7 Strategy Development

7.1 Overview

The main finding of the technical studies carried out within the Strategy development, is that Walney Island is ***not subject to imminent risk from breaching*** from erosion. Whilst current average erosion rates fluctuate along the west coast of the island, calculations from this study do not suggest recession any worse than up to one metre a year. In addition, key areas to the north and southern ends of the study frontage are healthy and relatively stable with beach accretion occurring at the distal ends of the island.

That said, there remains uncertainty regarding the timings of natural change on the island. The magnitude of fronting sand/shingle beach volumes along the study frontage is subject to a number of stresses including:

- A net loss of material from the system,
- wide variations in year on year wave / water level conditions which can result in increased erosion rates along un-defended cliffs and exacerbating "end effect" erosion where rock revetments currently exist e.g. at presently defended landfill sites

Paying due cognisance to the environmental importance and social pressures which present themselves, it is likely that in the medium term (i.e. strategy timeframe), managed realignment coupled with changing land use policy, is potentially a suitable approach. Improving flood forecasting and warning techniques, which are currently underway through the Environment Agency Tidal Triggers project, need to be tested, communicated and implemented in an effective way to ensure the impact of flooding to communities on Walney Island is reduced as much as possible. Issues including intervention in the form of flood re-routing techniques may need further consideration.

7.2 Introduction

This section of the report develops the strategy to a position where a 5 year programme can be proposed for improvements to the management of coastal defence on Walney Island. This covers the following:

- Appraisal approach adopted;
- The summary of preferred options and their prioritisation;
- Sensitivity testing;
- Strategy implementation;
- Future monitoring requirements.

In order to achieve this, a number of issues are resolved in the process enabling the following questions to be answered:

- What issues require addressing within each strategy unit (SU)?
- What is the appraisal process for the improvement options?
- What improvement options are to be examined in each SU (these should fall within the overall preferred strategy approach)?
- How sensitive and robust is the appraisal to changes in key factors e.g. costs, timing etc.
- Can the improvements be ranked by priority in order to produce an implementation programme?
- What (if any) ongoing monitoring is required to ensure the management approach is successful?
- What level of consultation needs to take place to communicate these issues?

The benefit-cost ratios of all appropriate options are considered and those with the highest benefit-cost ratio identified. In order to establish best value for money whilst achieving the most appropriate standard of protection, the next best option shall be considered if benefit cost ratios are marginal. Figure 7.1 (taken from FCDPAG3 Guidance Note for Economic Appraisal) clearly outlines the decision making process that needs to be adhered to.

The selection (initial preliminary options presented in tabular form in Appendix E, further appraised and summarised further in this section) seeks to:

- Eliminate unreasonable options (possibly presented as options in Appendix E).
- Establish 'Do Nothing Damages' and Option benefits, costs and benefit cost ratios.
- Identify the option with the highest benefit cost ratio.
- Identify if there are alternative options offering a higher level of service with an incremental BCR of greater than 3.0?

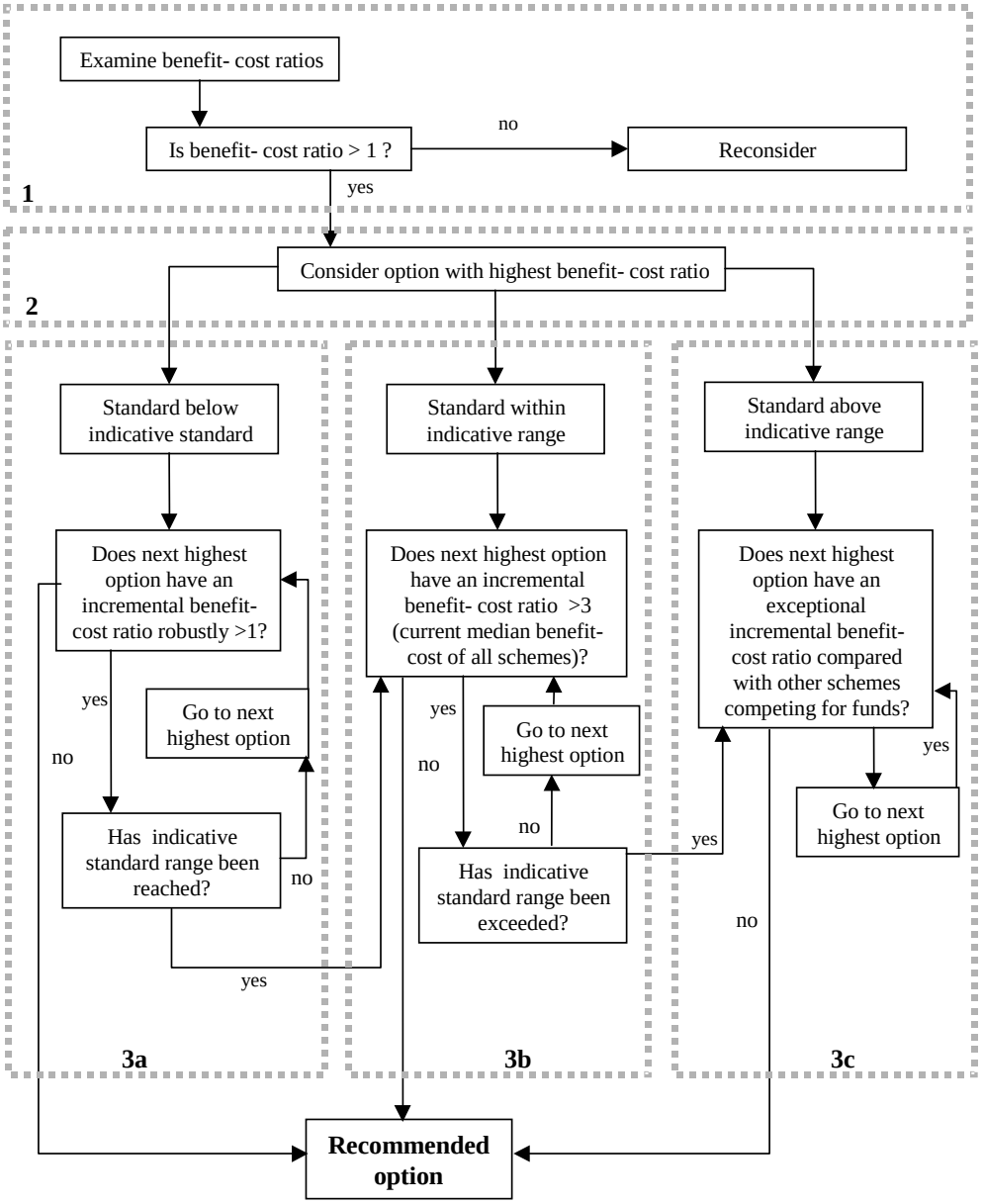

Figure 7.1 The Decision Process (from FCDPAG3)

7.3 Appraisal Approach

Tables E1 to E4 in Appendix E provide a breakdown of all the issues for each SU (based on the figures in Section 3). The tables also present generic and specific option possibilities for each SU.

