Christchurch Bay & Harbour FCERM Strategy

Leading Options Report

Bournemouth, Christchurch and Poole (BCP) Council and New Forest District Council (NFDC)

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Quality information

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Table of Contents

Contents

1. Introduction 1
1.1 Overview 1
1.2 This Report 1
1.3 Stakeholder Engagement 2
2. Option Development and Appraisal 3
2.1 Overview of the approach 3
2.2 Further Development of Short List Options 7
2.3 Selecting the National Economic Leading Option 8
2.4 Selecting the Local Aspirational Leading Option 10
2.5 Partnership Funding 11
2.5.1 Partnership Funding 11
2.5.2 Indicative Partnership Funding Assessment 11
2.6 Selecting a Backup Option 13
2.7 Summary of Appraisal Process 14
2.8 Adaptive Capacity of Options 16
2.8.1 Adaptive Capacity 16
2.8.2 Adaptive Pathways 17
3. Strategy Management Zone 1 19
3.1 Overview 19
3.2 ODU 1 – Hengistbury Head East 20
3.2.1 Short List of Options 22
3.2.2 Economic Appraisal 25
3.2.3 Social and Environmental Appraisal 26
3.2.4 Leading Option Selection 27
3.2.5 Funding 28
3.2.6 Local Benefits 28
3.2.7 Summary 28
3.3 ODU 2 – Mudeford Sandbank 29
3.3.1 Short List of Options 31
3.3.2 Economic Appraisal 35
3.3.3 Social and Environmental Appraisal 36
3.3.4 Leading Option Selection 37
3.3.5 Funding 38
3.3.6 Local Benefits 38
3.3.7 Summary 38
4. Strategy Management Zone 2 40
4.1 Overview 40
4.2 ODU 3 – Christchurch Harbour South 41
4.2.1 Short List of Options 43
4.2.2 Economic Appraisal of Options 46
4.2.3 Social and Environmental Appraisal 46
4.2.4 Leading Option Selection 48
4.2.5 Funding 49
4.2.6 Local Benefits 49
4.2.7 Summary 49
4.3 ODU 4 – Wick 50

4.3.1 Short List of Options 52
4.3.2 Economic Appraisal of Options 55
4.3.3 Social and Environmental Appraisal 57
4.3.4 Leading Option Selection 58
4.3.5 Funding 59
4.3.6 Local Benefits 60
4.3.7 Summary 60
4.4 ODU 5 – Willow Drive and the Quomps 62
4.4.1 Short List of Options 64
4.4.2 Economic Appraisal of Options 69
4.4.3 Social and Environmental Appraisal 71
4.4.4 Leading Option Selection 73
4.4.5 Funding 73
4.4.6 Local Benefits 74
4.4.7 Summary 75
4.5 ODU 6 – River Avon West Bank 76
4.5.1 Short List of Options 78
4.5.2 Economic Appraisal of Options 82
4.5.3 Social and Environmental Appraisal 84
4.5.4 Leading Option Selection 86
4.5.5 Funding 86
4.5.6 Local Benefits 86
4.5.7 Summary 86
4.6 ODU 7 – Rossiters Quay 88
4.6.1 Short List of Options 90
4.6.2 Economic Appraisal of Options 93
4.6.3 Social and Environmental Appraisal 95
4.6.4 Leading Option Selection 96
4.6.5 Funding 96
4.6.6 Local Benefits 97
4.6.7 Summary 97
4.7 ODU 8 – River Avon East Bank 99
4.7.1 Short List of Options 99
4.8 ODU 9 – Stanpit 102
4.8.1 Short List of Options 104
4.8.2 Economic Appraisal of Options 107
4.8.3 Social and Environmental Appraisal 109
4.8.4 Leading Option Selection 110
4.8.5 Funding 111
4.8.6 Local Benefits 111
4.8.7 Summary 112
4.9 ODU 10 – Mudeford 113
4.9.1 Short List of Options 115
4.9.2 Economic Appraisal of Options 118
4.9.3 Social and Environmental Appraisal 120
4.9.4 Leading Option Selection 121
4.9.5 Funding 122
4.9.6 Local Benefits 123
4.9.7 Summary 123
4.10 ODU 11 – Mudeford Quay 124
4.10.1 Short List of Options 126

