northern half of the zone is controlled both in plan shape and locally in the profile of the coastal cliffs by geomorphological features and factors. In terms of overall plan shape, the classic spiral curve of the bay is dominated by the shelter provided by Filey Brigg and by the southern massive control feature of the chalk cliffs. Modelling of sediment movement has indicated that there is a net drift from the north to south over most of the bay and, just north of the hard rock cliffs, slightly from south to north. Basically, in terms of net orientation, the shape of the bay is principally in line with the net wave energy; the curve of the bay being shaped as waves from the northerly sectors are diffracted in the lee of Filey Brigg.

However, because of the wide range of wave approach directions (from north through to the southeast, although dominantly from the northeast sector) the beach and movement along the beach is highly variable; given any specific offshore wave direction. This is seen in the sudden reductions in beach levels, often down to the basal clays of the foreshore. It has also been identified that high energy, low frequency storms can rapidly remove beach sediments exposing the toe of defences and the natural soft clay cliffs to erosion. The modelling does suggest that much of the sediment movement tends to occur over the mid and lower foreshore areas. Quite probably, sediment movement at the crest of the beach primarily activated during more significant storms.

In profile the cliffs tend to be destabilised by erosion at their toe or increased water permeating from the land above. As such the cliffs may remain relatively stable for long periods of time, with sudden

and, in some locations, quite major movement. This is seen at the southern end at Speeton but is also evidenced by the level terraces on the cliff face such as at Flat Cliff. Not only is much of the failure of the cliff line, therefore, episodic (relatively large sections of cliff failing suddenly after periods of stability) but the erosion at the toe of the cliff can be equally sporadic. There may be periods when the storm climate is relatively low with little overall erosion. Sudden changes in the level of wave activity, particularly over surge events can then result in short periods of quite rapid erosion.

During consultation the erosion rates at Flat Cliff were queried because over the last several years local observation had suggested very little change. This is quite reasonable. However, over a longer period of time the cliff line has quite clearly eroded (otherwise the area would be stood well proud of the general line of the bay). An apparent lack of change must therefore be viewed as a temporary respite, with an appropriate storm condition, or series of storms in effect making up for lost time.

Sediment supply to the bay is very low. There is an indicated loss from the southern end of the bay moving south and beyond Flamborough Head. There is also some suggestion that there may be a supply returning along the nearshore zone from south of the headland, but the main continuing source of sediment to the area is from continued erosion of the cliffs. It has been suggested that the balance of sediments within the bay is finely balanced. Any significant loss of supply could result in significant impact on beach levels.

In general terms, sediments moved from the north, north of Filey Brigg, will tend to be driven by wave action and tidal flows into an offshore stream bypassing the bay. The bay and the nearshore area of the bay tends, therefore, to act as an effectively closed system. There are records of movement of material from the shore in to the nearshore area. Under other conditions these sediments are brought back on shore. There would then be a division between the offshore system, where offshore activity is independent from the system within the bay, and an area of the nearshore where there are critical sediment deposits which act in a very interactive way with the shore.

At the actual cliff line, processes of cliff response are critically dependent on the nature of the cliff, its composition, its level and the drainage. To the north and immediately south of Filey, the cliff failure mechanism tends to be that of simple surface slides. Erosion of the toe and the rate of retreat of the crest of the cliff are closely interlinked. In many areas, particularly just north of Flat Cliff, the cliff is over steepened and major slippage is anticipated in the near future. In the area of Flat Cliff itself, there has been, in the past, a more complex system of slides, creating the terraced effect in the cliff profile. Erosion at the front face, while tending to be seen as merely initiating slides on the front face, is likely to allow progressive slipping over the whole area. In this area it has been indicated that further erosion, potentially in the order of 5m would set off failure slides extending back to the rear, higher cliff line. Based on typical erosion rates this occurrence could be within a 10 to 20 year period, but because of the episodic erosion of the toe could be sooner.

Further south the cliffs would appear to act in a manner similar to the north, but because of their position along the bay and, therefore, greater susceptibility of wave attack, these cliffs tend to be more generally active. Further south still at Reighton Gap, there is the possibility of more major failures of the whole cliff profile.

Along the whole cliff line, drainage and water tables are critical, so that periods of heavy rain may destabilise slopes earlier than might be anticipated from mere erosion rates. The development of the land to the crest of the cliff is important in this, in that large runoff from areas of hard development or drainage of land may be critical in terms of cliff stability.

In all this, change in sea level, change in wave climate and change in rainfall could substantially impact on the development and underlying relative stability of the bay and in development of cliff profiles. Certainly, sea level rise will tend to allow increased wave action to the toe of the cliffs and the bay will attempt to readjust by deepening (eroding back). Change in frequency of storms will similarly tend to cause more occasions when the cliff line is cut back.

Over the Flamborough Headland and cliffs, erosion will continue slowly. The cliff produces little beach building sediment and with the exception of the few bays, material will not be retained at the shore.

Unconstrained:
Despite the underlying near stable plan shape of the bay, there is an ongoing adjustment which means that erosion of the cliffs will continue. At no point has the past cliff retreat been sufficient that a stable upper beach has been able to develop. Therefore, in this unconstrained situation, as is the current case for most of the bay, there will be continued erosion. The forward position of Coble Landing does at present tend to retain some material to the north. Without defence in this area there

would be both a rapid erosion of the promenade area, with the reactivation of the coastal slope behind and a tendency for increased loss of sediment from the area to the north. While this would contribute to the overall volume of material free within the overall bay system, this would not substantially change the general process of erosion over the whole frontage. The hard rock cliffs to the south will continue to erode as they are already unconstrained.

MANAGEMENT

Present Policy

SMP1	Policy
The SMP1 divided the coast into 13 management units. The policies are:	
MU28A, MU30B, MU31A, B, C and D	Do Nothing
MU27, MU29A, B and C, MU30A, MU31D	Retreat
MU28B	Hold the Line
Filey Bay Coastal Defence Strategy	
The strategy has undertaken an examination of potential cliff failure scenarios identifying areas at risk. Based on a strategic benefit cost analysis the study concludes the benefit of maintaining defence to Filey but in all other areas to undertake no active intervention.	

Baseline scenarios for the zone.

No Active Intervention (Scenario 1):

The most significant development under this scenario would be the failure of the Filey seawall over the next 40 to 50 years. Failure is likely to arise from out flanking far earlier; potentially over the next 10 years, with subsequent general deterioration and potential undermining in the longer term. This would result in quite rapid erosion of the promenade and properties directly associated with the lower platform but in the longer term is likely to result in destabilisation of the coastal slope with possible loss, in total, of some 250 properties, in addition to the loss of the key sea front area of the town, facilities associated with the fishing fleet, tourism and amenity for the area.

Prior to this there would be losses elsewhere on the frontage. The short section of defence to the sailing club, to the north of the town, is already in poor condition. This defence does not extend over the full extent occupied by the club and erosion of the cliff toe will result in loss of this facility in any event. The general erosion of this cliff line will affect the site of the Roman Signal station at the root of Filey Brigg and car parking, open recreational land and the miniature golf course to the top of the cliff. As the walls in front of Filey fail, erosion of the toe to this northerly section of cliff is likely to become worse, as sediments partially retained by the forward position of Coble Landing erode.

To the south of Filey, there will be continued erosion to the open cliff. The defences immediately south of Filey only providing a limited degree of protection in the short term. This will affect the south Golf Course, further reducing amenity to the area. Of more significance would be the losses along the Hunmanby Sands. There would be loss of the front line properties at the Fold, just south of Primrose Valley, over the next 20 to 50 years, and further loss to chalets further back during the 100 years of the SMP. The main village at Primrose Valley, to the rear, is unlikely to be affected.

The access to the Flat Cliffs is at risk within the next few years. The slope has a very low factor of safety and any change in water levels could result in immediate failure. In the short term further erosion of the cliff toe will bring about failure of the slope. The factor of safety over the main area of Flat Cliffs is slightly better but the potential erosion of the toe brought about by a single major storm could reduce this to a critical level. Even based on average erosion rates, the whole area could be subject to failure over the next 10 to 20 years. Over the 100 year period of the SMP it is likely that more major failures could arise affecting considerable areas above the higher cliff, taking out a major section of the caravan park's support infrastructure. Services to both the residential community and to the holiday

park will also be affected and with the loss of the pump station within the Flat Cliffs area these will be affected sooner than much of the area provided with these services.

At Hunmanby Gap there would be an anticipated loss of 3 properties to the fore of the village with potential further loss to the northern end of the main village over the 100 years. At Reighton Gap the front row of properties, together with the holiday properties at the Larches are likely to be lost within 20 to 50 years. A far larger number of properties and somewhere in the order of two thirds of the Holiday Park will be lost over the 100 year period. Further south at Speeton there would be no anticipated loss of property, although clearly erosion and recession rates in this complex cliff area would need to be monitored and this assessment reviewed over time.

Along the chalk cliff frontage there would be no anticipated loss of property except in the area of North Landing, and possibly at Flamborough Head itself. In the first of these two areas there could be the loss over the long term to the Lifeboat House and almost certainly to the slipway and access to the cove. This would have a significant impact on the area in that North Landing is the sole access point to the sea on this northerly section of the coast and as such would fundamentally alter the character of the area. At Flamborough, the threat is to the Light House, and again this is would alter the character of the area as a whole.

In general, therefore, this scenario results in major change, having significant impact on the integral character of the area, principally within Filey Bay but also to the area of Flamborough Head. The use of the bay, its amenity value as a tourism holiday area, would be lost. Access to the beaches would be severely disrupted and the holiday parks would have to adjust both to this and to adapting to loss of land and loss of facilities. Nominally, since natural processes would be allowed to function unhindered, it might be argued that there would be benefit to the natural environment. However, in reality there would be little enhancement in terms of biodiversity, with basically the same extent of eroding cliff.

Visually the impressive sweep of the bay and the natural development of the chalk cliffs would be maintained. However, there would be loss in terms of the conservation area of the Filey coastal slope and promenade and to a degree due to the likely reduction in the number of people using the area, and certainly the number of people residing on the coast, the actual enjoyment value of the landscape would be reduced.

MDSF Evaluation		*PValue Damages*
Erosion	154 properties potentially lost	£3,455,000
Flooding	No flooding identified	
Other information	The strategy indicates far more significant damages amounting to £6.8M, due to subsequent cliff instability,	
Assessment of key objectives	• Maintains the high visual appeal but reduces landscape value of the natural coast. • Avoids damage to the natural heritage. • Fails to sustain the Town of Filey and local settlements on the frontage. • Fails to support the cultural heritage. • Fails to maintain the quality of the bathing beaches with regard to safe access and facilities. • Minimises reliance on defence.	

With Present Management (Scenario 2):

The policy developed from the strategy over Filey Bay, which only considers the next 50 years, is to hold the line at Filey but in all other areas to adopt a policy of no active intervention. At Filey, initial works to reduce the threat of outflanking are proposed with the longer term intent to maintain the sea wall. This approach has been demonstrated to have

a good economic basis and the need for thought as to how the management of the ends of the defence in creating a suitable transition between this area and the natural development of the coast to either side is recognised. The strategy's outline proposal for future works to maintain the wall is for a rock revetment. While this may reduce the general rate of erosion to the beach, which could occur in front of the wall, there is still likely to be some continuing loss in sand as the frontage becomes more advanced of the natural coastline.

To the north of Filey, the strategy identifies that the sailing club will be lost and therefore argues that maintenance of the defence of the launching access area is unsustainable. This would impact on access to the beach.

For the rest of the till backed frontage the policy is for no active intervention in terms of defences. However, the strategy recognises the real and quite immediate threat to the areas of Flat Cliffs, particularly the access slope, and Hunmanby Gap, and recommends that Rapid Response Monitoring is put in place to allow evacuation of residential areas. As recognised by the strategy, monitoring does not, of itself, provide any protection but rather is mitigation in reducing risk to life and possessions under a no active intervention policy.

As such, the existing policy scenario for the area is the same as the no active intervention policy set out in Scenario 1, with the exception of the Filey frontage. This will, however, result in a slightly different situation for the area north of Filey.

Holding the existing line at Coble Landing and undertaking works to create a transition between this and the coast to the north can allow better retention of sediment over the northern frontage, potentially to the point where the erosion rates to the cliff immediately to the north may be reduced, thereby better sustaining assets such as the miniature golf course at the crest of the cliff. It is unlikely to significantly affect the shore sufficiently far to create a more sustainable situation at the sailing club.

Management of this area will have only minor impact on provision of sediment to the frontage as a whole and is unlikely to impact significantly on the general movement of sediment, which the strategy indicates works largely over the lower section of the beach.

The present policy for the Flamborough Head area is to allow natural development of the coast but to take action as appropriate in maintaining the function of North Landing.

MDSF Evaluation		*PValue Damages*
Erosion	96 properties potentially lost	£1,928,000
Flooding	No flooding damages identified	
Other information	Strategy indicates damages of £1.7M.	
Assessment of Key objectives	• Maintains the high visual appeal and value of the natural coast. • Avoids damage to the natural heritage. • Sustains the Town of Filey. • Fails to sustain local settlements on the frontage. • Supports to a degree the cultural heritage. • Generally maintains the quality of the bathing beaches but there will be sand loss to Filey and loss of access elsewhere. • Generally minimises reliance on defence.	

DISCUSSION AND DETAILED POLICY DEVELOPMENT

In both scenarios the recommended policy for the Flamborough Head section of the zone is for no active intervention. There is generally no requirement for intervention and the extremely high natural value of the frontage is recognised in the environmental designations which apply. The more local defence issues with respect to Flamborough Light House and North Landing should be considered within this context. At North Landing there are no significant sustainability issues in relation to maintaining the basic function within the cove and it is not anticipated, given the overall setting and the importance in terms of the cultural value, that works to sustain existing use of the area would be in conflict with the broader internationally important designations of the area. Detailed study would be needed to determine to what degree works in this area could be justified as required under the Coast Protection Act, but even if this were not the case, and subject of course to proper environmental assessment, there would be no grounds, in terms of impact on coastal processes, not to undertake works to maintain structures in this area. The environmental impact would need to be considered in relation to the scope of work and impacts appropriately mitigated. In a similar manner the issue of the Flamborough Head Light House would need to be considered in more local detail. In fact the real threat to this structure needs to be better defined through monitoring. On this basis, it is felt that local policy in these areas should be to hold the line, but that these very local policy areas are within a broader policy of no active intervention for the whole length between Speeton Cliffs and the southern limit of the SMP area.