Options are assessed under the following headings:

- Technical effectiveness from an engineering/coastal processes perspective.
- Environmental impact / benefit from both a 'natural' and 'human' perspective.
- Likely economic performance.
- How robust the option is to change / risks.
- Compliance with the preferred strategy approach (selective intervention) and Strategic Objectives.
- Establish Defra Priority Score.

In these assessment tables, a tick indicates that an option may comply with the criterion on which it is tested and a cross indicates that it does not comply.

The Preliminary Assessment carried out in Appendix E was completed in sufficient detail to eliminate options that are not realistic for Walney Island on technical or environmental grounds or are not economically feasible. A more detailed assessment is then applied to those short-listed options presented below to ensure that the preferred option is robust in economic and sustainability terms.

It is assumed that those options that do not pass the initial screening exercise (Appendix E) are not applicable along each frontage reviewed and thus are not considered further as part of this Strategy Plan. However, it is recommended that these should be revisited for future assessment when this Strategy Study is reviewed and updated in 2007/2008.

This approach brings in all consultation views collated during the project.

7.3.1 Technical Options

Technical options are tested, to assess whether they provide the following:

- An appropriate standard of coastal defence in relation to the assets at risk.
- Are technically feasible for the area proposed.
- That the options do not compromise the H&S responsibilities of Barrow Borough Council.

In assessing the options for management on Walney Island, consideration is given to the suitability of the defence location, for which there are three alternatives: advance, hold or retreat the existing line of defence. Advance is not considered on Walney Island on economic, environmental and technical grounds. An indication is given on whether a new spatial location of defences is required.

Appendix E denotes whether an option seeks to reduce the standard of service in an area, sustain the current standard of service through observing (with minimum additional intervention) the situation, maintain current defence standard (e.g. set back defences, but maintain the standard for the hinterland area) or upgrades a defence standard.

The definition of an option to *"sustain"* a defence include:

- Continue with natural/built defences *in situ* and maintain their contemporary features/position through minimal works;
- Regular inspections of foreshore and defence structure (i.e.: BRMS);
- Flood Warning schemes.

Options to *"maintain existing standard"* a defence include:

- Redesign the defence with a scheme of similar generic form (i.e. existing groyne length/orientation, spacing) though not raising its standard of service;
- Initiate beach recharge using volumes to supplement short term sediment loss (i.e.: no net gain of material to an area);
- Re-orientation of defences (setting back defences if necessary) without raising crest height levels.

Options to *"upgrade existing standard"* a defence include:

- Introducing schemes of a different generic form to that currently present.
- Raising crest heights on existing defences (walls, quays etc) to improve their standard of service;
- Construction of new defences (front or back line) where they currently do not exist;
- Annual beach recharge in excess of the annual net sediment budget loss from the system (net gain);

7.3.2 Environmental Considerations

The environmental considerations against which the options are tested are as follows:

- Effects of an option on the behaviour of coastal and geomorphological processes.
- Maintenance of the "favourable" status of key environmental habitats across the majority of the shoreline and incorporation of the requirements of the Habitats Regulations (Regulation 33 & 48) and the Wildlife and Countryside Act 1981.
- Ensuring that options selected are compatible with and where appropriate, contribute to the sustainable enhancement of habitats in the wider coastal cell.

If the overriding issue within a SU is to ensure Biodiversity Action Plan (BAP) targets are maintained, then generic options towards change (in terms of introducing / altering coastal defences or the prevailing coastal processes of an area) would not be preferred unless there is no choice other than to introduce soft engineering to protect assets and in unison, seek to sustain or encourage habitat growth. This approach is taken in an attempt to ensure a strategic management of issues is adhered to though without having to review an unmanageable number of options for each SU. In delivering this Strategy, BBC should have regard to the delivery of UKBAP through the achievement of biodiversity objectives through flood and coastal management policies and programmes, working increasingly with natural processes. As competent authority, the need for separate Appropriate Assessments may also be required as this is not undertaken for this Strategy Study. English Nature can advise on the scope of such a document.

7.3.3 Socio-Economic Considerations

The February 2002 storm surge event provides a good guide to the type of hazards that can be experienced on Walney Island. There are not thought to be many, if any, lives at risk due to flooding and coastal erosion in normal circumstances. On the whole, damages are limited to flooded fields and flood damage to a number of residential properties. For most inhabitants, perhaps the main issue is the risk of isolation and the need for flood warning g extreme events as well as the management of the event itself. As referred to in Figure 3.3, this particularly relates to Biggar and the southern end of Walney Island. The only possible exception to this is at the settlement of Tummer Hill where between 30 and 120 properties are potentially at flood risk from a 1 in 200 year (0.5% annual risk) surge depending on the approach accepted for analysis of the return period of extreme water levels (see Walney Island Coastal Management Study Stage 1 Report – Volume 1).

The economics of flooding (using FLAIR 1990) has been brought into the economic analysis. In addition, the economic consequences of allowing landfill sites to be eroded were assessed on the basis of using a proxy value for damages based on the cost of moving the landfill, which was assessed as of the order £30 per m^3, assuming a suitable disposal method / location was available within 25 miles.

Likewise, the economic consequences of the loss of highways (e.g. the road link to Biggar) are assessed based on the cost of replacing / re-routing the road rather than the 'write off' value of the properties affected. This will underestimate actual do-nothing damages, but is in line with FCDPAG3.

