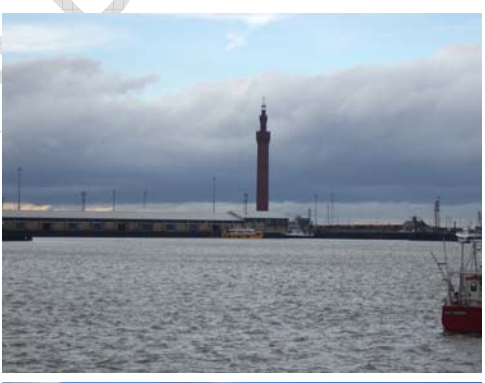


Humber Estuary Coastal Authorities Group Flamborough Head to Gibraltar Point Shoreline Management Plan

Appendix H – Economic Appraisal

Consultation Draft

November 2009



Prepared for
Humber Estuary Coastal Authorities Group

Revision Schedule

Flamborough Head to Gibraltar Point Shoreline Management Plan Appendix H – Economic Appraisal November 2009

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Table of Contents

H1	Introduction	2
H2	Methodology	3
H3	Appraisal	5
	Policy Unit A – Flamborough Head to Sewerby	5
	Policy Unit B – Bridlington to Hilderthorpe.....	5
	Policy Unit C – Wilsthorpe to Atwick.....	6
	Policy Unit D – North Cliff to Hornsea Burton (Hornsea).....	6
	Policy Unit E – Rolston to Waxholme	8
	Policy Unit F – Owthorne to Hollym (Withernsea)	9
	Policy Unit G – Hollym to Dimlington Cliffs.....	10
	Policy Unit H – Dimlington and Easington Gas Terminals.....	10
	Policy Unit I – Easington to Kilnsea.....	11
	Policy Unit J – Kilnsea to Spurn Point	12
	Policy Unit K – Easington Road to Stone Creek	12
	Policy Unit L – East Immingham to Cleethorpes	13
	Policy Unit M – Humberston Fitties	14
	Policy Unit N – South of Humberston Fitties to Theddlethorpe St Helen	15
	Policy Unit O – Viking Gas Terminal (Mablethorpe) to southern end of Skegness.....	16
	Policy Unit P – Seacroft to Gibraltar Point.....	16
H4	Summary	18
H5	References	19

H1 Introduction

- H1.1 The Shoreline Management Plan guidance (Defra, 2006) requires that proposed policy scenarios are robust against a range of criteria. Task 3.4 sets out to confirm the robustness of preferred policy scenarios through two activities:
- a. Sensitivity testing: Identify uncertainties in key variables and potential impacts on the preferred policy scenario;
 - b. Socio-economic assessment: consider costs/benefits also cumulative human and natural implications for the preferred policy scenario.
- H1.2 This appendix addresses the robustness of the preferred policies through Task 3.4b, the socio-economic assessment, only.
- H1.3 The socio-economic assessment uses broad scale information on the cost of existing defences and assets protected in order to determine if the preferred policy for each policy unit is:
- Clearly economically viable;
 - Clearly not economically viable; or
 - Of marginal viability.
- H1.4 Economic viability does not justify the selection of a particular policy, as non-quantifiable criteria such as environmental issues and adjacent policies must also be considered. However, it does assist in confirming the overall robustness of the selected policy.

H2 Methodology

- H2.1 Economic appraisal of the SMP is carried out using Defra’s Flood and Coastal Defence Project Appraisal Guidance Note 3: Economic Assessment (FCDPAG3). FCDPAG3 sets out the basis for calculation of whole life costs, discounting future costs, as well as outlining what benefits can be included in the economic appraisal. Benefit cost ratios are then calculated on the cost of the policy implementation and the benefits received from the policy over the “No Active Intervention” scenario.
- H2.2 Where Benefit / Cost ratios are greater than 1 the benefits received from the implementation of the policy are greater than the cost of the defences required; therefore the scheme is economically viable. Where Benefit / Cost ratios are less than 1 the cost of the policy implementation is less than the cost of the defences required; therefore the scheme is not economically viable.
- H2.3 The economic appraisal is based on the best available information for each Policy Unit. The appraisal uses two approaches depending on the availability of suitably detailed information:
1. In many areas existing strategies have undertaken an economic analysis using FCDPAG3 for sections of the coastline. In such cases, the information has been reviewed and details of the outcomes in relation to the draft preferred policies are presented.
 2. Where no previous economic analysis has been performed a strategic economic assessment has been undertaken using FCDPAG3. Defence costs have been estimated and assessed against the potential benefits of readily identifiable assets, such as residential properties. This method is used to determine only if the Policy is economically viable (has a cost benefit ratio greater than 1) or is not economically viable.
- H2.4 For method 2, where required, coastal defence capital and maintenance costs have been built up using the typical defence costs as outlined in Appendix C of the SMP Guidance (Defra 2006), see Table 2.1 for a summary. Benefits have been generated based on readily identifiable assets, predominantly residential properties. Property values have been obtained from the National Properties Dataset, corrected to present day values using appropriate index values. Where property values are not available, a conservative property value has been estimated.