The strategy upon which scenario 2 is based recommends holding the line along the Filey town frontage. While this has impacts on the coast to the north and will require future works to maintain the defence line, the economic, cultural and amenity damage which would otherwise arise, is considered unacceptable in terms of the objectives for the area. The whole length of the bay is in relative terms, near equilibrium. The coast to either side will continue to erode but, despite this frontage becoming further in advance of the natural line of the shore, its maintenance is not considered fundamentally unsustainable. Whilst the immediate issues would appear to be the outflanking of the town defences at either end, any solution to this problem should consider how this integrates with a longer term management approach looking at the whole frontage. Structures could potentially be designed, for example, that could achieve a solution to both the issue of outflanking and the general low beach levels along the frontage. While recognising that the strategy has only attempted to provide a nominal approach to the future defence of the length, in terms of considering the economic case for maintaining the structure, alternatives beyond that of purely constructing a rock revetment to the face of the wall have to be considered further at the time of considering detailed response in terms of dealing with the threat of outflanking.

The issues relating to the areas of Flat Cliff and to a lesser degree Hunmanby Gap and Reighton Gap are recognised to be very difficult, both in terms of the residential communities and in terms of the broader value to the region of the large holiday parks. In the longer term, over the 100 year period, and beyond, hard linear defence of these areas, which is what would be required to stabilise the cliff and prevent any property loss, would be considered unsustainable. This area is significantly further outwith the direct influence of Filey Brigg than is the Filey Town frontage and as such, to hold this position over time would require increasingly more effort, with increasingly greater influence on the whole development of the bay. In effect, heavy protection of Primrose Valley and Flat Cliffs would have the effect of creating a totally separate bay system, virtually independent of that created by the influence of Filey Brigg. Protection in this area may, over the longer term actually increase rates of erosion at Hunmanby Gap as the coast adjusts to a new line of equilibrium. Therefore,

despite the significant economic loss at Flat Cliff and the impact on the Holiday Village, the long term policy for the area should be one of no active intervention. To achieve this, but still allow adaptation in respect of both residents and the more general land use of the area, requires prompt realistic thought and discussion as to how the threat to people, property, infrastructure and business is to be managed; over the next few years in terms of access to the properties of Flat Cliff, over the next 5 to 20 twenty years with respect to the actual loss to properties and the management of safe access between the cliff top and the beach and over the longer term as to the impact and future operation of the holiday park.

The strategy has determined over a 50 year time span only a very marginal benefit cost ratio for long term defence of the Flat Cliff area and, certainly, the approach of a substantial rock revetment would tend to drive management of the frontage along a longer term policy of defence and unsustainability. Other options for a more temporary approach to defence were also considered by the strategy. While over the short term it was not considered that minor works would have any significant impact on the natural environment, a view accepted by the SMP2, such works where found to have virtually no economic benefit and would not be justified in terms of public funding. A continuing concern with such an option would also be the recognised difficulty of gaining strict acceptance to the concept that such work would provide only temporary additional protection. Extension of protection over the medium term and long term would then have an increasing impact on the management of the bay. The strategy made recommendations for rapid response monitoring covering the area of the access to Flat Cliffs.

While associated with the monitoring is a recommendation that the council develop an evacuation contingency plan, a more broadly based management approach is felt to be more appropriate. It is recommended that this be considered by the community of Flat Cliff.

The actual implications of abandoning property within the relatively short period of time allowed for by the monitoring needs to be established in more detail with residents. The need to maintain an important access to the beach associated with the holiday use of the area and the longer term needs of the holiday park also needs to be considered from a planning perspective. Furthermore discussion is needed with respect to the continued access to and operation of the pump station and pipe line. The loss of this infrastructure clearly has potential implications over the extent of Filey Bay and these issues have to be addressed under the preferred policy for the frontage.

The current approach of monitoring is felt to provide, potentially, only limited warning time and those affected by failure of the coastal slope need, therefore, to realise that this is likely to provide merely an immediate warning of failure of the over-steepened access length.

The short term policy from the SMP is for no active intervention, confirming the policy of the previous SMP policy and that concluded from the strategy.

The medium term and the long term policy is similarly for no active intervention. The issue of social justice has been raised during the development of the SMP. A discussion of this is provided in section 3.2.4.

Similar future problems potentially exist further south along the shore at Hunmanby Gap and Reighton Sands. The same basic argument applies. The SMP, therefore, recommends no active intervention in these areas. As such plans should be developed on the realistic probability that properties will be lost in these areas over the period of the SMP. The SMP

recommends monitoring of the bay as a whole and these areas in particular so as to assist people in planning for the the eventual loss of property.

At a local scale, the issue of the access point at the base of the cliffs to the north of Cobles Landing has been raised during consulation on the Draft SMP. This highlighted the importance of the access point in general and the continued use specifically for the Filey Yatch Club, of the slipway. While the policy for this frontage is for no active intervention, local work to support this access point would not have a significant detrimental impact on the adjacent coastline or coastal processes. Such local action would not therefore be counter to the policy, acting to maintain a valuable amenity. As the adjacent cliffs erode, further consideration will need to be given as to how the access is managed without starting to influence the longer term development of this section of the bay.

MANAGEMENT AREAS

Recognising that there are continuing sediment process linkages along the frontage, and that these need to be taken into account in terms of managing the whole bay, it is still felt appropriate to divide the zone into three basic management areas:

- The Filey frontage from Filey Brigg to Muston Sands
- The Hunmanby Sands frontage from Muston Sands down to Speeton
- Flamborough

In the last of these areas the dominant theme is maintaining the natural development of the area. As such small policy units (for North Landing and Flamborough Head itself) are defined within a larger policy unit, providing the context for management within the local areas.

Policy statements or summaries are presented by management areas in the following sheets.

4.12.2 MANAGEMENT AREA POLICY STATEMENTS (MA31-MA33)

Location reference:	Filey Brigg to Muston Sands
Management Area reference:	MA31
Policy Development Zone:	12

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the zone is to allow the coast to develop as naturally as possible without prejudice to essential aspects of Filey Town. This would include maintaining the regionally important interests of Filey but with a policy of no active intervention to the north and immediate south. Clearly, while these policy apply in intent the boundaries between units would depend on the detailed defence approach taken in defence of Filey. To the north of Filey the natural erosion of the coast would be allowed to continue, although minor local works to support the access point would not significantly impact on the overall intent of no active intervention.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Hold the line at Filey investigating options for addressing the issue of outflanking in a manner to provide maximum opportunity to maintaining a level of beach in front of the wall. No active intervention elsewhere.
Medium term	Develop a defence approach at Filey to maintain as far as possible beach levels. No active intervention elsewhere.
Long-term	Maintain the defence at Filey

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
31.1	North of Filey	NAI	NAI	NAI	Affected by works to stop outflanking of Filey
31.2	Filey	HTL	HTL	HTL	Looking to long term overall management.
31.3	Muston Sands	NAI	NAI	NAI	Affected by works to stop outflanking of Filey
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

No Change from SMP1 policy.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

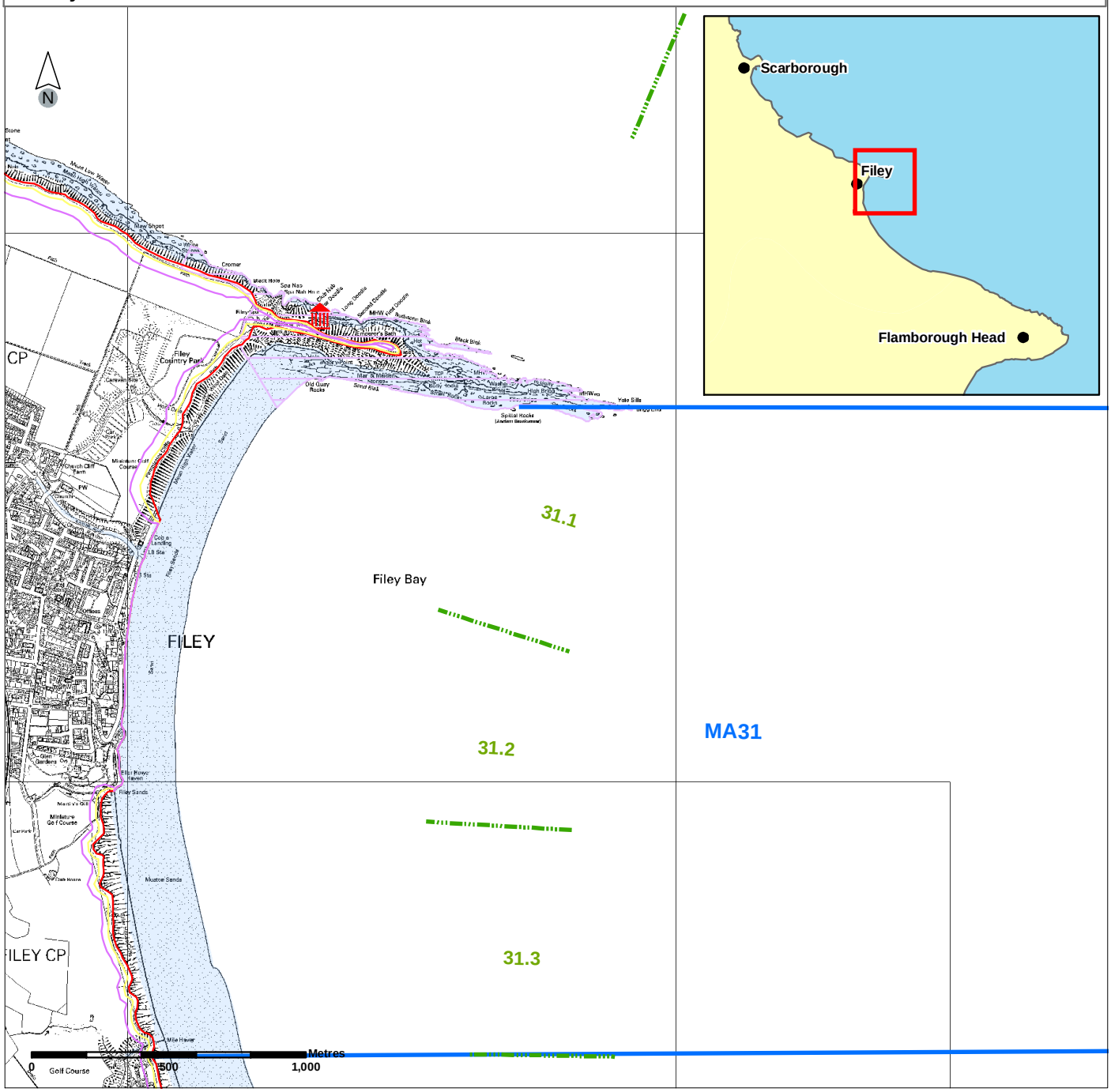
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	239	4,791	83	5,113
	Preferred Plan Damages £k PV	0	0	0	0
	Benefits £k PV	239	4,791	83	5,113
	Costs of Implementing plan £k PV	178	1,086	14	1,278
Costs based on strategy with additional cost in year 40 along main wall. damages based on strategy but extended over 100 years. Description of damage and benefits under preferred plan: • Loss to sailing club to north.					
Heritage	No heritage loss				
Amenity	Potential loss to golf courses to north and south.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA31
Policy Units 31.1-31.2



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Hold the line at Filey investigating options for addressing outflanking in a manner to provide maximum opportunity to maintaining a level of beach in front of the wall. No active intervention elsewhere.	Develop a defence approach at Filey to maintain as far as possible beach levels. No active intervention elsewhere.	Maintain the defence at Filey

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA31

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	none	N/A	None proposed
National	Filey Brigg SSSI (Geological and ornithological)	No active intervention – this policy will allow continued action of coastal processes on the Brigg. The proposed defence works are considered unlikely to affect movement of beach material within the SSSI.	None proposed
Local	none	N/A	None proposed

ACTION PLAN MANAGEMENT AREA 31

Action	By when	Responsibility	Cost £k
Filey - Investigation to examine stability of coastal slopes at Filey taking account of long term management to main wall.	2008	Scarborough BC	50
Filey - Scheme appraisal to develop strategy recommendations for outflanking defence. *High economic value and risk to properties. Important amenity of Filey Bay*	2008	Scarborough BC	40
Schemes: • Outflanking defence at Filey • Filey – Cliff Stabilisation	 2010 2010	 Scarborough BC Scarborough BC	 500 500

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Muston Sands to Speeton
Management Area reference:	MA32
Policy Development Zone:	12

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the zone is to allow the coast to develop as naturally as possible but encouraging the development of plan for adaptation to this policy. The policy from the short term onward over the period of the SMP2 is for no active intervention. It is recogbnised that to achieve this thought needs to be given to address the current expectations and use of the frontage in terms of the important regional issues of the residential communities and tourism.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	Develop a plan for abandonment of areas of settlement at risk in Flat Cliffs, Hunmanby Gap and Reighton Gap.
Medium term	No active intervention
Long-term	No active intervention.