As discussed in section 4, future "with scheme" costs and damages were assessed using a variable discount rate ranging from 3.5% to 2.5% in line with current guidance from Defra (March 2003).

7.4 Summary of Proposed Works and Prioritisation

7.4.1 Strategy Unit 1

Table 7.1 Proposed Works and Prioritisation for SU1

Issue Addressed	Feasible Options & Lead Authority	BCR	Priority / Implementation Date	Success Indicators
Integrity of natural sea defence provided to mainland	Beach Response Management System (BRMS) ***(sustain)*** **Barrow BC / EN**	<1	Non critical - Implement in conjunction with the Regional Shoreline Monitoring Strategy for the North West coast. Separate Project Appraisal Report – PAR1 (section 7.9) Implement during second half of 2004.	Better understanding of coastal processes leading to improved management of dune system to the north.

BRMS can be justified on an island wide basis and aids understanding of coastal processes and associated beach management options thus reducing the risk of inappropriate management decisions being made.

7.4.2 Strategy Unit 2

Table 7.2 Proposed Works and Prioritisation for SU2

Issue Addressed	Feasible Options & Lead Authority	BCR	Priority / Implementation Date	Success Indicators
Erosion of landfill at airfield and Tummer Hill (Sandy Gap)	Beach management works ***(sustain)*** **Lead authority TBC**	<1	Non critical as landfill not at risk at present, but implement as part of island wide scheme. (separate Project Appraisal Report – PAR2 to determine managed realignment options associated with current landfill tip sites) (section 7.9) Implement during first half of 2005.	Monitoring coastline will ensure pollution risk is minimised.
Flooding and erosion at West Shore Park	Beach management works; modifications to defences or shoreline ***(maintain)*** **Barrow BC**		Yr 5-10. Feedback from monitoring required before action taken. (separate Project Appraisal Report – PAR1). (section 7.9)	Less frequent damage to assets. Feasibility study completed after collection of further data to establish action required.
Erosion of golf course land	Locally recycle beach material and/or maintain existing defences ***(maintain)*** **Golf course owners**		Yr 5-10. Feedback from monitoring (as set out in PAR1) (section 7.9) required before action taken.	Feasibility study completed after collection of further data to establish action required.
All above	BRMS ***(sustain)*** **Barrow BC**		Yr 0-5. Essential element of management of coastline. (separate Project Appraisal Report – PAR1). (section 7.9) Implement during second half of 2004	By success in addressing issues.

There may not be sufficient economic justification for any immediate coastal defence works in this unit. A key point is that this Strategy Study has assumed that the homes at West Shore Park are ultimately mobile (i.e. they can be moved). However, it is desirable to support the inhabitants of West Shore on social grounds and wider economic grounds (e.g. tourism). The golf club is identified as a key player in future coastal defence needs and any future intervention that will benefit the club alone will require private funding (not from Defra). On-going liaison with locally interested parties is vital and it is likely that assistance to self help groups is the best way forward for this SU, with 'beach health' information supplied to local people through monitoring (BRMS). Further studies are required to scope these proposals in more depth (e.g.: PAR's 1 and 2 mentioned above).

7.4.3 Strategy Unit 3

Issue Addressed	Feasible Options & Lead Authority	BCR	Priority / Implementation Date	Success Indicators
Erosion to frontage of car park at Bent Haw	Remove defences and set back parking ***(maintain)*** **Barrow BC**	1 - 5	Yr 5-10. Feedback from monitoring required before action taken. (see ref to PAR 1 and 2 in section 7.9).	Feasibility study completed after collection of further data to establish action required
Flood risk to agricultural land at Middle Hill, Cow Leys and South End	Set back existing defence line (coordinate some works with works to Biggar Dyke – see below) ***(maintain)*** **Barrow BC / EA / Cumbria CC**		Yr 0-5. Release existing defence material for use elsewhere. A study required to manage this process. (see ref to PAR 1 and 2 in section 7.9).	Flood risk managed appropriately by retired line bunds, existing rock defences possibly reused in landfill defences elsewhere
Erosion of landfill at Bent Haw	Remove landfill; beach management works; or linear defences ***(upgrade/remove)*** **Lead authority BBC**		Yr 0-5. Study required examining feasibility of moving landfill or best option to protect. (see ref to PAR 2 in Section 7.9)	Prevention of foreshore pollution.
Erosion of major landfill at Hillock Whins / Low Bank	Beach management works and/or modifications to linear defences ***(upgrade)*** **Cumbria CC**		Yr 0-5. Study required establishing best scheme to protect. (see ref to PAR 2 in Section 7.9)	Prevention of foreshore pollution.
Erosion south of Hare Hill	Remove existing defences; beach management works; linear defences; or improve groynes. ***(remove/sustain)*** **Barrow BC**		Yr 0-5. Study required establishing best option. (see ref to PAR's 1 and 2 in Section 7.9).	BRMS informing success of beach management works.
Erosion at Hilpsford Point	Remove existing defences; beach management works; linear defences; or improve groynes. ***(remove/sustain)*** **Barrow BC**		Yr 0-5. Study required establishing best option. This could be linked to PAR 2 as discussed in Section 7.9).	BRMS informing success of beach management works.
All above	BRMS ***(sustain)*** **Barrow BC**		Yr 0-5. Essential element of management of coastline. (see ref to PAR 1 in Section 7.9).	By success in addressing issues
Loss of access south of Biggar during flood events	Flood warning (FW) ***(upgrade)*** **Barrow BC / EA**		Yr 0-5 – see ref to PAR3 in Section 7.9.	Adequate warning provided to people to enable evacuation of vulnerable people if required
Breaching of Biggar Dyke and flood risk around Biggar	Allow bank to fail and improve road surface in combination with FW; improve current defence line and FW; or set back defence line to line of improved road from Bent Haw. Coordination with works at Middle Hill and Cow Leys is required. ***(upgrade)*** **Barrow BC / EA / Cumbria CC**		Yr 0-5. Consultation and feasibility study required to establish best way forward. (see ref to PAR3 in Section 7.9).	Improved FW and flood risk management. Selection of sustainable long term defence line for Walney Island.
Saltmarsh management	Possibly not a direct activity for EN, though overview of natural change should be monitored through BRMS ***(sustain)*** **EN**		Non critical but implement as part of island wide monitoring scheme (possibly linked to PAR 1 – see Section7.9)	Wide stakeholder agreement on best management practice and monitoring of salt marsh
Flood risk to Tummer Hill area	Flood embankment approx 1m high. Flood re-		Yr 3-10. Study required establishing level of flood	More reliable assessment and management of flood

Issue Addressed	Feasible Options & Lead Authority	BCR	Priority / Implementation Date	Success Indicators
	routing option may be required. ***(upgrade)*** **Barrow BC / EA**		risk, followed by consultation to establish best way forward. (see ref to PAR 2 and PAR 3 in Section 7.9).	risk.