Table 2.1: Defence Capital and Maintenance Costs (Defra, 2006)

Defence Type	Lifetime (Years)	Capital Costs (£/km)	Maintenance Costs (£/km/yr)
Revetment	100	2,700,000	10,000
Seawall	100	2,700,000	10,000
Beach Management Scheme	50	5,100,000	20,000
Groynes	30	600,000	10,000

- H2.5 Additional details on the application of method 2 on individual Policy Units are contained within the Policy Unit assessments in Section H3.

- H2.6 Where a number of future policies may be implemented, the highest cost policy has been assumed for the economic analysis.

CONSULTATION DRAFT

H3 Appraisal

Policy Unit A – Flamborough Head to Sewerby

- H3.1 The Draft Preferred Policy for Policy Unit A is “No Active Intervention” for all epochs (Present to 2105).
- H3.2 This policy has no costs associated with its implementation and therefore is clearly economically viable. However, it should be noted that losses to assets may occur during the lifetime of the SMP.

Policy Unit B – Bridlington to Hilderthorpe

- H3.3 The Draft Preferred Policy for Policy Unit B is “Hold The Line”. For this Policy Unit this also includes maintaining the current standard of protection over all epochs (Present to 2105).
- H3.4 Maintaining the standard of protection over the lifetime of the SMP has both maintenance and capital costs associated with the implementation of the Policy.
- H3.5 The “Review of Bridlington Coastal Defence Strategy Update” (Posford Haskoning, 2005) has undertaken a review of potential options for protecting Bridlington at Strategy level. A number of options were assessed to determine the most economic solution for maintaining the defences over a 100 Year period. The defences focused on in the strategy update covered approximately 20% of the Bridlington frontage. For the purpose of the SMP it is assumed that similar cost benefit ratios would be achieved for schemes which extended along the entire frontage.
- H3.6 The economic assessment of the Bridlington frontage was undertaken in two sections; a variety of options were provided for the Royal Princess Parade (Table 3.1) and an option for the Spa Promenade (Table 3.2).

Table 3.1: Bridlington Strategy Economics - Royal Princess Parade including works to Harbour Road (Reproduced from Posford Haskoning, 2005)

Option	PV Costs (£)	PV Benefits (£)			Benefit Cost Ratio (Tangible Benefits Only)	Benefit Cost Ratio (All Benefits)
		Tangible Benefits	Intangible Benefits	Total PV Benefits		
Rock Breakwater	1,592,000	3,620,000	19,942,000	23,563,000	2.27	14.80
Reinforced Concrete Toe	939,000	3,620,000	19,942,000	23,563,000	3.86	25.09
Rock Armour Toe	563,000	3,620,000	19,942,000	23,563,000	6.43	41.81

Table 3.2: Bridlington Strategy Economics - Spa Promenade (Reproduced from Posford Haskoning, 2005)

Option	PV Costs (£)	PV Benefits (£)			Benefit Cost Ratio (Tangible Benefits Only)	Benefit Cost Ratio (All Benefits)
		Tangible Benefits	Intangible Benefits	Total PV Benefits		
Concrete Seawall Encasement	596,000	9,432,000	20,053,000	29,485,000	15.82	49.47

- H3.7 The Posford Haskoning (2005) Report included an analysis of “Intangible Benefits”. These benefits are derived from income figures from visitors to the frontage. These figures may not be typically included in economic analysis as they are considered as “Transfer Payments”.
- H3.8 For the SMP economic analysis the two sections (Royal Princess Parade and Spa Promenade) have been combined to provide a total analysis for the 20% of the frontage covered by the strategy (Table 3.3).

Table 3.3: Economic analysis for Bridlington

Option	PV Costs (£)	PV Benefits (£)			Benefit / Cost Ratio (Tangible Benefits Only)	Benefit / Cost Ratio (All Benefits)
		Tangible Benefits	Intangible Benefits	Total PV Benefits		
Rock Breakwater + Spa Promenade	2,188,000	13,052,000	39,995,000	53,047,000	5.96	24.24
Reinforced Concrete Toe + Spa Promenade	1,535,000	13,052,000	39,995,000	53,047,000	8.50	34.56
Rock Armour Toe + Spa Promenade	1,159,000	13,052,000	39,995,000	53,047,000	11.26	46.77

- H3.9 The table above shows that the economics for the protection of Bridlington have Benefit / Cost Ratios in excess of 5 for all options, even when excluding the “Intangible Benefits”.
- H3.10 This analysis covers only 20% of the Bridlington frontage. Assuming that no further benefits were accrued, but defence costs along the frontage were similar (i.e. they were 5 times that currently included in the analysis), then the Benefit / Cost ratio would remain greater than 1.
- H3.11 The Preferred Policy for Policy Unit B is therefore clearly economically viable.