SUMMARY OF SPECIFIC POLICIES

Policy Unit		**Policy Plan**			
		2025.	**2055**	**2105**	**Comment**
32.1	Hunmanby Sands	NAI	NAI	NAI	Consideration of long term management of frontage, access and hinterland.
32.2	Hunmanby Gap	MAI	NAI	NAI	Consideration of long term management of frontage
32.3	Reighton	NAI	NAI	NAI	Consideration of long term management of frontage
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

There is only a notional change from SMP1 from managed retreat to one of no active intervention. This was the longer term intent of the SMP1 and in effect the period between SMP1 and SMP2 has been used to consider the area in more detail through the development of the strategy and allowing, to a degree a period for adaption.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

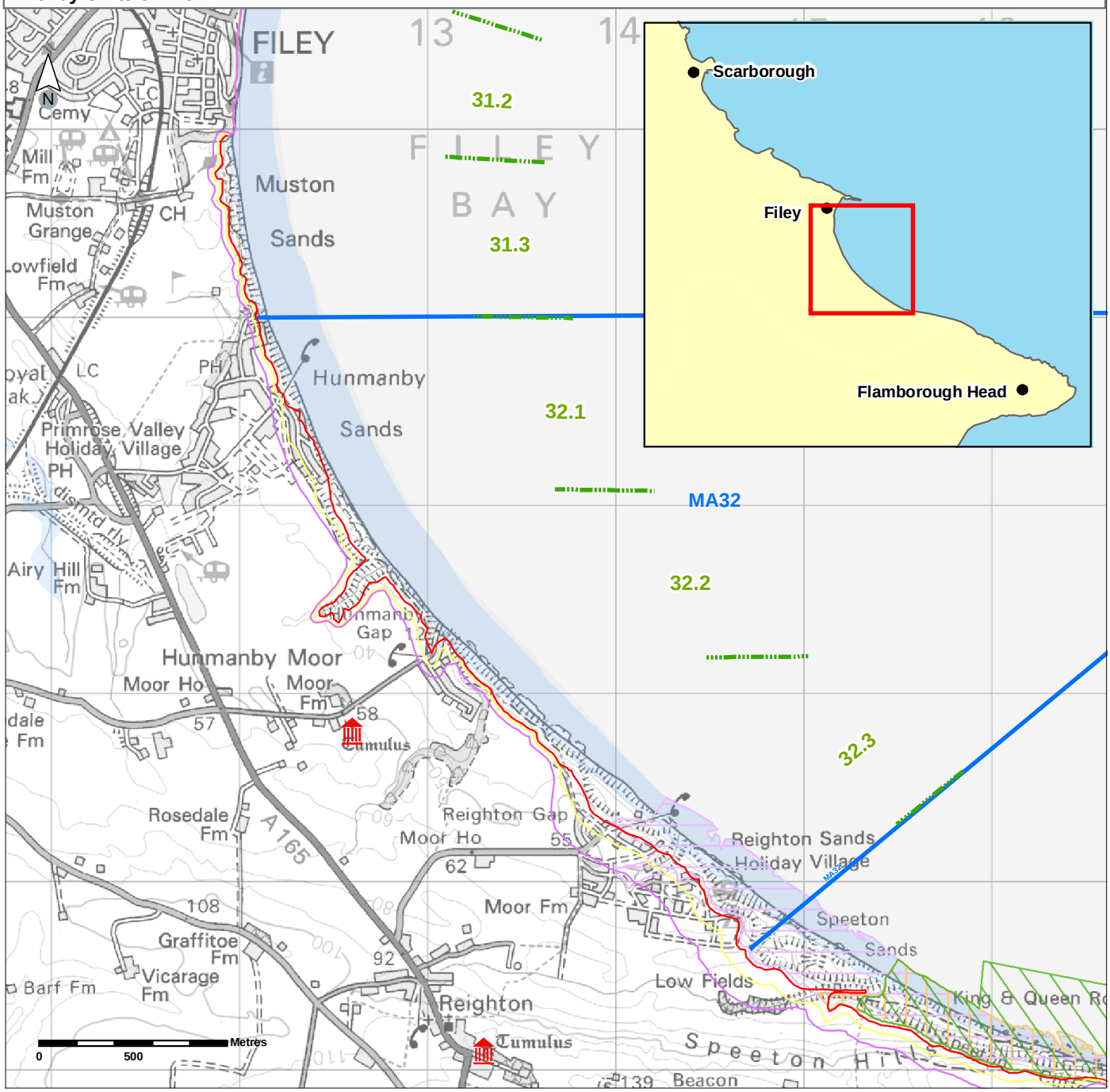
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	294	543	1,091	1,928
	Preferred Plan Damages £k PV	294	543	1,091	1,928
	Benefits £k PV	0	0	0	0
	Costs of Implementing plan £k PV	0	0	0	0
Description of damage and benefits under preferred plan: • Loss of Flat Cliff over the initial 20 years • Losses to Hunmanby Gap and Reighton Gap over the longer term					
Heritage	No specific losses				
Amenity	Potential loss of access to the beach.				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA32
Policy Units 32.1-32.4



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
Develop a plan for abandonment of areas of settlement at risk in Flat Cliffs, Hunmanby Gap and Reighton Gap	No active intervention	No active intervention

Key:

Predicted Shoreline Mapping*
Preferred Plan
20 Years
50 Years
100 Years

Management Areas
Policy Units
NNR
SSSI
EA Flood Zone - Sept 05

SPA
RAMSAR
SAC
Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

MANAGEMENT AREA: MA32

	Description of Designation	Effect of Preferred Plan	Measures to offset effects /impacts Compensation/Mitigation/Alternative Solution
International	Flamborough Head SAC (reefs, vegetated sea cliffs and submerged/ partially submerged sea caves) Flamborough Head and Bempton Cliffs SPA (Breeding Kittiwake and sea bird assemblage)	No actions planned but potential pollution impacts associated with loss of pump station and pipeline.	The production of the Scarborough Borough Local Development Framework should be used as an opportunity to establish a clear policy framework which facilitates the roll back of assets from eroding cliff lines. Alternative options for sewerage required.
National	Flamborough Head SSSI (Geology, coastal geomorphology, cliff top flora and ornithology)	No actions planned but potential pollution impacts associated with loss of pump station and pipeline.	As above
Local	SINC from Hunmanby Sands to Reighton Sands	No actions planned but potential pollution impacts associated with loss of pump station and pipeline. Potential enhancement associated with development fo access.	As above

ACTION PLAN MANAGEMENT AREA 32

Action	By when	Responsibility	Cost £k
Management Plan for Flat Cliffs , to support management for realignment. *Properties at risk. Potential unsustainable development. Access road. Potential contamination. Impacts on biodiversity.*	2007	Residents and private sector *Supported by* Scarborough BC	10
Schemes: None			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

Location reference:	Speeton to Flamborough Head
Management Area reference:	MA33
Policy Development Zone:	12

SUMMARY OF PREFERRED PLAN RECOMMENDATIONS AND JUSTIFICATION

PLAN: The overall management intent for the area is very clearly maintaining an overall policy of no active intervention along the Flamborough Head frontage in support of the overriding natural value of this section of the coast. Within this overall policy, the intent would be to allow works necessary to sustain operation of the North Landing subject to appropriate mitigation of possible impacts on the designated areas. The policy for Flamborough Head, would similarly be for local management based on improved monitoring of erosion rates.

PREFERRED POLICY TO IMPLEMENT PLAN:

From present day:	No active intervention. This would not preclude appropriate action being taken at North Landing and Flamborough Head.
Medium term	As above.
Long-term	As above

SUMMARY OF SPECIFIC POLICIES

Policy Unit		Policy Plan			
		2025.	**2055**	**2105**	**Comment**
33.1	Speeton	NAI	NAI	NAI	Allow natural development of coast.
33.2	Flamborough Head	NAI	NAI	NAI	Over arching policy for the whole area
33.3	North Landing	HTL	HTL	HTL	Within the context of the above policy
33.4	Flamborough	not defined			Reviewed following monitoring.
Key:	HTL - Hold the line,	A - Advance the line,		R - Retreat or Realignment,	NAI – No active intervention

CHANGES FROM PRESENT MANAGEMENT

No substantial change from SMP1 policy.

IMPLICATION WITH RESPECT OF BUILT ENVIRONMENT

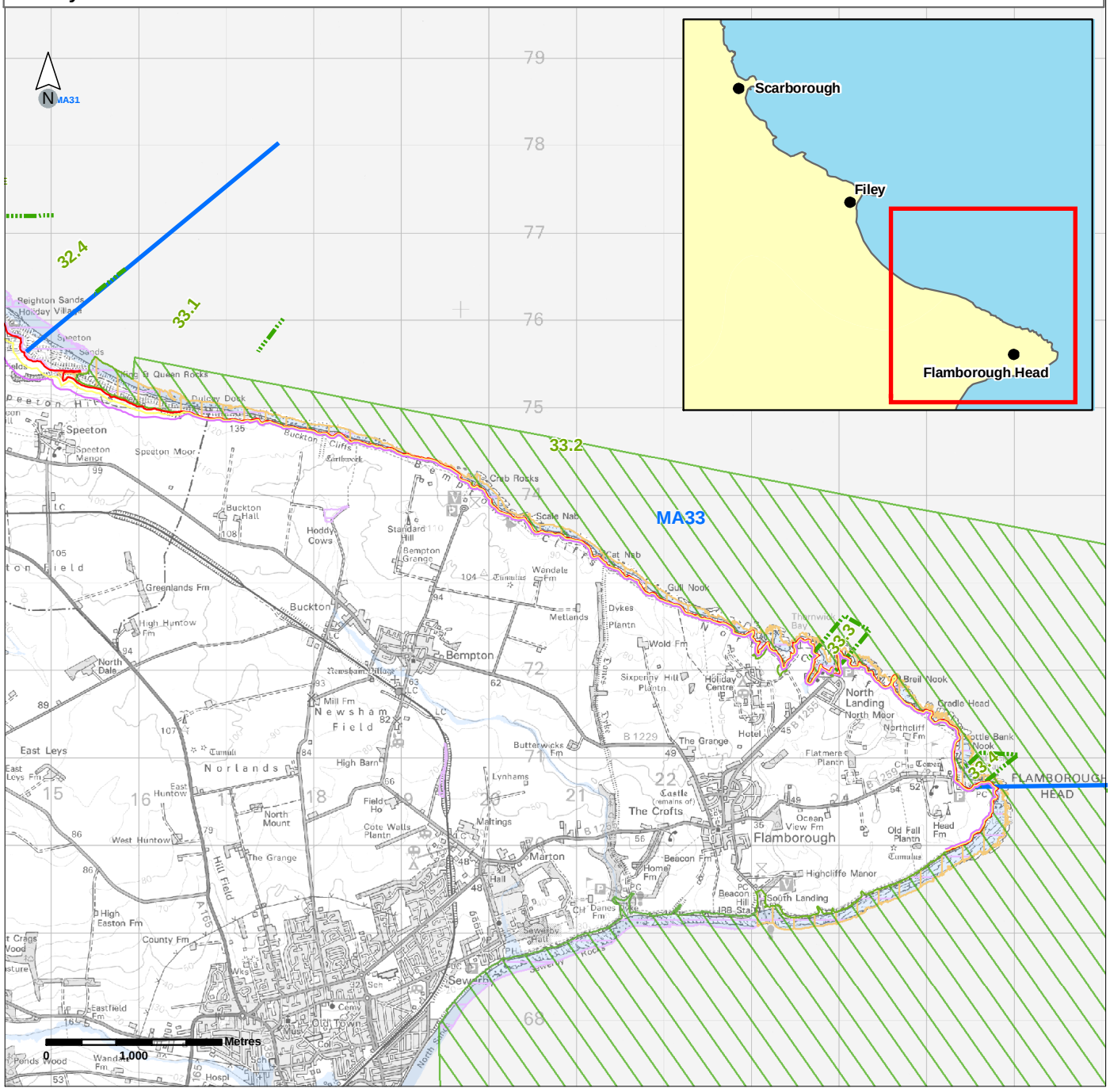
Economics		by 2025	by 2055	by 2105	Total £k PV
Property	Potential NAI Damages/ Cost £k PV	132	90	51	273
	Preferred Plan Damages £k PV	132	90	51	273
	Benefits £k PV	0	0	0	0
	Costs of Implementing plan £k PV	0	0	0	0
damages based on loss of land. Local costs and damages not recorded. Description of damage and benefits under preferred plan: •					
Heritage	No specific heritage loss				
Amenity	Maintains coastal path				

POTENTIAL WATER FRAMEWORK DIRECTIVE ISSUES (see Appendix F for details)

Impact on water quality	No
Impact of geomorphology and hydrodynamics	No

* Note: Predicted shoreline mapping is based on a combination of monitoring data, analysis of historical maps and geomorphological assessment with allowance for sea level rise. Due to inherent uncertainties in predicting future change these predictions are necessarily indicative. For use beyond the purpose of the shoreline management plan reference should be made to the baseline data.

River Tyne to Flamborough Head Shoreline Management Plan
Management Area MA33
Policy Units 33.1-33.4



POLICY (FOR FULL DETAILS SEE RELEVANT POLICY STATEMENT)

From Present Day:	Medium - Term:	Long - Term:
No active intervention. This would not preclude appropriate action being taken at North Landing and Flamborough Head.	No active intervention.This would not preclude appropriate action being taken at North Landing and Flamborough Head.	No active intervention.This would not preclude appropriate action being taken at North Landing and Flamborough Head.

Key:

Predicted Shoreline Mapping*
Preferred Plan
- 20 Years
- 50 Years
- 100 Years

- Management Areas
- Policy Units
- NNR
- SSSI
- EA Flood Zone - Sept 05
- SPA
- RAMSAR
- SAC
- Scheduled Ancient Monuments

ROYAL HASKONING

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ENVIRONMENTAL ASSESSMENT – PREFERRED PLAN

Summary of Alone Appropriate Assessment for Natura 2000 sites (Further details provided in Appendix K)

SPA and SAC Site Feature	Supporting internationally important populations of kittiwake, and an internationally important seabird assemblage, and the following Annex 1 habitats: reefs, submerged or partially submerged sea caves and vegetated sea cliffs	
Sub Feature(s) Supralittoral rock	**Sensitivity** Loss of SPA and SAC habitat	**Conservation Target** Subject to natural change, maintain in favourable condition the habitats for the internationally important populations of regularly occurring migratory bird species, with particular reference to coastal cliffs and caves. Subject to natural change maintain the following habitats in favourable condition; reefs, submerged or partially submerged caves and vegetated sea cliffs.
Potential effect of policy	The policy suite supports the overall natural development of the coastline through a policy of No Active Intervention. Within this overall policy, the intent would be to allow works necessary to sustain the operation of the North Landing (which could result in localised losses to SAC and SPA features). The policy for Flamborough Head, would similarly be for local management based on improved monitoring of erosion rates.	
Preventative Measures At present there are no speciifc plans to undertake works in the area. It is probable that any such works in the future will be little more than local maintenance. Even so, in the planning and assessment of the need for such works, the potential impact on site will need to be fully assessed.	**Mitigation** None	**Implications for the integrity of the site** Natural development of coastline, therefore, no adverse effects are anticipated on the integrity of the European site.

ASSESSMENT OF OTHER DESIGNATIONS

MANAGEMENT AREA: MA33

	Description of Designation	Effect of Preferred Plan	Measures to offset Effects /impacts Compensation/Mitigation/Alternative Solution
National	Flamborough Head SSSI (Geology, coastal geomorphology, cliff top flora and ornithology)	As above	None proposed
Local	None	N/A	None proposed

ACTION PLAN MANAGEMENT AREA 33

Action	By when	Responsibility	Cost £k
No actions			
Schemes: No schemes			

Section 7 provides a summary of actions grouped by operating authority areas. Monitoring is discussed in section 7 and includes both that associated with the specific actions identified above, together with that recommended for overall management of the area.

5 SUMMARY OF PREFERRED PLAN AND IMPLICATIONS

5.1 Plan for Balanced Sustainability

As discussed in Section 3, the SMP is attempting to deliver a balanced plan for the management of defences which will still support the values for each area of coast in terms of its human need, the natural environment and the heritage value, without commitment to ever increasing expenditure on defence.