Table 7.3 Proposed Works and Prioritisation for SU3

The range in benefit cost ratio stated reflects whether the landfill erosion and highway loss issues (Tummer Hill / Biggar road) are included in the analysis. When these issues are excluded, and are assumed to be managed by the relevant authorities as non coast defence issues, then the economic justification for intervention becomes marginal. Again, human / social issues support the case for providing support to the community, but this will have to be weighed against other national priorities if Defra support is sought. Local community action may be the best funding route for more marginal works.

With regard to the landfill at Bent Haw and Low Bank (South End Farm), a comparison of the per linear metre cost of either removing the landfill or providing linear revetment protection is informative. This is presented below:

Volume of material in Bent Haw	50,000m^3	Based on 2m depth of material
Length of landfill	220m	
Cost to dispose per m*	£7,000	
Volume of material in Low Bank **	1.2 million m^3	Based on 8m depth of material
Length of landfill **	750m	
Cost to dispose per m*	£50,000	
Cost of suitable linear revetment per m	< £1,000	

*based on £30 per m^3 disposal cost. ** Full frontage not examined, only northern length most at risk.

The costs emphasise that protecting the landfill is likely to be the preferred option. In addition, the relevant authority (Cumbria County Council) has indicated that alternative disposal for this volume of waste does not presently exist. Guidance is currently being sought from English Nature regarding their view on the acceptability of a long term hold the line policy to the landfill sites. A separate study (PAR 2) is proposed to review this issue in more detail and it is proposed that English Nature, EA and Cumbria CC will all be consulted (see Section 7.8).

7.4.4 Strategy Unit 4

Table 7.4 Proposed Works and Prioritisation for SU4

Issue Addressed	Feasible Options & Lead Authority	BCR	Priority / Implementation Date	Success Indicators
Flood risk north of Jubilee Bridge	Flood warning; flood proofing property at risk; providing safe access; monitoring, maintaining and renewing assets. ***(sustain)*** **Barrow BC / EA / Property owners**	Approx 1	Yr 0-5 (see PAR 3 in Section 7.9)	Flood awareness improvement and reduction in flood damages from events. Identification and provision of safe access/egress during flood events
Erosion of the Promenade due to failing revetment	Monitoring, heavy maintenance or replacement of revetment. ***(maintain)*** **Cumbria CC**		Yr 10 – 20. No immediate need, but revetment is life expired and will need to be replaced (not necessarily like for like) at some point. (see PAR 3 in Section 7.9)	Continuous awareness of condition.
Cliff erosion/failure at North Scale	Maintenance and possible extension to toe of coastal slope. Precise requirements to be established by study. Monitoring also required. ***(upgrade)*** **Barrow BC**		Yr 5-10. Action may follow on from studies if risk is deemed significant. (see PAR 1 in Section 7.9)	Better understanding of potential risk. Action taken as appropriate.

Although several properties along the Promenade are at relatively high risk of flooding on a regular basis, it is not economically justifiable to provide traditional flood protection as this would require a new flood defence over 1m high to be constructed along the full length of the Promenade. Therefore, specific flood proofing measures need to be adopted at individual properties to limit flood damage when an event occurs. Adequate flood warning is important for successful use of flood proofing measures. However, when the existing structure protecting the Promenade from tidal scour is replaced then it may be feasible to reduce flood risk for relatively low additional expense.

The regular flooding of the Promenade does create a further issue for the local population: access / egress from the housing area north of Jubilee Bridge is lost during such events. Safe access / egress should be established and included within any flood management planning by the relevant authorities (the Environment Agency and Barrow Borough Council). This issue can be addressed in the proposed PAR3 (see Section 7.8).

7.5 Sensitivity Assessment and Robustness Testing

FCDPAG3 recommends the use of sensitivity analysis and robustness testing to determine the confidence of the preferred option against the various assumptions made. Due to the nature of the recommendations being put forward, a full sensitivity analysis is not warranted for Walney Island. The more detailed Project Appraisal Reports (PAR), proposed as follow on projects from this Strategy Study, will be the more appropriate vehicle to assess cost sensitivities. The main concerns, at a strategic level, relate to how much certainty can be placed on the data used to formulate this Strategy, when the island will be breached and the implications of future management of the landfill tip sites.

To this end, and to ensure that the recommendations made are “robust”, the sensitivity to change of certain factors has been examined, determining whether the decisions made regarding the preferred options remain correct. Assumptions are therefore considered relating to two key areas of uncertainty: natural risk factors and economic changes. These are now discussed.

The timing of expenditure and damages could also be regarded as a key risk factor, but the relatively low discount rate now adopted by Defra (3.5%) means sensitivities over timing are less important than other issues presented below.

7.5.1 Natural Risk Factors

In our assessment of sensitive issues, the following questions are included for discussion:

- How much reliability can be placed on the current knowledge of coastal processes to formulate a robust "sediment friendly" policy for Walney Island? (Natural Risk Factor 1)
- What will be the long-term effects of sea level rise and subsequent changes to coastal dynamics? (Natural Risk Factor 2).
- How are environmental habitats likely to change long term? (Natural Risk Factor 3).