Policy Unit C – Wilsthorpe to Atwick

- H3.12 The Draft Preferred Policy for Policy Unit C is “No Active Intervention” for all epochs (Present to 2105), with the exception of works to maintain the outfall at Barmston Drain.
- H3.13 This policy has no costs associated with its implementation and therefore is clearly economically viable. However, it should be noted that losses to assets may occur during the lifetime of the SMP.
- H3.14 Works to Barmston Drain should be appraised at Project Appraisal Report (PAR) level to ensure that the proposed options are suitable and economically justified.

Policy Unit D – North Cliff to Hornsea Burton (Hornsea)

- H3.15 The Draft Preferred Policy for Policy Unit D is “Hold The Line”. For this Policy Unit this also includes maintaining the standard of protection over all epochs (Present to 2105).
- H3.16 Maintaining the standard of protection over the lifetime of the SMP has both maintenance and capital costs associated with the implementation of the Policy.

H3.17 The defences at Hornsea consist of promenade and seawall, with sections of the seawall protected with rock toe armour. The entire length is also fronted with groynes to stabilise the beach. Lengths and costs (from Table 2.1) of the defences at Hornsea are summarised in Table 3.4.

Table 3.4: Hornsea Defence Costs

Defence Type	Length (km)	Capital Costs (£)	Maintenance Costs (£/yr)
Seawall/Promenade	1.6	4,320,000	16,000
Groynes	1.8	1,080,000	18,000

H3.18 Current estimates of the residual life of the defences at Hornsea are greater than 20 years and therefore failure would only occur during epoch 2 at the earliest. For the economic appraisal maintenance costs have been included from Year 0 and for all years except where construction costs are included. Capital construction costs have been included in year 20 for both the revetment and the groynes, based on the residual life of the current structures; this is a conservative assumption. Costs for replacing the groynes have also been included in years 50 and 80 owing to the 30 year life of groynes.

H3.19 The Present Value of the “Hold the Line” policy for Hornsea would be £4.2Million. For the policy to be economically viable, benefits over the 100 Years would need to total at least £4.2Million to achieve a Benefit / Cost Ratio of 1.

H3.20 For Hornsea, the residual life of the defences is greater than 20 Years, therefore under a “Do Nothing” scenario no benefits are accrued in epoch 1. During epoch 2 of the “Do Nothing” Scenario only 5 residential and 2 commercial properties would be lost. Epoch 3 sees the loss of approximately 175 residential and 8 commercial properties (this excludes all static caravans). Benefits for this economic appraisal are based on property losses and exclude an assessment of infrastructure and amenity losses.

H3.21 Average house prices for Hornsea were estimated at £148,000 (Source: www.zoopla.co.uk, based on HU18). Commercial properties were conservatively estimated as 1.5 times the value of residential properties.

H3.22 FCDPAG3 calculation sheets were used to estimate the Present Value of properties lost due to erosion. Benefits totalled a cash value of approximately £29Million, however as the majority of the losses are accrued in epoch 3 the discounted Present Value is £2.7Million.

Table 3.5: Economic Analysis for Hornsea

Option	PV Costs (£)	PV Damage (£)	PV Benefits (£)	Benefit / Cost Ratio
“Hold The Line”	4,184,528	-	2,673,585	<1

H3.23 The economic analysis (summarised in Table 3.5) for Hornsea gives a Benefit / Cost ratio of less than 1, suggesting that the Policy is not economically viable, when only assessing on properties.

- H3.24 It should be noted that the assessment of Present Value damages is only based on properties identified as lost over the three epochs and that no infrastructure or amenity benefits have been included. Data for Bridlington showed that when amenity benefits were included the Benefit / Cost ratio increased by a factor of 4 to 5 times.
- H3.25 The inclusion of infrastructure benefits would improve the Benefit / Cost ratio further raising the Benefit / Cost ratio. Allowing for a conservative doubling of the Benefit / Cost ratio for amenity benefits would easily make the Benefit / Cost ratio greater than 1. Therefore, the policy for this unit is Clearly Economically Viable.