4.10.2 Economic Appraisal of Options 129
4.10.3 Social and Environmental Appraisal 130
4.10.4 Leading Option Selection 131
4.10.5 Funding 132
4.10.6 Local Benefits 132
4.10.7 Summary 133
4.11 Tidal Flood Barrier 134
4.11.1 Technical 134
4.11.2 Cost 134
4.11.3 Environmental 135
4.11.4 Social 135
4.11.5 Outcome 135
5. Strategy Management Zone 3 136
5.1 Overview 136
5.2 ODU 12 – Avon Beach and Friars Cliff 138
5.2.1 Short List of Options 140
5.2.2 Economic Appraisal of Options 143
5.2.3 Social and Environmental Appraisal 144
5.2.4 Leading Option Selection 145
5.2.5 Funding 146
5.2.6 Local Benefits 147
5.2.7 Summary 147
5.3 ODU 13 – Highcliffe 148
5.3.1 Short List of Options 150
5.3.2 Economic Appraisal of Options 154
5.3.3 Social and Environmental Appraisal 155
5.3.4 Leading Option Selection 156
5.3.5 Funding 157
5.3.6 Local Benefits 158
5.3.7 Summary 158
6. Strategy Management Zone 4 160
6.1 Overview 160
6.2 ODU 14 – Naish Cliff and Barton on Sea 161
6.2.1 Short List of Options 163
6.2.2 Economic Appraisal of Options 173
6.2.3 Social and Environmental Appraisal 174
6.2.4 Leading Option Selection 176
6.2.5 Funding 178
6.2.6 Local Benefits 178
6.2.7 Summary 179
7. Strategy Management Zone 5 180
7.1 Overview 180
7.2 ODU 15 – Barton on Sea to Hordle Cliff 181
7.2.1 Short List of Options 181
7.2.2 Economic Appraisal of Options 183
7.2.3 Social and Environmental Appraisal 183
7.2.4 Leading Option Selection 183
7.2.5 Funding 184
7.2.6 Local Impacts 184
7.2.7 Summary 184
8. Strategy Management Zone 6 185

8.1 Overview 185
8.2 ODU 16 – Cliff Road 187
8.2.1 Short List of Options 189
8.2.2 Economic Appraisal of Options 193
8.2.3 Social and Environmental Appraisal 194
8.2.4 Leading Option Selection 195
8.2.5 Funding 196
8.2.6 Local Benefits 198
8.2.7 Summary 198
8.3 ODU 17 – Rook Cliff 199
8.3.1 Short List of Options 201
8.3.2 Economic Appraisal of Options 207
8.3.3 Social and Environmental Appraisal 207
8.3.4 Leading Option Selection 209
8.3.5 Funding 210
8.3.6 Local Benefits 211
8.3.7 Summary 211
8.4 ODU 18 – Milford on Sea Frontage 212
8.4.1 Short List of Options 214
8.4.2 Economic Appraisal of Options 220
8.4.3 Social and Environmental Appraisal 221
8.4.4 Leading Option Selection 222
8.4.5 Funding 224
8.4.6 Local Benefits 225
8.4.7 Summary 225
9. Summary of Draft Leading Options 226
9.1 Key features of Leading Options 226
9.2 Strategic links between ODUs 233
Appendix A - Sensitivity Tests 238
ODU 3 – Christchurch Harbour South 238
ODU 4 – Wick 239
ODU 5 – Willow Drive and the Quomps 241
ODU 6 – River Avon West Bank 244
ODU 7 – Rossiters Quay 245
ODU 9 - Stanpit 247
ODU 10 - Mudeford 249
ODU 12 – Avon Beach and Friars Cliff 251
ODU 13 - Highcliffe 252
ODU 14 – Naish Cliff and Barton on Sea 254
ODU 16 – Cliff Road 255
ODU 17 – Rook Cliff 257
ODU 18 – Milford on Sea Frontage 258