Natural Risk Factor 1

Appendix D acknowledges that there is inherent uncertainty within coastal process related studies. Increased wave energy will strike the west coast of Walney Island if nearshore water depths increase and as a result, shoreline erosion rates along the west coast of Walney Island are likely to increase. The uncertainty is by how much. Best estimates for this study indicate a rate of beach lowering of the order 3 - 10mm per annum. It cannot be stated with certainty whether this trend will continue. In relation to tidal cycles, during the 1990's a period of higher peak tidal water levels was experienced around the Britain (peak water levels increased by 20-25mm pa). This may provide some part of the explanation for evidence of increased shoreline erosion rates during this period. Appendix G covers the uncertainties in data compilation and analysis carried out for this study in more detail.

Natural Risk Factor 2

Sea levels in North-West England are dominated by a global rise in sea level trend accompanied by isostatic uplift as a result of readjustment to de-glaciation that followed the last ice age. The UK Climate Change Scenarios (UKCIP02 Scientific Report) published in April 2002, suggests a net sea level rise of between 7cm and 67cm by 2080 for NW England (1-9mm pa), taking into account a 0.2mm/yr isostatic uplift rate. Current best practice is to allow for a 4mm pa increase (Defra's FCDPAG3 and HR Wallingford 2002).

A further effect associated with the processes discussed above, is that of increased vulnerability of low lying areas to overtopping and flooding, leading to more frequent linkage of the east and west coasts during storms. Particularly vulnerable areas include around South End Haws, Pho Hill and Rape Haw and between Biggar Bank, Hillock Whins, Biggar Village and Long Rein Point. Inundation (as a result of varying erosion rates predicted) may fluctuate in the short term from those quoted in this Strategy, but the long term overall trend will remain as predicted.

Natural Risk Factor 3

There are various factors influencing the long-term evolutionary succession of the key habitats around Walney Island, though above all, the impact of engineering works is seen as the most deleterious. Nevertheless, the natural risk of these habitats not being able to adapt to changing natural climates and sea level rise events, is likely to be directly linked to the space available for habitats to retreat/adapt into. The current ad-hoc defence frontage along the west coast of Walney coupled with natural net loss through erosion represents a significant challenge for Biodiversity Actions Plans, as maintaining a strategy of "no net habitat loss" relies on appropriate shoreline protection, suitable mitigation measures and if possible, enhancement opportunities to encourage habitat growth. Inevitably, coastal vegetation extent will change along this volatile frontage, though the strategy of managed realignment presents the most environmentally sensitive approach for the west coast (except for where landfill tip defences occur) in the short term and the one that brings the best opportunities for enhancement for vegetated shingle colonies. How this policy is actually implemented needs further attention (see PAR 2 in section 7.8). This sensitivity test is highly qualitative and dovetails all sensitivity tests presented. A separate numerical test is not proposed here. Further assessments are included in Appendix C.

7.5.2 Socio-Economic Risk Factors

In our assessment of sensitive issues, the following are included as sub headings:

The economic viability of Walney Island (Economic Risk Factor 1)

In order to ascertain agricultural land values, Atkins approached local land agents to gain the most recent land sale information. At that time, no recent sales had taken place and so there is uncertainty over the true saleable value of agricultural land on the island.

Standard damage databases were used to assess flood damage to residential and commercial property. Given the strategic level of the study, no 'on the ground' assessments were made regarding the type of housing, exact number and consequentially, the magnitude of the flood damages requires refinement for any coastal / flood defence scheme to be promoted. Properties were also grouped together in terms of flood risk.

Whilst the work does not show significant property "write off" for the do nothing scenario, it is useful to interpret likely future trends in Barrow (and thus Walney) from historical data, as shown in Figure 7.2 below. The figure highlights the recent national trend of increasing house valuations, albeit it with, on average, relatively low house prices.

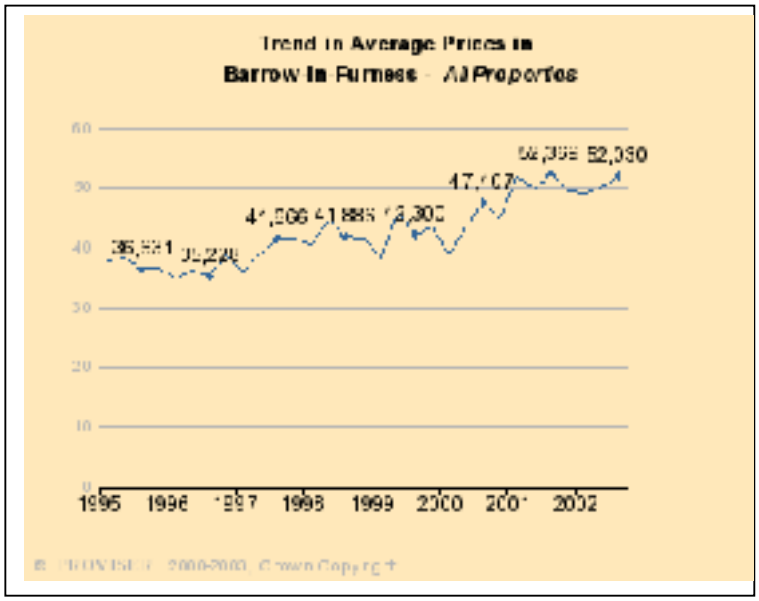

Figure 7.2 Trend in House Prices for Barrow in Furness.

Future changes in recreational patterns and the tourist trade for Walney and Barrow may influence the benefit values generated. In terms of future regional planning high level targets for the area and long term planning objectives for this part of Cumbria, there is a strong emphasis on promoting alternative sources of income and thus to promote and encourage the tourist industry to develop. It is probable that benefits presented for this study provide an underestimation of the "potential" recreational and tourism benefits that may apply on Walney Island (caravan parks etc) in the coming years, but further study on this here is not warranted as its inclusion would only change the detail and not the thrust of the findings of this study. If approved, the detailed feasibility studies recommended should include an appraisal of the significance of this issue.

7.6 Monitoring

It is important that long-term high quality monitoring data are available so that policy decisions are based on up-to-date and reliable information. Monitoring provides a level of data against which future comparisons can be made and changes in form can be identified. Furthermore, coastal monitoring allows operating authorities to understand coastal change better and to predict future evolution more reliably. As such, shoreline monitoring should be an ongoing process.