Policy Unit E – Rolston to Waxholme

- H3.26 The Draft Preferred Policy for Policy Unit E is “No Active Intervention” for all epochs (Present to 2105), with the exception of the area of existing defences at Mappleton.
- H3.27 This policy (in all areas other than Mappleton) has no costs associated with its implementation and therefore is economically viable. However, it should be noted that losses to assets may occur during the lifetime of the SMP.
- H3.28 At Mappleton, the Policy will be “Hold The Line” for epochs 1 and 2 (Present to 2055) and thereafter will be reviewed and either maintained as “Hold the Line” or will revert to “No Active Intervention”. As there are no implementation costs associated with the implementation of “No Active Intervention” policies the economic appraisal has been carried out based on “Hold the Line” for all epochs (Present to 2105).
- H3.29 The defences at Mappleton consist of rock revetments and groynes to stabilise the beach. The defence length is 0.44km. Using the values from Table 2.1 gives a defence value of £1,188,000 for the rock revetment and £264,000 for the groynes. Maintenance costs for these defences would be £8,800 per annum.
- H3.30 Current estimates of the residual life of the defences are greater than 20 years and therefore failure would only occur during epoch 2 at the earliest. For the economic appraisal maintenance costs have been included at £8,800/yr for from Year 0 and for all years except where construction costs are included. Capital construction costs have been included in year 30 for both the revetment and the groynes, based on the residual life of the current structures; this is a conservative assumption. Costs for replacing the groynes have also been included in years 60 and 90 owing to the 30 year life of groynes.
- H3.31 The Present Value Cost of the Hold the Line policy for Mappleton would be £1.1Million. For the policy to be economically viable, benefits over the 100 Years would need to total at least £1.1Million to achieve a Benefit / Cost Ratio of 1.
- H3.32 For Mappleton the residual life of the defences is greater than 20 Years, therefore no benefits are accrued in epoch 1 for the “Do Nothing” scenario. During epoch 2 of the “Do Nothing” scenario only 1 residential and 1 commercial property would be lost. epoch 3 sees the loss of approximately 11 residential and 5 commercial/agricultural properties. Benefits for this economic appraisal are based on property losses and exclude an assessment of infrastructure and amenity losses.

- H3.33 Average house prices for Mappleton were estimated at £148,000 (Source: www.zoopla.co.uk, based on HU18). Commercial properties were conservatively estimated as 1.5 times the value of residential properties.
- H3.34 FCDPAG3 calculation sheets were used to estimate the Present Value of properties lost due to erosion. Benefits totalled a cash value of approximately £3.1Million, however as the majority of the losses are accrued in epoch 3 the discounted Present Value is £326,000.

Table 3.6: Economic Analysis for Mappleton

Option	PV Costs (£)	PV Damage (£)	PV Benefits (£)	Benefit / Cost Ratio
"Hold The Line"	870,614	-	325,947	<1

- H3.35 The economic analysis (summarised in Table 3.6) for Mappleton gives a Benefit / Cost ratio of less than 1. It should be noted that the assessment of Present Value damages is only based on properties identified as being lost over the three epochs and that no infrastructure or amenity benefits have been included. However, doubling the benefits would still result in a Benefit / Cost ratio less than 1, suggesting that the policy is only Marginally Economically Viable at best.

Policy Unit F – Owthorne to Hollym (Withernsea)

- H3.36 The Draft Preferred Policy for Policy Unit F is "Hold The Line". For this Policy Unit this also includes maintaining the current standard of protection over all epochs (Present to 2105).
- H3.37 Maintaining the current standard of protection over the lifetime of the SMP has both maintenance and capital costs associated with the implementation of the Policy.
- H3.38 The "Withernsea Coastal Defence Strategy Study" (Posford Duvivier, 2001) has undertaken a review of potential options for protecting Withernsea at the Strategy level. A number of options were assessed to determine the most economic solution for maintaining the defences over a 100 Year period. The strategy covered the entire defended and undefended Withernsea frontage.
- H3.39 The options presented for each section of the frontage were combined to form three preferred options which were then economically assessed. Table 3.7 shows a summary of the economic analysis for the three options.

Table 3.7: Withernsea Coastal Defence Economics (Reproduced from Posford Duvivier, 2001)

Option	PV Costs (£)	PV Benefits (£)			Benefit / Cost Ratio (Tangible Benefits Only)	Benefit / Cost Ratio (All Benefits)
		Tangible Benefits	Intangible Benefits	Total PV Benefits		
2P - Timber Groynes	2,373,000	2,611,000	14,407,000	17,018,000	1.10	7.17
2Q – Groynes and Toe Protection	2,136,000	2,611,000	14,407,000	17,018,000	1.22	7.97
2R – Rock Revetment and Groynes	2,644,000	2,611,000	11,042,000	13,653,000	1.00	5.16

- H3.40 The Posford Duvivier (2001) Report included an analysis of “Intangible Benefits” (Amenity Benefits). These benefits are derived from income figures from visitors to the frontage. These figures may not be typically included in economic analysis as they are considered as “Transfer Payments”.
- H3.41 The table above shows that the economics for the protection of Withernsea is marginal (Benefit / Cost ratios just above 1) when considering only “Tangible Benefits” (those attributed to assets lost due to erosion and flooding). When considering “Intangible Benefits” the Benefit / Cost ratios are significantly improved owing to the income from Amenity within the area.
- H3.42 The Preferred Policy for Policy Unit F is therefore clearly economically viable.

Policy Unit G – Hollym to Dimlington Cliffs

- H3.43 The Draft Preferred Policy for Policy Unit G is “No Active Intervention” for all epochs (Present to 2105).
- H3.44 This policy has no costs associated with its implementation and therefore is clearly economically viable. However, it should be noted that losses to assets may occur during the lifetime of the SMP.