The objectives against which this is judged are set out in Appendix E and an assessment of how effective the plan has been in achieving this is provided in Appendix G. This assessment is summarised in Figures 5.1 (for the epoch to 2025), 5.2 (for the epoch to 2055) and 5.2 (for the epoch to 2105). Care is needed in considering these figures as the information is presented as percentages and does not fully reveal the actual detail associated with each theme (these being described in the tables in Appendix G). A brief discussion by theme is given in Section 5.2. However, it is useful to consider the overall information and to set this in the context of different sections of the coast as a whole.

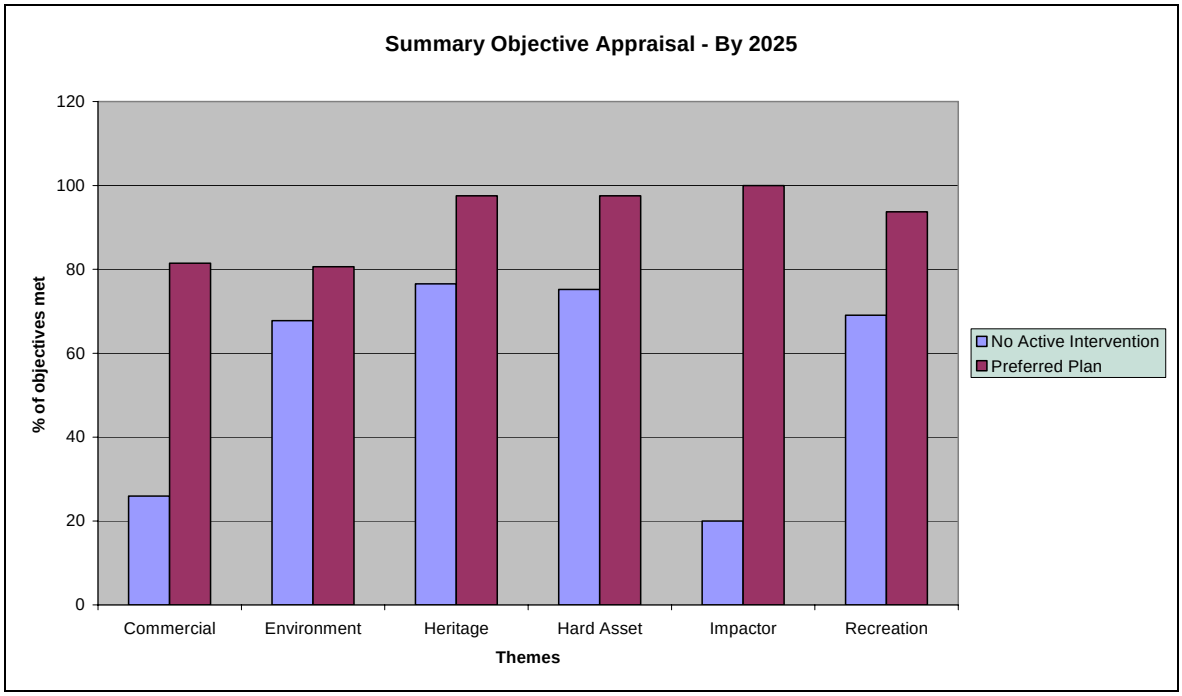

Figure 5.1: Summary Objective Appraisal for epoch to 2025

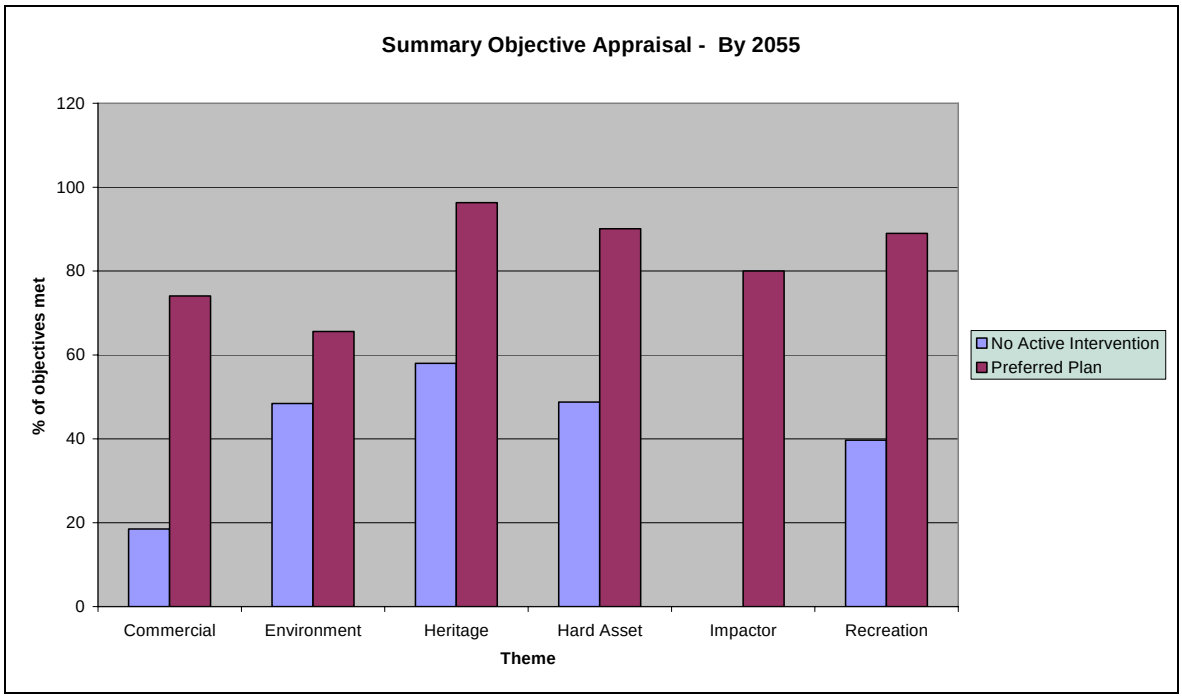

Figure 5.2: Summary Objective Appraisal for epoch to 2055

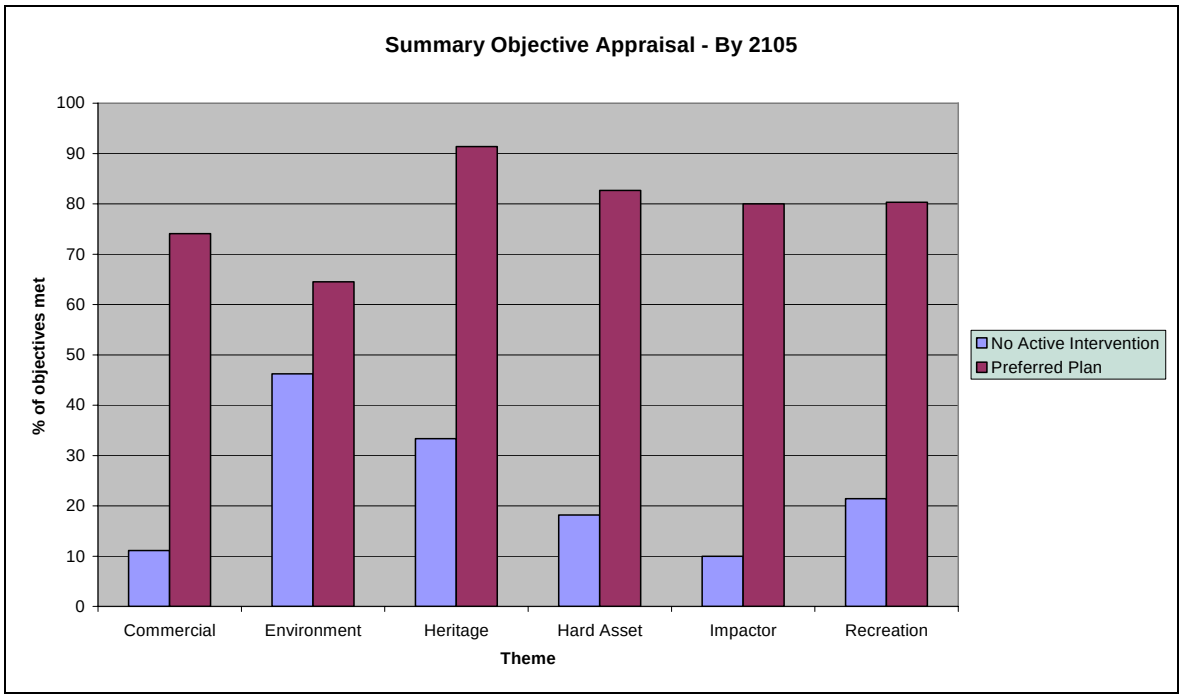

Figure 5.3: Summary Objective Appraisal for epoch to 2105

Considering initially the figures, it may be seen that over the short term, with the specific exceptions of the commercial activities and the 'Impactors' (or risks due to pollution), there is only marginal difference between the preferred plan and that of no active intervention. This reflects the fact that on the whole defences are in reasonable condition and that the coast is functioning relatively well. Over the medium term under no active intervention for all themes there is a general fall off in terms of objectives met. In comparison the preferred plan, while clearly introducing certain changes, maintains a relatively high success in balancing objectives. The same may be seen to apply in the third epoch. Of particular note is the relatively low achievement of environmental objectives overall. This is discussed below. However, it may be seen that this is not specifically as a result of conflict in meeting other objectives.

Considering the Preferred plan by area:

South Tyneside to Sunderland

There is increasing pressure on defences, with the potential threat of the low water moving landward and causing steepening of beaches, increased pressure on defences and loss of amenity. The plan recommends the need to build greater width into the defence systems to take account of this; either, in the case of South Tyneside and areas of Sunderland, by allowing or looking for opportunity to create width for retreat of defences or, in the case of north Sunderland, by attempting to manage the beaches to greater effect. Where feasible, the plan has recommended no further construction of defences, allowing the cliffs to erode naturally, but this requires full involvement with the planning authorities in controlling land use. Only really to the south of Sunderland is a significant change made to policy, where there is both coastal squeeze against the cliffs but also squeeze of the open cliff top land against well established development. Here it is vital that early decisions are made once a better understanding of erosion rates are established, allowing a balanced approach to management which will neither result in major economic loss nor extensive damage to the natural environment.

There is opportunity in all areas for coastal defence policy to be integrated better into the regeneration plans currently being considered. This again relies on coordination between planning authorities and managers of coastal defence.

Seaham to Hartlepool

For much of this coast the policy is self evident, supporting the effort put in to restoring the coast by the Heritage Coastal Management, allowing width for natural development while balancing local use of the area. At Seaham, in many respects the policy is also evident. Despite increasing pressure, the seafront is important to the regeneration of the area and the policy of holding the line is proposed. To the south the policy for hold the line at the Headland at Hartlepool is important in maintaining vital assets, although here there needs to be further discussion with respect to the impacts on the

designated areas. Just north of the Headland, there is an area where the issues move beyond the strict scope of the SMP. There is opportunity to draw upon the natural physical character of the coast to allow both potential environmental enhancement and new development.

Hartlepool to Saltburn

The overall shape of the coast within this area is held by the natural physical features to either end of the frontage and by the breakwaters at the mouth of the Tees. Within this context sustaining the sea front of Hartlepool is appropriate in meeting the aims of the town. However, while it would still be feasible to maintain the sea front at Seaton Carew, there is opportunity as the existing defences deteriorate for some set back of the defence line. This, as in other areas, has to be achieved through overall planned development of the frontage. The important issue is to be thinking in advance so that this opportunity is not lost by inappropriate development.

Because of the control imposed at the mouth of the Tees, by the Gares, the semi-natural dune frontages can be allowed to retreat in a manageable manner. This creates opportunity for habitat development in an area quite unique to this section of the coastline.

At Redcar there are concerns that there will be a loss of beach which will be to the detriment of the town's values. While the present review of the strategy for the area needs to examine this, it is important to learn from the situation that exists there, when considering how to accommodate the new proposed development to the west of the town. To avoid the same inherent problems, the SMP makes recommendations such that without undue constraint on the development, allowance is made now in considering how management of this area provides suitable transition to the natural development of the coast to the west.

There seems little overall pressure at present on the frontage to the east of Redcar, although it will continue to erode. Within this context the defence of Marske and Saltburn would appear sustainable given their local importance.

North Yorkshire

The dominant feature of this area is its superb coastal cliffs. Within this, are the towns and villages of Skinningrove, Staithes, Runswick Bay, Sandsend, Whitby and Robin Hoods Bay. In each of these locations the underlying policy is to maintain the communities. In some areas, in particular at Robin Hoods Bay, but also in the case of individual properties elsewhere along the coast, there may be loss under the preferred policy over the period of the SMP2. In many cases this would not be until towards the end of the SMP2 period; and this being dependent on erosion rates. To take action to defend would be difficult to justify economically and would tend to result in a creeping destruction of the natural environment. Even at Sandsend the SMP2 recommends consideration of alternative routes for the coastal road rather than unnecessarily allowing ever more hard defence of the shoreline. At Whitby the policy remains to hold the line.

Scarborough to Flamborough

Within North Bay, there is the situation that the Victorian builders created both a much valued coastal infrastructure and sea front but at the expense of a defence line that becomes increasingly difficult to maintain. While the policy remains to hold the line, this needs to be managed in such a manner as to maintain the natural beach defences. At South Bay there is evidence at present of an accreting beach, in part because of the shelter and control provided by the Harbour. The policy here is to hold the line. However, particularly in addressing the severe flooding problem of Foreshore Road, care needs to be taken in not disrupting this valuable sediment system.

South from Scarborough the coast returns to effectively its natural shape. This is maintained over much of the area with a policy of no active intervention. Within Filey Bay, the defence of Filey town is to be held, with the typical concerns as to the manner in which this is achieved. This is considered feasible because of the town's position with respect to the shape of the bay and the proximity of Filey Brigg. Further south within the Bay the SMP accepts the need to allow a natural retreat of the cliff line. There is conflict in this with the objectives to sustain communities such as Flat Cliff. The policy here requires an integrated approach with planning associated with both the community and the major holiday park set further back. While over the short term, over possibly the next twenty years, defence of the area is not likely to cause severe disruption of the coastal system, in the medium to long term such actions would be both more difficult to sustain and have an increasing impact on these processes. In addition, despite the expected loss of property, there is poor justification for public funding of defence. As such, the recommended policy is for No Active Intervention. It is recognised that such a policy requires a plan to manage this.