As the awareness of coast protection and flooding issues increases among the general public, coastal defence measures are being placed under increased scrutiny. Equally, it is becoming increasingly important that detailed historical geomorphological data exists on coastal environments so that accurate coastal strategy decisions can be realised. Recent Defra research work (Future Coast – Halcrow 2002) has been finalised to improve this understanding.

The Strategy has identified a requirement to develop a more robust coastal monitoring programme. This is because the current approach on Walney Island, whilst producing some useful information, is not focussed enough and in places is considered to have provided unreliable data. This has inevitably led to some conclusions being reached that have a greater level of uncertainty associated with them than might otherwise be the case. It is therefore recognised that ongoing local programmes need to be better coordinated and integrated into a more structured monitoring approach to maximise use of data and to provide best value.

Appendix F presents a review of current data collection practices on Walney Island, the need for robust monitoring, the types of approaches possible (indicating the advantages of developing a strategic monitoring programme, such as a Beach Response Management System (BRMS) on both a local and regional basis), future research needs and overall conclusions. Throughout, it should be recognised that the aims of coastal monitoring are ultimately to:

- Promote a standard, repeatable and cost-effective method of monitoring.
- Integrate the monitoring requirements of SMP's, coastal strategies, regional programmes and individual schemes.

Proposed future monitoring arrangements for Walney Island (that need to be addressed as part of a separate PAR 1 – see Section 7.8) could include the following elements:

- Beach Profiles and Topographic Surveys.
- Offshore Bathymetry / Hydrographic Surveys.
- Saltmarsh Monitoring.
- Environmental Habitat Monitoring e.g. vegetated shingle.
- Link to the Port of Barrow to ensure water level data is collated and reviewed.

An experience sheet describing the successful implementation of BRMS elsewhere in the UK is presented in Appendix F.

It is acknowledged that the proposals for a Regional Monitoring Strategy for the north west coast is underway. BRMS is proposed to complement this larger monitoring initiative.

7.7 Flood Warning, Post Event Appraisal and Emergency Planning

Flood warning during the February 2002 event was poor on Walney Island with limited coordinated pre-event or post-event assistance from the Environment Agency. Historically, local residents have relied more on local radio than flood warnings from EA. It is recommended that flood warning and post-event appraisal issues are more closely managed in future, partly through BRMS and better coordination with the Agency (e.g. Tidal Triggers project).

A preliminary assessment of flood forecasting needs for Walney Island has been undertaken by the Agency as part of the Tidal Triggers project. The intention was to use real time data in the winter of 2002 to help formulate a coherent flood forecasting strategy for the island. Surge/wave conditions data are used to predict events such as overtopping/overflow, risk of breach and/or damage in many areas. The details have not been reviewed during this study and so comment cannot be made on its validity, but future close liaison between the relevant authorities will be required to ensure maximum benefit is achieved.

Emergency planning could also be improved. BBC should consider generating an emergency flood plan for tidal flooding. This would ensure that circumstances during flood events are managed effectively and proactively as well as reactively (as present). Such a plan would encourage links with other relevant authorities (the Agency, County Council and emergency services), ensure effective use of resource and could encompass flood warning mechanisms and emergency access issues. This could include the production of an island wide topographic model (Digital Terrain Model) would aid visualising flood risk. The use of marker posts that supportive local residents could be used as a means of reporting flood event information back to the council, thus allowing adjustment of emergency planning and existing estimates for flood risk. It is recommended that this is addressed as part of a separate PAR 3 (see Section 7.8) which importantly can be delivered quickly to respond to local needs.

7.8 Defra Priority Scores

LDW14 forms have been prepared for the recommended approach in this Strategy. A score is derived for each site and all SU's of Walney Island combined. For information regarding the calculation of the Defra Priority Score refer to Appendix J.

A sensitivity analysis for the Defra Priority Score has been undertaken and includes consideration of:
- increase of the costs,
- decrease of the benefits,
- decrease in the number of residential properties benefiting from the scheme,
- area of SSSI and other rural designations protected against pollution.

The Defra Priority Score for the whole of Walney Island is in between 16.2 and 19.7.

Priority Score Thresholds are currently set as follows:

2004-05[1]	2005-06[1]	2006-07[2]
20	19	19

[1]Firm threshold, not subject to further change
[2]*Indicative* thresholds, subject to possible change in October 2005.

For this Strategy Study, the following scores have been calculated for the four main SU's covering the island. An island wide score is provided for cross comparison and is of particular significance for certain recommendations being put forward. Due to the intrinsic links between the natural assets of the island, its strategic importance as a "defence buffer" to the mainland and the disparate nature of settlements and communication links between settlements on the island, the decision to score each SU reflects the importance of a regional approach to future shoreline and flood management for Walney Island. De-compartmentalising the island for scoring purposes is not deemed appropriate.

7.8.1 Economic Score

The input is the Benefit / cost ratio out of the Economic Appraisal: (see Appendix H):

- SU1 BCR = 0
- SU2 BCR = 0.26
- SU3 BCR = 2.91
- SU4 BCR = 0.68

- Whole of Walney Island BCR = 2.22

7.8.2 People Score

Properties at Risk
The number of residential properties which have their risk of flooding or loss through erosion significantly reduced by the proposed project is used. The residential properties that only benefit by the proposed scheme through assurance of emergency services access are not included in the analysis.

There are between 30 and 120 properties in Tummer Hill (SU3) which will have their flooding risk significantly reduced. For the analysis, 75 properties are selected for analysis. In SU4 there are 9 properties at risk of flooding at Jubilee Bridge. This results in the following input for the Priority Score calculation :

- SU1,
- SU2: 0 properties
- SU3: 75 properties
- SU4: 9 properties

- Whole Walney Island: 84 properties

Scheme cost

The scheme whole life costs follow out of the Economic Appraisal: (see Appendix H)
- SU1: £79k
- SU2: £264k
- SU3: £2315k
- SU4: £588k

- Whole Walney Island costs: £3245k

Public safety mitigated
The pre-scheme situation is not thought to be high risk. Therefore there is no adjustment for public safety mitigated.