Policy Unit H – Dimlington and Easington Gas Terminals

- H3.45 The Draft Preferred Policy for Policy Unit H is “No Active Intervention” for all epochs (Present to 2105), with the exception of currently defended areas (at Easington).
- H3.46 This policy (in all undefended areas) has no costs associated with its implementation and therefore is economically viable. However, it should be noted that losses to assets may occur during the lifetime of the SMP.
- H3.47 At the currently defended areas the Policy will be “Hold the Line” for epoch 1 (Present to 2025) and thereafter will be reviewed and either maintained as “Hold the Line” or will revert to “No Active Intervention” (2025 to 2105). As there are no implementation costs associated with the implementation of “No Active Intervention” policies the economic appraisal has been carried out based on “Hold the Line” for all epochs (Present to 2105).
- H3.48 The defences at Easington Gas Terminals consist of rock revetments. The defended length of shoreline is 1.0km. Using the values from Table 2.1 gives a defence capital cost of £2,700,000 and maintenance costs would be £10,000 per annum.
- H3.49 Current estimates of the residual life of the defences are greater than 20 years and therefore failure would only occur during epoch 2 at the earliest. For the economic appraisal maintenance costs have been included at £10,000/yr for from Year 0 and for all years except where construction costs are included. Capital construction costs have been included in year 20, based on the residual life of the current structures; this is a conservative assumption.
- H3.50 The Present Value Cost of the “Hold the Line” policy for the Easington Gas Terminal defences would be £1.7Million. For the policy to be economically viable, benefits over the 100 Years would need to total at least £1.7Million to achieve a Benefit / Cost Ratio of 1.

H3.51 The residual life of the defences at Easington Gas Terminals is greater than 20 Years, therefore no benefits are accrued in epoch 1 for the “Do Nothing” scenario. During epoch 2 of the “Do Nothing” scenario some areas of land are lost and these may have short term impacts on the operation of the Gas Terminals. Under the “Do Nothing” scenario erosion during epoch 3 would be significant enough that it would require some Gas Terminal operations to be halted or relocated. Associating damages/benefits to this depends on the operation of Easington Gas Terminals in the future. Currently the Easington Gas Terminals are a significant strategic asset in the UK Power Infrastructure and the economic benefits are likely to significantly outweigh the cost of maintaining the current defence line. In the future, further reviews will need to determine if the Easington Gas Terminals remain as strategic an asset, particularly if gas production in the North Sea declines over the SMP period.

H3.52 On the basis of the strategic nature of the Easington Gas Terminals and the low Present Value costs of maintaining the current line of defences this Policy is clearly economically viable.

Policy Unit I – Easington to Kilnsea

H3.53 The Draft Preferred Policy for Policy Unit I combines a number of Policy approaches. Defences within the Policy Unit will be under a “Hold the Line” policy for epoch 1 (Present to 2025) and then “Managed Realignment” for epoch 2 (2025 to 2055), reverting to a “Hold the Line” policy (for the realigned defences) in epoch 3 (2055 to 2105). Other areas currently undefended will be managed under a “No Active Intervention” policy for all epochs (Present to 2105).

H3.54 The defences within this unit consist of 2.5km of earth embankment providing flood protection. The present value cost of maintaining the defences in epochs 1 and 3, and providing additional defences in epochs 2 for the “Managed Realignment” is estimated as £3.2 Million.

H3.55 The defences along this stretch of coastline provide protection against tidal inundation for the areas of land behind the Policy Unit I and Policy Unit K, and therefore the economic analysis of the two Policy Units are linked to some extent. To avoid double counting of benefits the costs of implementing the Policy Unit I has been combined with the costs of implementing Policy Unit K and assessed against the benefits accrued for Policy Unit K. The results are presented in Table 3.8.

Table 3.8: Humber SMP2 Economics (From RPA (2003), amended to include Policy Unit I costs)

Option	PV Costs (£)	PV Damage (£)	PV Benefits (£)	Benefit / Cost Ratio
Maintain Low Standard (1 in 10)	30,700,000	13,500,000	266,059,000	8.7
Maintain High Standard (1 in 100)	60,600,000	386,000	279,317,000	4.6

H3.56 The combined economic analysis of Policy Units I and K shows that the policy is clearly economically viable. However, given the fact that alternative options are considered, subject to monitoring in epochs 2 and 3, it has been considered prudent to categorise policy unit I as marginally economically viable.

- H3.57 The Humber Flood Risk Management Strategy (HFRMS) is a live document and further work is currently being undertaken on the costs. Therefore, this conclusion should be reviewed as the HFRMS is updated.