5.2 Predicted Implications of the Preferred Plan

5.2.1 Implications for Property and Land Use

Overall the main centres of development are maintained. There are recommendations within the detail of the plan for not allowing further extension of defences. This will result in loss of hard assets. In particular as identified above this would include properties around Runswick Bay, Robin Hoods Bay, Cayton Bay and to the communities to the south of Filey Bay.

Generally the transport system would be maintained although the plan recommends examination of re-alignment to the roads at Marsden, at Sandsend and to the back of Cayton Bay. At Cowbar (to the west of Staithes) there is already a policy for retreating the road, as it is affected by erosion.

A significant area of loss is to some of the more mobile or softer commercial activities of the area; the agriculture generally along much of the frontage, the golf courses at Seaton Carew, at Whitby and Filey and the caravan parks to

the north of Hartlepool, at Coatham, south of Whitby and again at Filey. The difficulties with managing defence of these frontages to a large degree is in terms of economic justification but also in the very nature of where such activities are situated; on the open coast deriving benefit from the natural coastline. It is important, therefore, that monitoring is put in place, or continued, so as to work with the owners in providing best advice as to when change is occurring. Equally, where there is a policy for no active intervention the planning authorities should work with these organisations and individuals to examine how the impact on businesses of a retreating coast may be mitigated.

In terms of the more major industries the policies generally work to sustain their activities in meeting the objectives of sustaining employment to the region. In none of these areas is there seen to be any great advantage in terms of the natural development of the coast in recommending change in shoreline management.

There are several areas, particularly to the northern half of the frontage, where there is potential for pollution or contamination. These areas are considered individually in the Plan.

5.2.2 Implications for Nature Conservation

Clearly there is concern when considering Figures 5.1, 5.2 and 5.3, showing failure to meet natural conservation objectives. To a large degree, when considered in detail, this is a function of the eroding coast and the nature of the interest. For example, that many of the designated sites include both the aim to allow erosion of a cliff but also to maintain the integrity of the habitat at the crest of the cliff. This is reflected in the specific wording of the objectives; to work within the constraints of a dynamic coastal system. Even so, in assessing the success of the plan it has been highlighted that such a natural development will result in loss of area of the site. While, certainly it would be equally damaging to intervene, by making explicit this loss, it highlights the need to maintain integrity in other ways. There is little scope, unfortunately again because of the character of the coastline, to create major areas of new habitat. The Plan attempts to redress the balance to a degree by recommending restricting the extension of defences further into undeveloped areas of the coast and to take advantage of the basic control imposed by natural or manmade structures to maintain areas of open dune habitat and the potential low lying areas behind.

The Plan highlights this basic problem associated with the coast and recommends that, during detailed examination of sections of the coast, every effort is made to create further opportunity for enhancing nature conservation. The corollary of this is that the understanding this document hopes to provide, of how the coast behaves and the interdependencies between sections of the coast, may be used to effect by local managers in identifying realistic opportunities for enhancement. This would build on the

very valuable work already undertaken by English Nature in their opportunities report.

5.2.3 Implications for Landscape

There are very stark differences in coastal landscape over the length of the SMP shoreline; principally in the change from areas of outstanding natural coastline to the urban areas. Both can have significant value.

The Plan aims to restrict further encroachment of defence over undefended areas. Even so, where defence is in place the plan aims to offer opportunity for less intrusive approaches to defence which helps maintain the important interface between the hinterland and the shoreline. In this the plan highlights the danger of linear defences in some areas where there is evidence that the shore may be steepening, indicating the possibilities of a more controlled approach to engineering. It is understood that, in some areas, councils have a policy to avoid the use of rock armour in amenity beaches. This is understandable in terms of use of massive rock revetments. However, rock is a valuable tool in coastal engineering and where such policies are in force, consideration should be given to the specific use of the material in providing strategic control to beaches, for example, through offshore structures, shore connected structures or reefs. In particular, this latter approach may be an appropriate manner through which both coastal defences may be maintained while substituting for natural rock outcrops which may be lost due to sea level rise.

A key component of landscape value is its enjoyment. Over virtually the entire length of the SMP, a coastal path has been established. In places this is threatened by erosion, in places quite critically, such as in the length to the north of Skinningrove. More typically there is scope for the path to be set back. The SMP should be used to identify where and when negotiations may be required to allow this set back to take place. This is not strictly a role of coast protection.

5.2.4 Implications for Historic Environment

There is a board range of historical and heritage features identified over the full length of the coast. Many of the features identified during consultation are found not to be at specific risk of coastal erosion. Even so there are several areas where features will suffer loss. In many situations, as recognised by the objectives, there is little scope for actual defence to protect these areas of interest. The Plan attempts to identify where there are risks and as suggested by the objectives this will allow prioritisation of recording prior to loss of the feature. Coastal monitoring recommended by the plan will assist in this. There should be increased co-ordination of this information between coastal managers and those with responsibility for heritage features.

5.3 Managing the Change

5.3.1 Recommendations

The Plan sets out a development of policy over the three epochs from the present forward over 100 years. There are still essential decisions to be made in taking these changes in policy forward.

What has become very evident in developing the plan is the need for better involvement and co-ordination between different departments within authorities and between different authorities and organisations over the coastal zone. The coast cannot be managed by default.

In several areas recommendations have been made for the development of spatial planning of the coastal zone. Without this, the coastal engineering has to be purely based on risk to existing assets. Even taking the far more forward looking approach engendered by SMPs and strategies, the emphasis for defence or engineering management will tend to be responsive to threat rather than opportunity. This will tend to result in decisions being made at a time when options are already constrained.

This is a coastline where, because of the underlying geology, overall change, even given sea level rise, will tend to be manageable. The impetus for management can, therefore, come from coastal management; actual managementof many of the broader issues, to deliver benefits, rather than purely from shoreline management delivering the benefits associated with damage and risk avoidance.

In specific areas where there is a short term policy for hold the line with a longer term policy of retreat or no active intervention, this must be taken as an opportunity to allow adaptation, not a policy of delay.

It is recommended that the policies be adopted by all organisations represented on NECAG and that these policies, together with an understanding of their intent, are incorporated as guidance for the development of statutory planning within each area.

The following Section of this document provides an overall summary of policies for the shoreline. This summary should be considered with reference to the detailed development of the plan provided in Section 4.

5.3.2 Funding

Each management area contains a number of policy units. For each management area an outline economic assessment has been provided based initially on the high level assessment of damages provided by MDSF. Where strategy studies have been undertaken, and where appropriate further economic data has been incorporated within each policy statement.

Overall, given the level of detail available to the SMP, the policies are shown or are believed to be cost effective in terms of economics; taking into account the additional information from strategies not specifically evaluated in the SMP. However, it is equally recognised that in many areas direct funding under coast protection may not be available due to the need for prioritisation of this funding at a national level.

The development of policies set out in Section 4, highlights the consequences of alternative approaches. In this the SMP aims to identify the specific beneficiaries of the policy. In many cases this is driven by the specific objectives such as maintaining open coastal land as identified in planning documents or maintaining the commercial interests of an area. In line with the Government's strategy "Making Space for Water" co-funding of projects for the coast should be considered.

6 POLICY SUMMARY

6.1 Introduction

The approach to development of the Plan is set out in Section 3. Locally-specific issues and objectives driving this development are presented in Appendix E. Section 4 then provides a detailed discussion of each area and an explanation of why the recommended policies are preferred. This section also includes policy statements collated by management area. An overview of the preferred SMP-wide plan and its implications is presented in Section 5. This section (Section 6) contains a Summary of the policies by area. This summary should be read in conjunction with the detailed analysis in Section 4. Figure 6.1 provides an overview location of units.

Management Area		Policy Unit		Policy Plan			
				2025	2055	2105	Comment
MA01	River Tyne to South Pier	1.1	South Groyne	HTL	HTL	HTL	Key control structure
		1.2	Littlehaven	MR	HR*	HR*	Developed in conjunction with land use plan
		1.3	South Pier	HTL	HTL	HTL	Key control structure
MA02	Herd Sand	2.1	Herd Sands North	HTL	HTL	R	Maintain the integrity of the dune defence
		2.2	Herd Sands South	HTL	MR	HR*	Retreat to maintain the value of the beach
		2.3	Trow Point (north)	R	MR	HR*	Maintain longer term control function
MA03	Trow	3.1	Trow Point (south)	R	MR	HR*	As required for management area B1
		3.2	Trow Quarry	HTL	MR	MR	Subject to detailed appraisal.
MA04	Frenchmans Bay to Lizard Point	4.1	North of Lizard Pt.	R	R	NAI	Local protection, road re-alignment, reassess car parking
		4.2	Lizard Pt	NAI	NAI	NAI	Re-align car parking
MA05	Lizard Point to Souter Point	5.1	Harbour Quarry	HTL	R	R	Investigation of potential pollution
		5.2	Harbour Quarry to Souter Point	NAI	NAI	NAI	local management to enhance bio-diversity
MA06	Souter Point to Sunderland Harbour	6.1	Whitburn Cliffs	NAI	NAI	NAI	No change
		6.2	The Bents	MR	MR	HR*	Provide additional nearshore protection
		6.3	South Bent/ Seaburn	HTL	HTL	HTL	Maintain defences and improve beach control.
		6.4	Parson's Rock	HTL	HTL	R	Eventually removing defences
		6.5	Marine Walk	HTL	HTL	HTL	Maintain defences and improve beach control
MA07	Sunderland Harbour	7.1	Main Harbour Piers	HTL	HTL	HTL	Principle benefit to Port operation
		7.2	North Harbour	HTL	HTL	HTL	Improve condition of North Pier
		7.3	South Harbour	HTL	HTL	HTL	Examine opportunity for local retreat

Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention
* HR – Hold the Line on a retreated alignment, MR – Managed Realignment

Management Area		Policy Unit		Policy Plan			
				2025	2055	2105	Comment
MA08	Sunderland Harbour to Pincushion Rocks	8.1	Harbour East Bay	HTL	HTL	HTL	Integrate with land use planning
		8.2	Harbour South Face	HTL	HTL	HTL	
		8.3	Hendon Seawall	HTL	HTL	HTL	Linked benefits with area to south
		8.4	Hendon to Pincushion	R	MR	MR	Hard point control
MA09	Pincushion to Chourdon Point	9.1	Pincushion to Seaham	NAI	NAI	NAI	
		9.2	Seaham North Prom.	HTL	HTL	HTL	
		9.3	Red Acre Cliffs	R	HR*	HR*	
		9.4	Seaham Harbour	HTL	HTL	HTL	Primarily for port activities
		9.5	Seaham South	HTL	HTL	HTL	
		9.6	Dawdon Beach	NAI	NAI	NAI	Subject to potential contamination
		9.7	Blast Beach	NAI	NAI	NAI	
MA10	Chourdon Point to Blackhall Rocks	10.1	Chourdon Point to Blackhall Rocks	NAI	NAI	NAI	Local management in line with objectives of the Durham Coastal Strategy
MA11	Blackhall Rocks to Heugh Breakwater	11.1	Crimdon Valley	NAI	NAI	NAI	Local management to beck may be considered. Possible beneficial use of dredgings for environmental reasons.
		11.2	North Sands	HTL	HTL	MR	Provisional policy of controlled management of the frontage subject long term development master plan. Otherwise the policy reverts to retreat.
		11.3	Headland	HTL	HTL	HTL	Current discussions with EN with respect to impact on the designated area.
MA12	Hartlepool Bay	12.1	Hartlepool	HTL	HTL	HTL	Detailed consideration of Heugh Breakwater.
		12.2	Seaton Carew north	HTL	HTL	HTL	Monitor impact on designated foreshore area.
MA13	Tees Bay	13.1	Seaton Carew	HTL	HTL	HTL	But consider planned retreat
		13.2	Seaton Sands	NAI	NAI	NAI	Possible future feed with dredged material
		13.3	North Gare	HTL	HTL	HTL	
		13.4	North Gare Sands	NAI	R	R	Controlled by structure to south
		13.5	Bran Sands	NAI	NAI	NAI	Investigate use of dredged material
		13.6	South Gare	HTL	HTL	HTL	
		13.7	Coatham Sands	NAI	NAI	NAI	With detailed flood risk assessment of developed areas

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Management Area		Policy Unit		Policy Plan			
				2025	2055	2105	Comment
MA14	Coatham and Redcar	14.1	Coatham East	HTL	HTL	HTL	Consideration of a transition between the development area and Coatham Sands.
		14.2	Redcar	HTL	HTL	HTL	Look to local management to maintain beach.
		14.3	Redcar East	HTL	HTL	MR	Strategic control
MA15	Marske and Saltburn Sands	15.1	Red Howles	NAI	NAI	NAI	
		15.2	Marske	HTL	HTL	MR	Headland control
		15.3	Marske Sands	NAI	NAI	NAI	
		15.4	Saltburn	HTL	HTL	HTL	
MA16	Huntcliffe	16.1	Saltburn/Huntcliff	NAI	NAI	NAI	Investigate potential threat to railway.
MA17	Skinningrove	17.1	Cattersty Sands	R	NAI	NAI	retreat through maintaining inner section of Jetty
		17.2	Skinningrove	HTL	HTL	HTL	Consolidate existing defence approach
		17.3	Hummersea	NAI	NAI	NAI	
MA18	Boulby	18.1	Boulby	NAI	NAI	NAI	Loss of property
MA19	Cowbar and Staithes	19.1	Cowbar Cottages	HTL	HTL	HTL	Continued monitoring determining the need for further intervention.
		19.2	Cowbar Cliffs	NAI	NAI	NAI	
		19.3	Staithes	HTL	HTL	HTL	Develop a detailed strategy for local management of defences, taking in to account works at Cowbar.
MA20	Staithes to Runswick Bay	20.1	Old Nab	NAI	NAI	NAI	
		20.2	Port Mulgrave	R	R	NAI	Subject to further investigation
		20.3	Lingrow	NAI	NAI	NAI	
MA21	Runswick Bay to Sandsend Ness	21.1	Runswick Village	HTL	HTL	HTL	
		21.2	Runswick Bay	NAI	NAI	NAI	Loss of property south of Runswick
		21.3	Kettleness	NAI	NAI	NAI	
MA22	Sandsend Wyke	22.1	Sandsend cliffs	NAI	NAI	NAI	Consideration of works associated with the unit to the east.
		22.2	Sandsend Village	HTL	HTL	HTL	
		22.3	Coastal road	HTL	R	R	Subject to further investigation of options for the road.
		22.4	Upgang Beach	NAI	NAI	NAI	Adaptation of the Golf Course
MA23	Whitby	23.1	Upgang Beck	HTL	R	R	Transition form hard defence
		23.2	West cliff	HTL	HTL	HTL	
		23.3	Harbour and Abbey cliffs	HTL	HTL	HTL	
MA24	Whitby to Saltwick Nab	24.1	The Stray	NAI	NAI	NAI	