Vulnerability of people ranking

From the website link http://neighbourhood.statistics.gov.uk , it follows that there are two ranks given for Walney Island: one for Walney Island North and one for Walney Island South. Both scores result into an adjustment of one point for the People Score. A figure of 689 is calculated as being appropriate to be used for each SU.

7.8.3 Environment Score

SSSI protected
The monitoring and the protection from pollution of the possibly contaminated landfill sites are necessary to maintain the integrity of the SSSI surrounding Walney Island. The website Magic.gov.uk shows the extent of the area designated as SSSI.

- SU1: 600ha
- SU2: 253ha
- SU3: 326ha
- SU4: 150ha

- Whole Walney Island: 1329ha

Other designated area protected
The website www.magic.gov.uk shows the extent of all rural designated areas. The designations include Ramsar site amongst others.
- SU1: 300ha
- SU2: 253ha
- SU3: 300ha
- SU4: 150ha

- Whole Walney Island: 1003h

National BAP habitat area gain
There is potential habitat growth on the east coast, such as wet grazing marsh from increased flooding on the west coast (area unknown). Due to uncertainty over amounts of habitat creation linked to schemes, the decision is made to not include figures in this analysis.

7.8.4 Sensitivity Analysis on Defra Priority score

Sensitivity	Action	Priority Score (whole of Walney Island)
Economic Score	Benefits reduced by 50%	16.2
	Costs increased by 20%	17.3
	Costs reduced by 20%	19.7
People Score	Number of residential properties benefiting from the scheme = 30	19.4
	Number of residential properties benefiting from scheme = 129	19.4
Environment Score	SSSI protected area reduced by 50%	18.4
	Other designated protected area reduced by 50%	18.4

Table 7.5 Defra Priority Score Sensitivity Analysis

7.9 Summary and Implementation of Strategy

It is proposed that to take forward the recommendations of this Strategy and to embark on appropriate implementation measures, the following actions are required during the second half of 2004 and beyond.

7.9.1 PAR 1 – Beach Response Management System (BRMS).

The preparation of a structured long term monitoring programme is vital to being able to deliver sustainable shoreline management options for the future of Walney Island. Whilst monitoring currently takes place, and whilst it is acknowledged that the Cell 11 Coastal Groups are seeking to embark on a Regional Monitoring Strategy, a data management system that provides advice specifically for Walney Island is required. PAR1 will complement the Regional Monitoring Strategy being proposed though shall assist BBC in being able to identify priority areas for action with a strategic view to the results being of value to assisting policy decision making for PAR's 2 and 3 (see below). The results will also be disseminated easily to key stakeholders in agreed formats to enable robust decisions to be made on longer term strategic policies for the island. PAR 1 will be scoped to help Barrow BC identify (amongst others) the following :

- Availability of local recycling material to maintain beach levels at critical locations (plus over time provide estimates as to the long term availability of this resource).
- Re-use of existing defence materials (e.g.: rock from Earnse Point "T" shaped groyne).
- Whether material could be resourced from foreshore or hinterland (suitable extraction sites). From this, ideas on timings of operations, impacts on "borrow" and "recipient" sites can then be deduced.
- Implications of removing the timber groyne at Hilpsford Point.
- Need for Appropriate Assessment and other consents (FEPA, Coast Protection Act approvals etc) should sediment recycling be seen as a possible future option.

It is proposed that BBC are the lead authority for PAR1 (with Defra grant aid).

7.9.2 PAR 2 – Managed Realignment Implementation

Building upon information created from PAR 1 on an annual basis and the Regional Monitoring Strategy (currently being proposed), a second PAR is urgently required to determine the long term strategy for the landfill tip site defences at Bent Haw and Low Bank in particular. The Strategy Study to date has not been able to determine the potential contamination issues associated with relocating the contents of the tips, and from this, coupled with more robust topographic surveying in the hinterland area, a clearer action plan for how implementing selective or total managed realignment can be achieved. PAR2 is a key report that will require topographic and geotechnical investigations, the potential development of an island wide digital elevation terrain model and based on these results, proposals for redefining a 2050 "defence line" that will be acceptable to all Walney Island stakeholders. A separate Appropriate Assessment may be required in addition to the above which will need to be complemented with planning permission, FEPA licence and Coast Protection Act approvals etc. Guidance from English Nature and other stakeholders may be sought on determining future contents.

PAR2 should be led by BBC as the historic waste disposal sites (Bent Haw, Biggar Bank and north of the recent County Council tip site) are the responsibility of BBC and not Cumbria County Council.

7.9.3 PAR 3 – Tummer Hill, Middle Hill and Biggar Village Community Flood Risk Assessment

Following on from the preparation and implementation of PAR1 and findings presented in PAR2, a third PAR is proposed that will focus specifically on flood risk assessment and awareness for all residential settlements of Walney (SU2, SU3 and SU4 grouped together). This will include future flood mitigation measures for Tummer Hill and Middle Hill, Biggar Village, access issues to the south of the island and properties adjacent to Jubilee Bridge at Vickerstown. A clear statement on appropriate actions to mitigate against flood risk and seek to reduce flood risk and access route problems to the south will be ascertained and founded on sound scientific data derived from PAR1 and strategic long term defence options derived from PAR 2.

PAR3 needs to be a joint responsibility between the Environment Agency, BBC and Cumbria County Council. Figure 7.2 shows the implications of the current Strategy in terms of the management of the Walney Island coastline from 2004. Table 7.5 outlines a proposed approach for the implementation of the Strategy.