Policy Unit J – Kilnsea to Spurn Point

- H3.58 The Draft Preferred Policy for Policy Unit J is “Managed Realignment” for epoch 1 (Present to 2025), with either “Managed Realignment” or “No Active Intervention” for epochs 2 and 3 (2025 to 2105) depending on the evolution of Spurn.
- H3.59 The Managed Realignment for Spurn will require some maintenance cost to ensure that the infrastructure on the barrier remains operational. However, this maintenance will be required only to the infrastructure and not to provide additional defences to the barrier.
- H3.60 This policy has no costs associated with its implementation and therefore is clearly economically viable. However, it should be noted that some costs will be associated with maintenance of infrastructure along the barrier during the lifetime of the SMP.
- H3.61 The Humber Flood Risk Management Strategy (HFRMS) is a live document and further work is currently being undertaken on the costs. Therefore, this conclusion should be reviewed as the HFRMS is updated.

Policy Unit K – Easington Road to Stone Creek

- H3.62 The Draft Preferred Policy for Policy Unit K is “Hold the Line” for all epochs (Present to 2105), however, some managed realignment will occur but this will not affect the assets along the shoreline.
- H3.63 Holding the line will require maintenance of the current defences over the lifetime of the SMP therefore there are costs associated with the implementation of the Policy.
- H3.64 The “Humber Shoreline Management Plan – Stage 2: Economic Appraisal” RPA (2003) has undertaken Benefit / Cost analysis for the Humber Estuary. Management Unit 1: Spurn Head to Paull, within the Humber SMP covers approximately the same frontage as the Easington Road to Stone Creek Policy Unit.
- H3.65 Two options were assessed against the “Do Nothing” policy in the RPA (2003) Economic Appraisal. One option held the defence line with a low standard of protection (1 in 10 Year) and the other with high standard (1 in 100 Year). The economic analysis for both options is reproduced in Table 3.9.

Table 3.9: Humber SMP2 Economics (Reproduced from RPA, 2003)

Option	PV Costs (£)	PV Damage (£)	PV Benefits (£)	Benefit / Cost Ratio	Benefit / Cost Ratio (Sensitivity Range)
"Do Nothing"	-	279,558,000	-	-	-
Maintain Low Standard (1 in 10)	27,492,000	13,500,000	266,059,000	9.68	5.66 – 10.67
Maintain High Standard (1 in 100)	57,358,000	386,000	279,317,000	4.87	2.85 – 5.55

H3.66 Sensitivity analysis was undertaken during the economic analysis to ensure that the options were robust. The final column in Table 3.9 shows the variation in the Benefit / Cost ratio which shows that all options maintain a Benefit / Cost ratio above 1.

H3.67 Both options have Benefit / Cost ratios above 1 and therefore the "Hold the Line" policy for Policy Unit K is clearly economically viable.

H3.68 The Humber Flood Risk Management Strategy (HFRMS) is a live document and further work is currently being undertaken on the costs. Therefore, this conclusion should be reviewed as the HFRMS is updated.

Policy Unit L – East Immingham to Cleethorpes

H3.69 The Draft Preferred Policy for Policy Unit L is "Hold The Line". For this Policy Unit this also includes maintaining the current standard of protection over all epochs (Present to 2105).

H3.70 Maintaining the current standard of protection over the lifetime of the SMP has both maintenance and capital costs associated with the implementation of the Policy.

H3.71 The "Humber Shoreline Management Plan – Stage 2: Economic Appraisal" RPA (2003) has undertaken Benefit / Cost analysis for the Humber Estuary. Policy Unit L spans both Management Unit 7 (North Killingholme to Cleethorpes) and Management Unit 8 (Cleethorpes to Donna Nook), within the Humber SMP.

H3.72 As a detailed breakdown of the economics is not provided in the RPA (2003) report a number of assumptions for the economic analysis for the SMP have been applied:

1. The Humber SMP Management Unit 7 includes benefits for Immingham and North Killingholme, where there are significant industrial and commercial assets which provide significant benefit values. Management Unit 8 comprises of the benefits from Cleethorpes to Donna Nook, however the contribution to the benefits of the areas outside of Cleethorpes is small as it is mainly agricultural land. Therefore for the assessment of Policy Unit L the benefits of Management Unit 8 has been adopted; this provides a conservative estimate as it excludes some of the commercial and industrial benefits to the west of Cleethorpes.

2. The costs for the defences at Cleethorpes are included in the Humber SMP Management Unit 8, as well as those to Donna Nook. The cost of the defences west of Cleethorpes are included in Humber SMP Management Unit 7, which also includes the costs of the defences at Immingham and Killingholme. The entire defence costs for Management Units 7 and 8 are included in the economic analysis of Policy Unit L; this is a conservative assumption.
3. The Present Value damages for both Management Unit 7 and 8 of the Humber SMP have been included in the economic assessment of this SMP; this is a conservative assumption.

H3.73 Using the above assumptions and the Management Unit information from the RPA (2003) report, Table 3.10 shows the total figures for Policy Unit L.

Table 3.10: Economic Analysis for Policy Unit L

Option	PV Costs (£)	PV Damage (£)	PV Benefits (£)	Benefit / Cost Ratio
“Do Nothing”	-	438,696,000	-	-
Maintain Low Standard	29,849,000	5,764,000	432,932,000	14.5
Maintain High Standard	48,235,000	1,115,000	437,581,000	9.07

H3.74 The economic analysis for Policy Unit L has been undertaken using conservative assumptions of the benefits and costs. However, the Benefit / Cost ratios still demonstrate that the “Hold the Line” policy is clearly economically viable for Policy Unit L.