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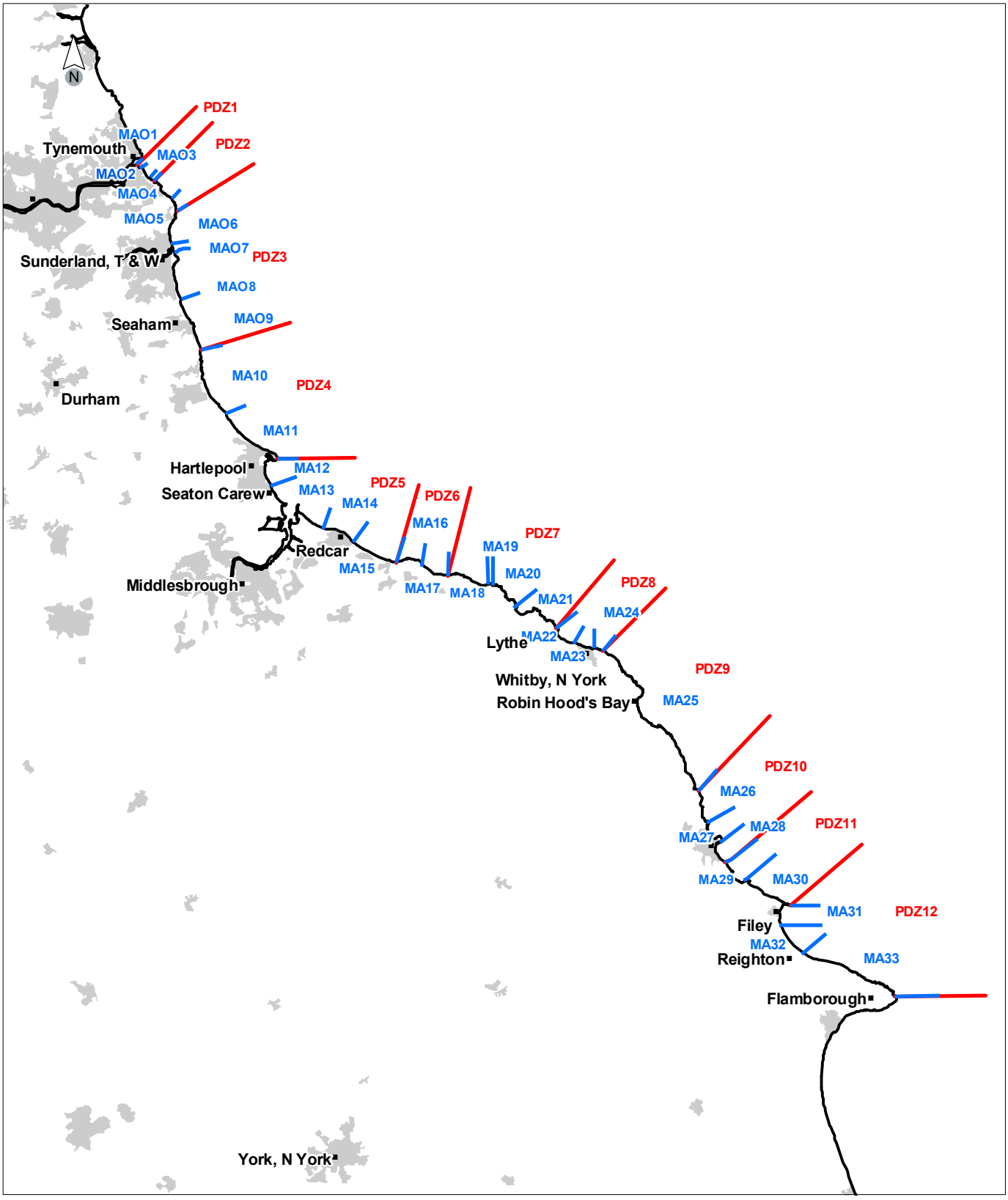
* HR – Hold the Line on a retreated alignment, MR – Managed Realignment

Management Area		Policy Unit		Policy Plan			
				2025	2055	2105	Comment
MA25	Saltwick Nab to Hundale Point (Robin Hoods Bay)	25.1	Saltwick to Hundale	NAI	NAI	NAI	
		25.2	Village of Robin Hood's Bay	HTL	HTL	HTL	This policy is a local exception to the general policy for this larger section of the coast.
MA26	Hundale Point to Scalby Ness	26.1	Burniston	NAI	NAI	NAI	
MA27	Scarborough North Bay and Castle Cliffs	27.1	North Bay	HTL	HTL	HTL	Detailed strategic appraisal of options required.
		27.2	Castle Headland	HTL	HTL	HTL	
MA28	Scarborough South Sands and Harbour	28.1	Harbour	HTL	HTL	HTL	Essential control point
		28.2	Foreshore Road	HTL	HTL	HTL	Improve overtopping risk
		28.3	Spa and access	HTL	HTL	HTL	Consider opportunity for advance
		28.4	Cliff Gardens	HTL	HTL	HTL	Minimise impact on foreshore
		28.5	South Cliffs	NAI	NAI	NAI	
MA29	Black Rocks to Filey Brigg	29.1	Cornelian Bay	NAI	NAI	NAI	
		29.2	Cayton Bay	NAI	NAI	NAI	
		29.3	Cayton Bay Access	MR	MR	MR	Within the broader policy unit of the bay
MA30	Filey	30.1	Gristhorpe Cliff	NAI	NAI	NAI	Provide advice to caravan Parks with respect to retreat.
		30.2	North Cliff	NAI	NAI	NAI	Set back line of Coastal footpath
MA31	South Filey Bay	31.1	North of Filey	NAI	NAI	NAI	Affected by works to stop outflanking of Filey
		31.2	Filey	HTL	HTL	HTL	Looking to long term overall management.
		31.3	Muston Sands	NAI	NAI	NAI	Affected by works to stop outflanking of Filey
MA32	Muston Sands to Speeton Cliffs	32.1	Hunmanby Sands	NAI	NAI	NAI	Consideration of long term management of frontage, access and hinterland.
		32.2	Hunmanby Gap	NAI	NAI	NAI	Consideration of long term management of frontage
		32.3	Reighton	NAI	NAI	NAI	Consideration of long term management of frontage
MA33	Muston Sands to Flamborough Head	33.1	Speeton	NAI	NAI	NAI	Allow natural development of coast.
		33.2	Flamborough Head	NAI	NAI	NAI	Over arching policy for the whole area
		33.3	North Landing	HTL	HTL	HTL	Within the context of the above policy
		33.4	Flamborough	not defined			Reviewed following monitoring.

Key: HTL - Hold the line, A - Advance the line, R - Retreat or Realignment, NAI – No active intervention
* HR – Hold the Line on a retreated alignment, MR – Managed Realignment



Key:

Source:

Title:
Policy Development Zones and Management Areas

Project:
SMP2 River Tyne to Flamborough Head

Client:
North East Coastal Authorities Group

Date:
February 2007

Scale:
1: 650,000

Figure:
6.1

ROYAL HASKONING

7 ACTION PLAN

7.1 Introduction

This section outlines further investigation, studies or works which need to be carried out or developed in order to implement policies for each area. The action plan also identifies the monitoring required; in part from the identification of investigations and studies mentioned above, but also with respect, more of the need to gain a better understanding of coastal processes, so as to perform coastal management in an effective manner and to feed back into the shoreline management process. The rational for both undertaking further investigation and studies and that of monitoring is discussed in sections 7.2 and 7.3, respectively, below.

7.2 Investigations, studies and works.

The need for further work is discussed in the main body of the SMP2 (Section 4). This need is drawn together in the Action Plan. In setting out this programme it is necessary to have regard to the priority and urgency of actions. Defra has recently published possible outcome measures (consultation December 2006) aimed at better aligning delivery of Flood and Coastal Erosion Risk Management with Defra policy. While these measures are still under discussion they can be used to help establish a priority for further work specifically from the flood and coastal erosion risk management standpoint. In addition, other important issues, not specifically covered by these outcome measures were identified during the development of the SMP2. In the following tables the further works are identified in summary. (Reference should also be made to Section 4 of this document, to the specific management area to which the action relates. In Section 4, together with the description as to what is to be undertaken, is a brief note providing an indication of those aspects which are relevant in assessing the priority of the action.)

An indicative cost is also shown in the table, together with an indicative timescale by when the action should be undertaken. While the degree of urgency may in one way be assessed from consideration of all issues (i.e. in terms of the significance of the issue being addressed), a more absolute urgency also arises from the possibility of being too late. This can arise from the timescale of potential loss (i.e. there is little point in investigating how loss may be avoided once loss has actually occurred). Equally, urgency may arise in terms of integrated decision making (i.e. the need for decisions on risk management needed to inform or be developed alongside land use planning).

It should be noted that, in the proposed outcome measures, the requirements of the Water Framework, Habitats and Birds Directives are statutory and are assumed to act as a defining framework for activities as other legal obligations. They are not, therefore, included in the proposed outcome measures. However, where relevant these issues are identified within the

SMP assessment of policy. In the Appropriate Assessment, preventative measures are identified aimed to avoid and demonstrate no negative impact on Natura 2000 sites. These are highlighted in the SMP2 and must be included in developing the implementation of SMP2 policy.

7.3 Monitoring

Monitoring is an essential element of good coastal management. However, it is equally important that the purpose of monitoring is clearly understood:

- providing justification for expenditure,
- to ensure that there is an overall coherence between different aspects of the monitoring process, ensuring maximum value is being obtained,
- from the above, scoping what actually needs to be done, and
- in being able to assess whether the overall programme or specific aspects of monitoring is providing the information required, and providing justification for further actions and expenditure.

In considering these, it may be seen that there are different scales of monitoring. It has been identified that there may be a general steepening of the nearshore area[5] over sections of the coast at Sunderland, and over the Scarborough frontage. Understanding this process, particularly in association with sea level rise, and assessing whether this process is more widespread, affecting the whole coast, may best be monitored at a regional scale. This would provide common information feeding into local management at the coast. Other processes, such as changes in wave climate or sea level rise may similarly be seen to be important at a regional scale, as might examination of the nearshore sediment processes.

In contrast, direct assessment of defence condition, local beach levels or, ecological impact may need to be considered at a local level, providing direct information in management of risk in specific areas (although also providing still a broader picture of change and need at the regional or even national scale).

In general, therefore, there is:

- Regional Level Monitoring,
  - providing an understanding of underlying processes acting at the regional scale,
  - identifying long term trends in relation to the whole coast
  - providing context within which local scale change may be assessed
  - assessing eco-system behaviour and integrity
  - cost effective management of data collection, storage and utilisation where appropriate over the region.

  It is also envisaged that there will be a need for regional scale collation, storage and dissemination of data and information collected or derived

[5] A landward movement of the nearshore contours, resulting in deeper water against the coast and increasing energy at the shoreline.

from monitoring at more a more local level. This function needs to be developed through the Coastal Group, acting as a group and drawing upon information provided by individual Group members.

- Strategy Level Monitoring
  - providing an understanding of underlying processes acting at the management area scale,
  - identifying trends in relation to the specific management areas,
  - identifying local scale impacts resulting from management,
  - assessing SMP2 policy, testing assumptions and addressing identified uncertainty.
  - developing general design data for use in developing solutions.
  - assessing general ongoing condition of defences and priorities for intervention.

- Defence Monitoring
  - identifying local variation and sensitivity of foreshore levels,

establishing defence performance, condition, vulnerability, deterioration and maintenance.

The strategy level and defence monitoring relates directly to areas of flood and coastal erosion risk management and is sensibly maintained by individual operating authorities in relation to their specific functions and responsibilities. However, this clearly needs to be co-ordinated through the coastal group.

There will be overlap between levels of monitoring such that data collected at a strategic level may incorporate data required for monitoring of specific defences which may be aggregated to provide more general data required for strategic or national programming and assessment.

7.4 Action Plan

The action plan, combining studies, schemes and monitoring, is set out in this sub-section. In general it is the Operating Authorities who, even if not actually managing specific actions, will be promoting or ensuring actions are undertaken in a timely manner. These actions, summarising the information given for each management area (defined in Section 4) have, therefore, been grouped by Operating Authority. A brief overview of the need for these actions covering each Authority's area is given, further details being provided in Section 4. Where joint action is required between authorities or between authorities and other organisations, this is identified. Joint actions are repeated in sections covering the area of any other authority involved with that action for completeness. As part of this the SMP has attempted to provide a guide to both the timescale and priority for action, also identifying where actions need to be co-ordinated between organisations and with an indicative cost.

7.4.1 South Tyneside Council (STC)

Overview

The South Tyneside frontage may be considered in two sections: the developed area immediately south of the Tyne and the more natural frontage from south from Trow Point.

The principal issues, associated with the first of these, are that of ensuring good integrated management of the frontage in relation to current activities and regeneration plans. Within this is the need to ensure enhancement of the natural ecological features.

Over the southern section of coast, the main issues are the management of pollution or potential pollution from quarries and the management of the retreating coastline. Associated with this latter issue is planned relocation of car parks and possibly the coastal road.

The following action plan is recommended.

By When	Action	Management Area	Responsibility	Cost £k
On going	Trow: design development. Establish specific design criteria and undertake design.	MA 03	STC	150
2007	Revise strategy for Littlehaven, with intention to realign defence.	MA 01	STC	30
2007	Establish plan for dune management at Herd Sands, including long term plan for recreation area.	MA 02	STC	10
2007	Risk assessment at harbour Quarry, initial surveys and report	MA 05	STC	5
2008	Marsden Bay, risk assessment of areas of concern, initial surveys and report	MA04	STC	5
2009	Investigation. Examine nature and extent of material in Harbour quarry.	MA 05	STC	50
2010	Assess potential impacts and confirm SMP policy.	MA 05	STC	10
2010	Scheme development. Review strategy and develop appraisal for maintenance and refurbishment plan.	MA 06	SCC/ *Co-ordinated with STC*	40
2012	Outline strategy for Herd Sands developed in conjunction with land use plan.	MA 02	STC	25
2012	Planning Strategy. Development of realignment strategy for road, car parking and access. Including examination of alternative route for road.	MA 04	STC	50
Schemes				
2008	Dune management	MA 02	STC	200
2008	Short term defence to Trow quarry	MA 03	STC	1600
2009	Develop new promenade on realignment	MA 01	STC	2100

2011	Initial scheme implementation to the south of Herd Sands	MA02	STC	200
2025	Retired defence at Harbour quarry (subject to investigations and plan)	MA 05	STC	240

Associated with these activities are the following monitoring recommendations for the two general areas defined above

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Monitoring recommendations for the northern section of coast.