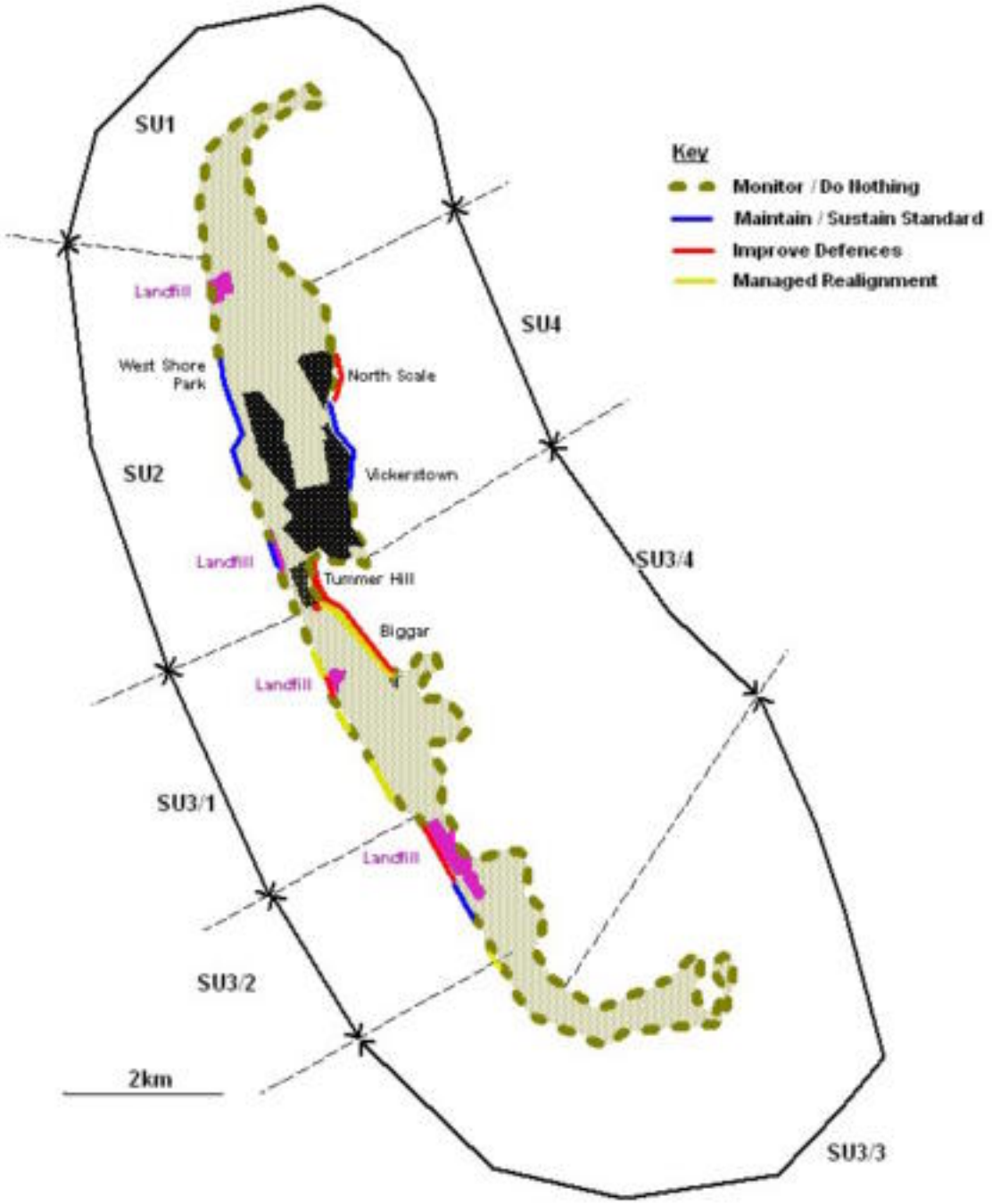

Figure 7.2 Proposed Management of Walney Island's Coastline

Walney Island Coastal Management Strategy Study Implementation Programme	Issue No	2
	Date	June 2004

Task ID	Task	Financial Year & Quarter																						Indicative Costs £k	
		2004/2005				2005/2006				2006/2007				2007/2008				2008/2009				2009/2010				One off	Annual
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd			
A	**Communication on Final Strategy Plan**																										
1	Key stakeholder consultation on Strategy Plan Recommendations																										
2	Consultation with Environment Agency																									2	
3	Finalise strategy / Defra Acceptance			X																							
B	**PAR 1 - BRMS**																										
1	Prepare PAR 1 (outline manual and set up to complement Regional Monitoring Strategy)																									15	
2	Implement (in conjunction with Regional Monitoring Exercise)																										10
3	Review findings (annual reports)										X				X				X				X				10
4	Appropriate Assessment					X																				15	
C	**PAR 2 - Managed Realignment Implementation ad Landfill Tip Management**																										
1	Feasibility PAR (Scoping Document)																									20	
2	Topographic Survey of tip areas and hinterland.																									40	
3	Geotechnical Analysis of tip sites.																									100	2
4	Defence options for Bent Haw and Cross Lane.									X	Depending on level of risk															70	1
5	Managed realignment works.													X	(Depending on PAR1 results)											500	2
6	Appropriate Assessment											X														10	
	PAR 3 - Tummer Hill, Middle Hill and Biggar Village Community Flood Risk																										
1	Advice to property owners (private and commercial) on flood proofing / risk.														dependent upon outcome of PAR2)											15	
2	Develop links with key authorities and generate flood warning plan (link to PARs 1 and 2)																									25	
4	Develop links with key authorities and generate flood emergency plan (link to PARs 1 and 2)																									25	
5	Improved engineering works to reduce flood risk																									500	
	Review of Strategy Plan																		X							20	
																										£ 1,337	**£ 30**
	Cost per Financial Year (k) excludes capital costs				32				220				85				20				40						

X Key Deliverable

Summary per FY	2004/5				2005/6				2006/7				2007/8				2008/9			
PAR 1				12				30				20				20				20
PAR2 (excluding captial costs)				40				195				10								
PAR3 (excluding capital costs)												65								
Totals				**32**				**225**				**95**				**20**				**20**

Table 7.6 Strategy Implementation Programme
(Note – potential lead authorities are indicated in Tables 7.1 to 7.4)

It should be emphasised that the successful implementation of this Strategy depends on partnership between public authorities and key stakeholders. It should also be stressed that there is a need to consider future management on an island wide basis, as there is strong linkage between east and west coasts, particularly south of Tummer Hill (SU3). For this reason, PAR's 1,2 and 3 are of island wide significance.

The Strategy does not fully cover the potential implications of more remote interventions, such as low water channel changes in the Leven, alterations to the road crossing in the Duddon, or dredging issues linked to the Port of Barrow. BBC need to be able to seek reassurance from stakeholders that should any development occur on these aspects, that such actions will not be deleterious to the preferred strategy presented within this report.