H3.75 The Humber Flood Risk Management Strategy (HFRMS) is a live document and further work is currently being undertaken on the costs. Therefore, this conclusion should be reviewed as the HFRMS is updated.

Policy Unit M – Humberston Fitties

H3.76 The Draft Preferred Policy for Policy Unit M combines a number of Policy approaches. Defences at Humberston Fitties form two lines. The front line defences consist of groynes to stabilise the beach and sand dunes reinforced by a rock gabion. Within the Chalet Park is the second defence line consisting of a flood embankment to protect against inundation.

H3.77 During epoch 1 (Present to 2025) the frontline of defences will be maintained but their standard of protection will not be increased to account for sea level rise. The secondary defence will be maintained and improved to maintain the current standard of protection. During epochs 2 and 3, the secondary defence will be maintained and the standard of protection will be maintained. Further policy evaluation will take place to determine the preferred policy for the front line of defence in epochs 2 and 3.

H3.78 Although the policy for the front line of defence is uncertain in epochs 2 and 3, by inspection it will be economically viable to continue to hold the secondary defence line since this area is part of a large flood cell extending southwards.

H3.79 The Humber Flood Risk Management Strategy (HFRMS) is a live document and further work is currently being undertaken on the costs. Therefore, this conclusion should be reviewed as the HFRMS is updated.

Policy Unit N – South of Humberston Fitties to Theddlethorpe St Helen

H3.80 The Draft Preferred Policy for Policy Unit N is “Hold the Line” over all epochs (Present to 2105). Maintaining the current standard of defences, over the lifetime of the SMP, has both maintenance and capital costs associated with the implementation of the Policy.

H3.81 The defences along this shoreline consist mainly of earth embankments to prevent flooding. The foreshore is reasonably wide in areas and the area at Donna Nook has been accreting.

H3.82 “Hold the Line” policy costs have been based on provision of hard defences along the entire shoreline as a conservative estimate of maintenance and future construction costs.

H3.83 The shoreline along Policy Unit N is approximately 30km. Therefore, capital construction costs would be in the order of £81Million with annual maintenance fees of £300,000. Present Value costs are based on annual maintenance fees of £300,000 from year 0. Capital Construction costs totalling £81Million have been added in as three £21Million payments in years 20, 30, and 40.

H3.84 The Present Value Cost of the “Hold the Line” policy for the Policy Unit N would be £40.8Million. For the policy to be economically viable, benefits over the 100 Years would need to total at least £40.8Million to achieve a Benefit / Cost Ratio of 1.

H3.85 Damages for the “Do Nothing” scenario for this Policy Unit have been based on the flood zones of each epoch. Using the flood extent, the properties inundated have been identified for the stretch of land immediately within the boundaries of the Policy Unit – in practice the flood cell is not compartmentalised and inundation would extend further; this is a conservative assumption. The total property values have been calculated using the National Property Dataset, where values are missing they have been supplemented with average house prices per Post Code.

H3.86 As the damages are from flooding rather than erosion the total value of the properties will not be lost. Therefore, the following conservative assumptions have been applied:

1. In epoch 1, only 15% of the total property asset value is lost due to flooding;
2. In epoch 2, only 25% of the total property asset value is lost due to flooding;
3. In epoch 3, only 40% of the total property asset value is lost due to flooding.

H3.87 FCDPAG3 sheets have been used to discount the future damages to a Present Value. Conservatively only one incident of damage, using the above assumptions on the percentage of asset value lost, has been applied per epoch. The analysis has not taken into account property values written off due to frequent inundation, nor has it accounted for any benefits from Infrastructure or Agricultural Land; these are highly conservative assumptions.

Table 3.11: Economic Analysis for Policy Unit N

Option	PV Costs (£)	PV Damage (£)	PV Benefits (£)	Benefit / Cost Ratio
"Hold the Line"	40,806,255	-	88,843,364	>1

H3.88 Despite the conservative assumptions relating to the Cost of implementing the Policy and the generation of "Do Nothing" damages the Preferred Draft Policy has a Benefit / Cost ratio greater than 1.

H3.89 The Benefit / Cost ratio still demonstrates that the "Hold the Line" policy for is clearly economically viable for Policy Unit N.

H3.90 The stretch of shoreline south of Humberston Fitties to Saltfleet is covered under the Humber Flood Risk Strategy (HFRMS). This is a live document and further work is currently being undertaken on the costs. Therefore, this conclusion should be reviewed as the HFRMS is updated.