ISSUES			
Performance of the beach after realignment at Littlehaven and identifying the potential roll back and pressure on defences over Herd sand. Deterioration of coast protection structures and increasing pressure on defence line. Pedestrian damage to dunes Influence of Trow Point Possible change in nearshore area as identified elsewhere in SMP area.			
OBJECTIVES			
Topographic change over the two beach areas Establish erosion rate of Trow point Position of defences in relation to beach crest. Mapping human pressure on dunes and extent of dunes Establish and monitor condition of defences Establish reliable record of sea bed change			
MONITORING	**SCOPE**	**FREQUENCY**	**SCALE**
Air photography	Long term background monitoring of shape of beaches and pressures on natural frontages. Detailed examination of erosion of Trow point	Two yearly	Co-ordinated by group
Topographic survey	Survey covering both open beaches and dunes.	yearly	strategy
Crest profiles	Local variation of beaches and vulnerability of defences	quarterly	local
Defence inspection	Visual inspection and record photographs of defences.	After storms/ two yearly	Local, feeding to NFCDD
Bathymetric survey	Corridor survey out to 20m. CD contour, centred on Herd sands.	ten yearly	Regional

Monitoring recommendations for the southern section of coast.

ISSUES			
Influence of Trow Point and Target Rock, with the pressure and extent of erosion within Trow Quarry. Threat of loss of car parks and road, associated with loss of footpath. Condition of defence at harbour quarry			
OBJECTIVES			
Establish erosion rate of Trow point and target rock Erosion of quarry infill. Establish and monitor condition of defences at Harbour quarry			
MONITORING	**SCOPE**	**FREQUENCY**	**SCALE**
Air photography	Long term background monitoring of erosion of cliffs.	Two yearly	Co-ordinated by group
Topographic survey	Survey covering Trow Quarry.	yearly	local
Defence inspection	Visual inspection of defences. and record photographs	After storms/ two yearly	Local, feeding to NFCDD

7.4.2 Sunderland City Council (SCC)

Overview

The frontage is covered by the Whitburn Bay to Ryhope Coast Protection Strategy (May 2001). In addressing the immediate issues the SMP confirms the overall approach set out in the strategy. The key elements of this are maintenance and major refurbishment of the linear defences and the actions recommended are summarised in the table below. Towards the end of the first epoch, and depending on monitoring, consideration needs to be given to development of the longer term intents set out in the SMP. Development of initial project appraisal should take account of this.

Along the port area, the developments of the defence actions need to be integrated with the proposed regeneration plan. This will tend to determine the timescale for action.

Over the southern extent of the Council's area both major refurbishment work and reconstruction is to be undertaken. Further south, the investigation into the Halliwell Banks quarry is on-going. The outcome of this investigation together with the development of detailed appraisal of actions along the Hendon area need to take account of the longer term policies of the SMP2.

The following action plan is recommended.

By When	Action	Management Area	Responsibility	Cost £k
2007	Complete Investigation of Halliwell Banks. Management of potential contamination.	MA 08	SCC	80
2007	Longitudinal access study to Hendon Beach.	MA 08	SCC	5
2008	Review strategy priorities against outcome measures.	MA 06 -08	SCC	15
2008	Scheme development for Harbour East Bay. Review and develop defence requirements to port regeneration area.	MA 08	SCC	50
2010	Scheme development. Review strategy and develop appraisal for maintenance and refurbishment plan.	MA 06	SCC/ *Co-ordinated with STC*	40
2012	Review strategy along Hendon frontage/ Ryhope.	MA 08	SCC	25
2017	Review strategy for port area .	MA 07	SCC	30
Schemes				
2009	Scheme under review for Harbour East Bay	MA 08	SCC	6000
2012	Refurbishment of defences to North Sunderland	MA 06	SCC	3000
2012	Potential schemes to South Sunderland	MA 08	SCC	4000
2012	Continued refurbishment of harbour piers	MA 07	SCC	1500

Associated with these activities are the following monitoring recommendations.

Monitoring recommendations for the Sunderland frontage.

ISSUES Long term steepening of nearshore area. Stability of cliffs Risk at the Bents Erosion of area south of Sunderland and potential impact on transport infrastructure. Potential loss of beaches Defence condition and vulnerability to loss of material at the toe.			
OBJECTIVES Topographic change over the two main beach areas and at the Bents Establish erosion rate of Ryhope cliffs Position of defences in relation to beach crest. Mapping human pressure on dunes and extent of dunes Establish and monitor condition of defences Establish reliable record of sea bed change			
MONITORING	**SCOPE**	**FREQUENCY**	**SCALE**
Air photography	Long term background monitoring of shape of beaches and cliff and foreshore position.	Two yearly	Co-ordinated by group
Topographic survey	Survey covering beaches to north and south of Sunderland with local survey at the Bents	yearly	strategy
Cliff crest profiles	Profiles along the Ryhope cliff	yearly	strategy
Crest profiles	Local variation of beaches and vulnerability of defences along the Seaburn walls	quarterly	local
Defence inspection	Visual inspection and record photographs of defences.	After storms/ two yearly	Local, feeding to NFCDD
Bathymetric survey	Corridor survey out to 10m CD contour at Sunderland North beach.	Five yearly	Strategy
	Corridor survey out to 20m. CD contour	10 yearly	Regional

7.4.3 Easington District Council (EDC)

Overview

The Seaham Strategy Study identified that defences are at present adequate but that deterioration is likely to increase over the next 20 years. There are concerns over potential contamination from erosion of the cliff line to the south of the harbour. This may have implications with respect to continued regeneration of the area. Critical to management of the coast is the change occurring on the shore as mining waste continues to erode. The behaviour of the beaches is, therefore likely to change over the next 20 years. The action plan has to be built from and understanding of this change. Monitoring is, therefore essential in developing the SMP2 policies.

The following action plan is recommended.

By When	Action	Management Area	Responsibility	Cost £k
On going	Local management	MA 10	Durham Heritage Coast	
2009	Management strategy for Crimdon Valley.	MA 11	*Co-ordinated by* HBC/ EBC /DHC	5
2010	Investigate potential contamination at Dawdon Beach.	MA 09	EDC	50
2014	Review overall coastal strategy	MA 09	EDC	
Schemes				
	No schemes at present.			

The following monitoring recommendations will provide information relevant to the above activities but as importantly providing information for Durham Heritage Coast management.

Monitoring recommendations

ISSUES
Long term steepening of nearshore area.
Performance of the beach in relation to maintenance of defences.
Potential need to stabilise cliff to north of the port.
Local management and long term evolution of the Durham Coast.
Potential contamination from erosion south of the port.
Long term risk to the railway line.
Access management to the coast.
OBJECTIVES
Establish erosion trends and vulnerability of defence to North Seaham
Determine cliff erosion north of port
Determine cliff erosion south of the port to inform contamination risk.
Establish erosion trends of mining waste and stability of beaches over the Durham Coast.
Establish and monitor condition of defences
Establish reliable record of sea bed change

MONITORING	SCOPE	FREQUENCY	SCALE
Air photography	Long term background monitoring of cliff erosion.	Two yearly	Co-ordinated by group
Beach profiles	Covering areas identified in strategy, establishing both trends and variation.	yearly	strategy
Crest profiles	Erosion of Cliff crest at Dawdon Beach	yearly	local
Defence inspection	Visual inspection and record photographs of defences.	After storms/ two yearly	Local, feeding to NFCDD
Bathymetric survey	Corridor survey out to 10m CD contour at Seaham.	Five yearly	Strategy
	Corridor survey out to 20m. CD contour, centred on bays along frontage.	10 yearly	Regional

7.4.4 Hartlepool Borough Council (HBC)

Overview

The recent strategy study has set out detailed management to the north of Hartlepool and the Headland through to the marina. From this specific schemes are identified at the Headland, in front of the Town walls and the marina defences. In addition to this detailed proposals are being developed for North Sands. To the south of Hartlepool there is concern over condition of defences in front of Seaton Carew, management and maintenance needing to be taken forward with regard to development of the Seaton Carew sea front. There needs to be a management plan for Seaton Dunes to ensure the SMP2 policy for managed realignment is taken forward in an appropriate manner. The action plan and monitoring requirements are as set out covering the three general areas: North Hartlepool, Hartlepool Bay and Seaton Carew.

The following action plan is recommended.

By When	Action	Management Area	Responsibility	Cost £k
On going	Scheme Development for Headland. Detailed appraisal for improving defences.	MA 11	HBC	40
2007	Development strategy for area of North Sands. Develop an integrated approach to defence of the cemetery frontage. Identify potential erosion risk contribution.	MA 11	*Co-ordinated by* HBC	25
2008	Town walls. Detailed scheme appraisal report	MA 12	Private/ Co-ordinated by HBC	130
2009	Management strategy for Crimdon Valley.	MA 11	*Co-ordinated by Hartlepool BC/ Easington DC/ Durham Heritage Coast*	5
2009	Middleton Beach. Advise on defence.	MA 12	*Co-ordinated by* HBC	5
2009	Strategy for Seaton Carew, review of condition and develop management strategy.	MA 13	HBC	80
2010	Marina. Detailed project appraisal report.	MA12	Private/ Co-ordinated by HBC	80
2010	Management plan for Seaton Dunes. Co-ordinate land use and dune management	MA 13	*Co-ordinated by* HBC/(EA)	5
2012	Heugh Breakwater. Review strategy	MA 12	Private/ Co-ordinated by HBC	30
2012	Review flood defence strategy to Teesmouth	MA13	Environment Agency. (HBC/ RCBC.)	50

Schemes				
	Schemes for North Hartlepool to be identified by strategies	MA 11	HBC	
2009	Town walls	MA 12	HBC	500
2010	Management for Seaton Carew defences determined from strategy.	MA 13	HBC	

Associated with these activities are the following monitoring recommendations.

Monitoring recommendations for North Hartlepool.

ISSUES

Developing pressures on golf course, access and car park and caravan park at Crimdon Valley as coast erodes. Position of beck.

Determining behaviour of foreshore in relation to development and management and risk to LNR and cemetery.

Transition from managed realignment to holding the line at the Headland

Potential deterioration of exposed rock at Headland.

Condition of defences.

Possible change in nearshore area as identified elsewhere in SMP area.

OBJECTIVES

Overall evolution of foreshore and interaction with beck and dunes. Mapping pressure on dunes and extent of dunes and sand banks.

Long terms trends of foreshore levels and interaction between sections of the coast.

Determine erosion rates of rock headland.

Establish and monitor condition of defences

MONITORING	SCOPE	FREQUENCY	SCALE
Air photography	Long term background monitoring of shape of beaches and pressures on natural frontages.	Two yearly	Co-ordinated by group
Topographic survey	Survey covering open beaches and back dunes.	Yearly	Strategy
	Survey covering rock headland	Five yearly	local
Defence inspection	Visual inspection and record photographs of defences.	After storms/ two yearly	Local, feeding to NFCDD

Monitoring recommendations for Hartlepool Bay.

ISSUES

Uncertainty associated with extreme water levels within Hartlepool Bay.

Overall change and sediment transport within Hartlepool Bay.

Impacts associated with Heugh Breakwater

Condition of defences.

OBJECTIVES

Establish bathymetric change over the Bay

Establish local variation in extreme water levels.

Determine trends in local foreshore levels.

Establish ornithological value of area in the lee of the Heugh Breakwater.

Monitor shoreline use of area in lee of Heugh Breakwater.

Monitor condition of defences

MONITORING	SCOPE	FREQUENCY	SCALE
Topographic survey	Survey covering foreshore levels.	yearly	strategy
Defence inspection	Visual inspection and record photographs of	After storms/ two	Local, feeding to

	defences.	yearly	NFCDD
Bird counts	Establish bird use of area in the lee of the Heugh Breakwater. (Co-ordinate with TBC)	As required	local
Bathymetric survey	Co-ordinate monitoring with Tees Port.	Determined by port operations	Strategy
Water levels	Collate local water level data.	Event driven	Strategy

Monitoring recommendations for Seaton Carew and Teesmouth.

ISSUES			
Uncertainty associated with extreme water levels within Hartlepool Bay.			
Overall change and sediment transport within Hartlepool Bay.			
Condition of defences at Seaton Carew associated with long term management of pressure.			
Management of integrity and retreat of dunes.			
Management of flood defence within the mouth of the Tees.			
OBJECTIVES			
Establish bathymetric change over the Bay			
Establish local variation in extreme water levels.			
Determine trends in foreshore levels.			
Establish variation in beach levels in front of defences at Seaton Carew.			
Establish ornithological value of area of Seaton Dunes.			
Monitor condition of defences			
MONITORING	**SCOPE**	**FREQUENCY**	**SCALE**
Air photography	Long term background monitoring of the evolution of Tees Bay.	Two yearly	Co-ordinated by group
Topographic survey	Survey covering foreshore and dunes levels.	yearly	strategy
	Local survey in front of Seaton Carew	After storms / six monthly	local
Defence inspection	Visual inspection and record photographs of defences.	After storms/ two yearly	Local, feeding to NFCDD
Bird counts	Establish bird use of (Co-ordinate with TBC)	As required	local
Bathymetric survey	Co-ordinate monitoring with Tees Port.	Determined by port operations	Strategy
Water levels	Co-ordinate local water level data.	Event driven	Strategy

7.4.5 Redcar and Cleveland (RCBC)

Overview

The frontage is taken in two sections: from the Tees through to Redcar and the frontages from Marske through to Staithes. In the first, a strategy is being developed for the Redcar frontage in association with the Environment Agency. There are potential flood risks associated with the policies for natural realignment of the dunes at Coatham and within the Tees. Along the Marske to Saltburn frontages there is still uncertainty associated with cliff erosion rates, coupled to foreshore evolution. These uncertainties will determine the timing for intervention at Marske and are critical to the management at Saltburn. There is a more immediate need to develop a strategy fro Saltburn, this should include consideration of the longer term development management at Marske. The recently concluded strategy at Skinningrove sets out a plan for refurbishment of defences. Over the coast to the east the rates of erosion of the cliff remains uncertain and requires long term monitoring. This is most critical at Cowbar and links to the management of Staithes.

The following action plan is recommended.

By When	Action	Management Area	Responsibility	Cost £k
On going	Revised scheme and appraisal. Extend scheme to Redcar east and develop detailed works.	MA14	Environment Agency/ RCBC	300
2007	Management review. Review of defence measures associated with development at Coatham.	MA 14	*Co-ordinated by* RCBC	5
2008	Skinningrove Scheme Development. Define specific works based on strategy.	MA 17	RCBC	50
2009	Develop strategy for Marske and Saltburn	MA 15	RCBC	120
2009	Review Staithes strategy. Review flood risk and set out long term management of harbour and piers.	MA 19	SBC/ RCBC	50
2010	Review flood risk to rear of Coatham dunes. Examine need for retired flood defence	MA 13	Environment Agency. / RCBC	30
2012	Review flood defence strategy to Teesmouth	MA13	Environment Agency. (HBC/ RCBC.)	50
Schemes				
2009	Improved protection to Redcar frontage	MA 14	Environment Agency/ RCBC	12,000
2009	Refurbishment of defences at Skinningrove	MA 17	RCBC	1400
2016	Potential need to relocate Cowbar Lane (not coast protection)	MA 18	RCBC	

Associated with these activities are the following monitoring recommendations.

Monitoring recommendations for the Coatham and Redcar frontages.

ISSUES			
Uncertainty associated with extreme water levels within Hartlepool Bay. Overall change and sediment transport within Hartlepool Bay. Condition of defences at Redcar associated with long term management of pressure and potential beach loss. Transition between defended sections and natural coast. Management of integrity and retreat of dunes. Management of flood defence within the mouth of the Tees.			
OBJECTIVES			
Establish bathymetric change over the Bay Establish local variation in extreme water levels. Determine trends in foreshore levels. Establish variation in beach levels in front of defences at Redcar. Monitor condition of defences			
MONITORING	**SCOPE**	**FREQUENCY**	**SCALE**
Air photography	Long term background monitoring of the evolution of Tees Bay.	Two yearly	Co-ordinated by group
Topographic survey	Survey covering foreshore and dunes levels.	yearly	strategy
	Local survey in front of Coatham, Redcar and Redcar East	After storms / six monthly	local
Defence inspection	Visual inspection and record photographs of defences.	After storms/ two yearly	Local, feeding to NFCDD
Bathymetric survey	Co-ordinate monitoring with Tees Port.	Determined by port operations	Strategy
Water levels	Co-ordinate local water level data.	Event driven	Strategy

Monitoring recommendations for Marske through to Staithes.

ISSUES
Uncertainty of soft cliff erosion rates. Understanding of erosion of hard cliff frontages. Overall change and sediment transport over eastern section of Tees Bay. Sediment exchange in the offshore area. Erosion rates at Cowbar Condition of defences at Saltburn and Skinningrove Condition and variation of beaches at Marske, Saltburn and Skinningrove
OBJECTIVES
Determine trends in foreshore levels. Establish variation in beach levels in front of defences at Saltburn and Skinningrove. Long term understanding of offshore sediment transport. Monitor condition of defences

MONITORING	SCOPE	FREQUENCY	SCALE
Air photography	Long term background monitoring of the evolution of cliffs.	Two yearly	Co-ordinated by group
Cliff face surveys	Support work by Durham University	Monthly	Local/ regional
Cliff crest profiles	Continue monitoring profiles at Cowbar lane	yearly	local
Topographic survey	Survey covering foreshore and dunes levels.	yearly	strategy
	Local survey in front of Saltburn, Cattersty Sands and Skinningrove.	After storms / six monthly	local
Defence inspection	Visual inspection and record photographs of defences.	After storms/ two yearly	Local, feeding to NFCDD
Bathymetric survey	Corridor survey out to 10m CD contour at Saltburn and Skinningrove.	Five yearly	Strategy
		10 yearly	Regional
	Corridor survey out to 20m. CD contour, centred on bays along frontage.		
Sea bed sediments	Side scan sonar and initial seismic profiling	Ten yearly	Regional

7.4.6 Scarborough Borough Council (SBC)

Overview

The North Yorkshire frontage naturally divides into three areas, covering: the town of Whitby and the villages over the northern section of the frontage, the areas around Scarborough and Cayton and Filey Bay. Common to each area is the need to better understand and monitor erosion and instability of the coastal cliffs. Following existing strategies, there is on-going concern over condition of defences at Staithes, Runswick Bay and Robin Hood's Bay. At Whitby the condition of the piers, the management of beach levels and the future management at Sandsend all require prompt action.

Strategies have been developed over the Scarborough frontages; these are being reviewed following protection works and building upon existing monitoring. Various actions derive from these and from the SMP2.

Further south the principle issues relate to cliff instability and erosion rates, particularly at Cayton Bay, Filey and the smaller communities in Filey Bay. There are specific concerns at Osgodby Point and Flat Cliffs where the policy is for managed realignment. In these areas there needs to be a co-ordinated plan to address loss of properties, supported by SBC. There is a general erosion of the cliff line which may have long term implications for land management.

The following action plan is recommended.

By When	Action	Management Area	Responsibility	Cost £k
On going	Scarborough - Review Holbeck to Scalby Mills Strategy,	MA 27	SBC	on going
On going pending funding	Whitby - Appraisal of Whitby Harbour Piers, examining condition of Piers and development of management approach.	MA 23	SBC	225
On going	Review of all SBC Coastal Strategies	All	SBC	
2007	Cayton Bay - Cliff stability investigations at Cayton Bay	MA 29	SBC	80
2007	Filey Bay - Management Plan for Flat Cliffs, to support management for realignment.	MA 32	Residents and private sector *Supported by* SBC	10
2008	Runswick Bay - Scheme appraisal for defence of Runswick Bay. Develop recommendations of strategy	MA 21	SBC	30
2008	Whitby - Strategy study examining flood risk within Whitby harbour.	MA 23	Environment Agency/ SBC	
2008	Cayton Bay - Management plan at Cayton Bay, to review implications of managed realignment.	MA 29	SBC/ NYCC/ National Trust	10

2008	Filey - Investigation to examine stability of coastal slopes at Filey taking account of long term management to main wall.	MA 31	SBC	50
2008	Filey - Scheme appraisal to develop strategy recommendations for outflanking defence.	MA 31	SBC	40
2008	Review strategy priorities against outcome measures.	All	SBC	
2009	Staithes - Review Staithes strategy. Review flood risk and set out long term management of harbour and piers.	MA 19	SBC/ RCBC	50
2009	Sandsend - Strategy Review. Highway investigation and review possible realignment of coastal strategic route.	MA 22	SBC/ NYCC	60
2010	Robin Hoods Bay - Develop Strategy for Robin Hood's Bay, further consideration of cliff stability.	MA 25	SBC	50
2010	Robin Hoods Bay North of Mount Pleasant Study	MA 25	SBC	30
2010	Port Mulgrave - Investigation to examine slope stability and dependency on harbour area at Port Mulgrave.	MA20	SBC	50
2012	Cayton Bay - Realignment strategy at Cayton Bay, develop managed realignment and access strategy plan.	MA 29	SBC	30
2025	Negotiate retreat of the Cleveland Way	MA 24	NYMNPA/ Heritage Coast	
Schemes				
2008	Scarborough South Bay: Spa Chalet Cliff - Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	MA 28	SBC	7,030
2008	Scarborough South Bay: The Spa – Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	MA28	SBC	11,700
2008	Scarborough North Bay: Sea Life Centre – Rock berm and seawall repairs	MA 28	SBC	8,777
2013	Scarborough North Bay: Peasholm Gap and Clarence Gardens - Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	MA28	SBC	17000
2010	Robin Hoods Bay - Preventative maintenance at Robin Hood's Bay as recommended by strategy	MA 25	SBC	150
2010	Whitby - Whitby Harbour Pier improvements	MA 23	SBC	16,000
2010	Scarborough South Bay: South Cliff Gardens – Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	MA 28	SBC	3,654
2010	Filey - Outflanking defence at Filey	MA 31	SBC	500
2010	Filey – Cliff Stabilisation	MA 31	SBC	500

2012	Scarborough South Bay: Foreshore Road and St Nicholas Cliff – Raise height of existing wall, drainage improvement Foreshore Road and slope stabilisation	MA 28	SBC	5,232
2012	Staithes - Potential scheme to improve flood risk to Staithes Harbour	MA 19	SBC	500
2013	Scarborough South Bay: South Bay Pool – Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	MA 28	SBC	5,518
2015	North Bay Cliffs – Seawall repairs and slope stabilisation	MA 28	SBC	4000
2015	Scarborough South Bay: Rose Gardens - Rock revetment in front of existing seawall, seawall repairs and slope stabilisation	MA 28	SBC	6,679

Associated with these activities are the following monitoring recommendations.

Monitoring recommendations for the northern section of the coast.

ISSUES

Uncertainty of soft cliff erosion rates and stability.
Improved understanding of erosion of hard cliff frontages.
Potential nearshore steepening.
Sediment exchange in the offshore area.
Condition of defences at Staithes, Runswick, Robin Hood's Bay, Whitby and Sandsend.
Condition and variation of beaches at , Runswick, Robin Hood's Bay, Whitby and Sandsend.

OBJECTIVES

Establish mechanisms and cliff erosion rates.
Determine trends in foreshore levels.
Establish variation in beach levels in front of defences.
Long term understanding of offshore sediment transport.
Monitor condition of defences

MONITORING	SCOPE	FREQUENCY	SCALE
Air photography	Long term background monitoring of the evolution of cliffs.	Two yearly	Co-ordinated by Group
Cliff face surveys	Stability issues	Monthly	Local/ regional
Topographic survey	Survey covering foreshore and cliffs in Whitby Bay.	yearly	strategy
	Local survey in front of Runswick and Robin Hood's Bay.	After storms / six monthly	local
Defence inspection	Visual inspection and record photographs of defences.	After storms/ annually	Local, feeding to NFCDD
Bathymetric survey	Corridor survey out to 10m CD contour at Whitby.	Five yearly	Strategy
	Corridor survey out to 20m. CD contour, centred on bays along frontage.	10 yearly	Regional
Sea bed sediments	Side scan sonar and initial seismic profiling	Ten yearly	Regional

Monitoring recommendations for the Scarborough frontage

ISSUES

Cliff stability.
Potential nearshore steepening.
Sediment exchange in the offshore area.
Long term trends in beach levels.
Condition of defences
Condition and variation of beaches

OBJECTIVES

Establish mechanisms cliff instability.
Determine trends in foreshore levels.
Establish variation in beach levels in front of defences.
Long term understanding of offshore sediment transport.
Monitor condition of defences

MONITORING	SCOPE	FREQUENCY	SCALE
Air photography	Long term background monitoring of the beach shape and cliffs.	Two yearly	Co-ordinated by group
Cliff stability	Inclinometers and slope movement	Continuous	Local/ regional
Topographic survey	Survey covering foreshore areas. (monitoring linked to beach management)	yearly	strategy
	Local survey in front of defences	After storms / six monthly	local
Defence inspection	Visual inspection and record photographs of defences.	After storms/ annually	Local, feeding to NFCDD
Bathymetric survey	Corridor survey out to 10m CD contour.	Five yearly	Strategy
	Corridor survey out to 20m. CD contour, centred on bays along frontage.	10 yearly	Regional
Sea bed sediments	Side scan sonar and initial seismic profiling	Ten yearly	Regional

Monitoring recommendations for the southern section of coast.

ISSUES

Uncertainty of cliff stability.
Potential nearshore steepening.
Sediment exchange in the offshore area.
Long term trends in beach levels.
Condition of defences
Condition and variation of beaches

OBJECTIVES

Establish mechanisms cliff instability.
Determine trends in foreshore levels.
Establish variation in beach levels in front of defences.
Long term understanding of offshore sediment transport.
Monitor condition of defences

MONITORING	SCOPE	FREQUENCY	SCALE
Air photography	Long term background monitoring of the beach shape and cliffs.	Two yearly	Co-ordinated by group
Cliff stability	Inclinometers and slope movement	Continuous	Local/ regional
Topographic survey	Survey covering foreshore areas.	yearly	strategy
	Local survey in front of defences at Filey	After storms / six monthly	local
Defence inspection	Visual inspection and record photographs of defences.	After storms/ annually	Local, feeding to NFCDD
Bathymetric survey	Corridor survey out to 10m CD contour.	Five yearly	Strategy
	Corridor survey out to 20m. CD contour, centred on bays along frontage.	10 yearly	Regional
Sea bed sediments	Side scan sonar and initial seismic profiling	Ten yearly	Regional

7.4.7 East Riding of Yorkshire Council (ERYC) (Flamborough)

The main issues relate to long term erosion rates of Flamborough, in particular in the area of Flamborough Head. As such there are no specific studies or investigations. The following monitoring is recommended.

Monitoring recommendations

ISSUES Uncertainty of cliff erosion rates. Condition of defences			
OBJECTIVES Establish erosion in key areas. Monitor condition of defences			
MONITORING	**SCOPE**	**FREQUENCY**	**SCALE**
Air photography	Long term background monitoring of the beach shape and cliffs.	Two yearly	Co-ordinated by group
Defence inspection	Visual inspection and record photographs of defences.	After storms/ two annually	Local, feeding to NFCDD

7.5 General

The above action plan is developed covering each coast protection authority area. Actions associated with the Environment Agency are identified within this. These areas tend to be around the flood risk areas adjacent to the Tees and Esk and would be developed in co-operation with the relevant CPA.

The Action Plan sets out in outline the requirements for studies, investigations and works, together with an identification of overall issues which need to be addressed through monitoring. Based on this, specific strategy and local monitoring needs will be developed in detail. This, together with the regional monitoring programme should be developed further through collaboration at the Coastal Group level. In particular, consideration needs to be given as to how monitoring results may be presented in a consistent format to allow regional information to be collated, exchanged, analysed and interpreted

Erosion and stability of both soft and hard cliffs is an issue common to much of the frontage. As further information is drawn together, there is the potential for this to provide improved understanding of these issues relevant to management of the UK coast in general. It is recommended, through the SMP2, that this necessary effort for local management is brought together as a centre of coastal research into these issues. Consideration should be given to how this can be developed through the valuable work being undertaken by the regional academic institutions and in co-operation with other areas of the UK with similar issues (such as the Isle of Wight, Dorset and the West Coast of Wales).

The Coastal Group should also be aware of national data collection relevant to their frontages on tidal levels, extreme water levels and wave climate. This national data set should be used to provide baseline context for the regional monitoring. This national data may be most appropriately collated through the Environment Agency, feeding information on these underlying processes in to the collation of regional monitoring managed by the Coastal Group.