Policy Unit O – Viking Gas Terminal (Mablethorpe) to southern end of Skegness

H3.91 The Draft Preferred Policy for Policy Unit O is "Hold the Line" over all epochs (Present to 2105), including maintaining the standard of defence. In epoch 3 some localised "Managed Realignment" will also be implemented. Maintaining the defences, over the lifetime of the SMP, has both maintenance and capital costs associated with the implementation of the Policy.

H3.92 This section of shoreline is maintained as part of the Lincshore scheme with the beaches managed through a programme of renourishment. The economic assessment of the Lincshore scheme was reviewed and updated in 2008 to ensure that the scheme remained economically viable, and is presented in Table 3.12.

Table 3.12: Lincshore Benefit / Cost Analysis

Option	PV Costs (£)	PV Damage (£)	PV Benefits (£)	Benefit / Cost Ratio
Lincshore Scheme	227,334,000	109,010,000	1,879,233,000	8.3

H3.93 The economic analysis of the Lincshore Scheme demonstrates that the "Hold the Line" policy for Policy Unit N is clearly economically viable.

Policy Unit P – Seacroft to Gibraltar Point

H3.94 The Draft Preferred Policy for Policy Unit P is "Hold the Line" over all epochs (Present to 2105) and maintaining the current standard of protection of the defences. Maintaining the defences, over the lifetime of the SMP, has both maintenance and capital costs associated with the implementation of the Policy.

H3.95 Currently this shoreline consists of beaches and dunes protecting against flooding. "Hold the Line" policy costs have been based on provision of hard defences along the entire shoreline as a conservative estimate of maintenance and future construction costs.

- H3.96 The shoreline along Policy Unit P is approximately 4.7km. Capital construction costs would be in the order £9.9Million with annual maintenance fees of £47,000. Present Value costs, with construction in year 20 and annual maintenance thereafter, are £5.8Million. For the policy to be economically viable, benefits over the 100 Years would need to total at least £5.8Million to achieve a Benefit / Cost Ratio greater than 1.
- H3.97 Damages for the “Do Nothing” scenario for this Policy Unit have been based on the flood zones of each epoch. Using the flood extent, the properties inundated have been identified for the stretch of land immediately within the boundaries of the Policy Unit – in practice the flood cell is not compartmentalised and inundation would extend further; this is a conservative assumption. The total property values have been calculated using the National Property Dataset, where values are missing they have been supplemented with average house prices per Post Code.
- H3.98 As the damages are from flooding rather than erosion the total value of the properties will not be lost. Therefore, the following conservative assumptions have been applied:
1. In epoch 1, only 15% of the total property asset value is lost due to flooding;
 2. In epoch 2, only 25% of the total property asset value is lost due to flooding;
 3. In epoch 3, only 40% of the total property asset value is lost due to flooding.
- H3.99 FCDPAG3 sheets have been used to discount the future damages to a Present Value. Conservatively only one incident of damage, using the above assumptions on the percentage of asset value lost, has been applied per epoch. The analysis has not taken into account property values written off due to frequent inundation, nor has it accounted for any benefits from infrastructure or agricultural land; these are conservative assumptions.

Table 3.13: Economic Analysis for Policy Unit P

Option	PV Costs (£)	PV Damage (£)	PV Benefits (£)	Benefit / Cost Ratio
“Hold the Line”	7,180,685	-	11,827,049	>1

- H3.100 Despite the conservative assumptions relating to the Cost of implementing the Policy and the generation of “Do Nothing” damages the Preferred Draft Policy has a Benefit / Cost ratio greater than 1.
- H3.101 The Benefit / Cost ratio still demonstrates that the “Hold the Line” policy for is clearly economically viable for Policy Unit P.

H4 Summary

H4.1 The economic analysis of the draft preferred policies has tested the economic viability of each policy for each Policy Unit. Table 4.1 below summarises the economic viability of each Policy Unit within the SMP.

Table 4.1: Policy Economic Outcomes

Policy Unit	Economic Viability
A – Flamborough Head to Sewerby	Clearly Economically Viable
B – Bridlington to Hilderthorpe	Clearly Economically Viable
C – Wilsthorpe to Atwick	Clearly Economically Viable
D – North Cliff to Hornsea Burton (Honsea)	Clearly Economically Viable
E – Rolston to Waxholme	Marginally Economically Viable
F – Owthorne to Hollym (Withernsea)	Clearly Economically Viable
G – Hollym to Dimlington Cliffs	Clearly Economically Viable
H – Dimlington and Easington Gas Terminals	Clearly Economically Viable
I – Easington to Kilnsea	Marginally Economically Viable
J – Kilnsea to Spurn Point	Clearly Economically Viable
K – Easington Road to Stone Creek	Clearly Economically Viable
L – East Immingham to Cleethorpes	Clearly Economically Viable
M – Humberston Fitties	Clearly Economically Viable
N – South of Humberston Fitties to Theddlethorpe St Helen	Clearly Economically Viable
O – Viking Gas Terminal (Mablethorpe) to southern end of Skegness	Clearly Economically Viable
P – Seacroft to Gibraltar Point	Clearly Economically Viable

H5 References

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