Figures

Figure 1-1: Map of Strategy area 1
Figure 2-1: Location of the SMZs 5
Figure 2-2: Flowchart showing the Strategy Option development and appraisal process 6
Figure 2-3: Option Appraisal Summary Flowchart 15
Figure 2-4: Adaptive Pathway example 18
Figure 3-1: Location of ODUs within SMZ 1 19
Figure 3-2: Key features in ODU 1 21
Figure 3-3: ODU 1 options 24
Figure 3-4: Key Features in ODU 2 30
Figure 3-5: ODU 2 options 34
Figure 4-1: Location of ODUs within SMZ 2 40
Figure 4-2: Key features in ODU 3 42
Figure 4-3: ODU 3 options 45
Figure 4-4: Key features in ODU 4 51
Figure 4-5: ODU 4 options 54
Figure 4-6: Key features in ODU 5 63
Figure 4-7: ODU 5 options 68
Figure 4-8: Key features in ODU 6 77
Figure 4-9: ODU 6 options 81
Figure 4-10: Key features in ODU 7 89
Figure 4-11: ODU 7 options 92
Figure 4-12: ODU 8 options 101
Figure 4-13: Key features in ODU 9 103
Figure 4-14: ODU 9 options 106
Figure 4-15: Key features in ODU 10 114
Figure 4-16: ODU 10 options 117
Figure 4-17: Key features in ODU 11 125
Figure 4-18: ODU 11 options 128
Figure 5-1: Location of ODUs within SMZ 3 136
Figure 5-2: Key features in ODU 12 139
Figure 5-3: ODU 12 Options 142
Figure 5-4: Key features in ODU 13 149
Figure 5-5: ODU 13 Options 153
Figure 6-1: Location of ODUs within SMZ 4 160
Figure 6-2: ODU 14 key features 162
Figure 6-3: ODU 14 Improve Options 169
Figure 6-4: ODU 14 Managed Realignment Options A and B 170
Figure 6-5: ODU 14 Managed Realignment Options C and D 171
Figure 6-6: ODU 14 Managed Realignment Options E and F 172
Figure 7-1: Location of ODUs within SMZ 5 180
Figure 7-2: ODU 15 options 182
Figure 8-1: Location of ODUs within SMZ 6 185
Figure 8-2: Key features in ODU 16 188
Figure 8-3: ODU 16 Options 192
Figure 8-4: Key Features in ODU 17 200
Figure 8-5: ODU 17 Improve Options 204
Figure 8-6: ODU 17 Managed Realignment A 205
Figure 8-7: ODU 17 Managed Realignment B 206
Figure 8-8: Key Features in ODU 18 213
Figure 8-9: ODU 18 Improve Options 217
Figure 8-10: ODU 18 Managed Realignment A 218
Figure 8-11: ODU 18 Managed Realignment B 219

Tables

Table 3-1: ODU 1 economic appraisal 25
Table 3-2: ODU 1 social appraisal 26
Table 3-3: Summary of potential environmental impacts in ODU 1 27
Table 3-4: Summary of ODU 1 Leading Options 28
Table 3-5: ODU 2 economic appraisal 35
Table 3-6: ODU 2 social appraisal 36
Table 3-7: Summary of potential environmental impacts in ODU 2 37
Table 3-8: Summary of ODU 2 Leading Options 38
Table 4-1: ODU 3 economic appraisal 46
Table 4-2: ODU 3 social appraisal 47
Table 4-3: Summary of potential environmental impacts in ODU 3 48
Table 4-4: Summary of ODU 3 Leading Options 49
Table 4-5: ODU 4 economic appraisal 55
Table 4-6: ODU 4 IBCR comparison for the Sustain C option 56
Table 4-7: ODU 4 social appraisal 57
Table 4-8: Summary of potential environmental impacts in ODU 4 58
Table 4-9: Indicative Partnership Funding Scores for ODU 4 (epoch 3 intervention) 60
Table 4-10: Summary of ODU 4 Leading Options 60
Table 4-11: ODU 5 economic appraisal 69
Table 4-12: ODU 5 IBCR comparison for the Improve D option 70
Table 4-13: ODU 5 IBCR comparison for the Improve E option 70
Table 4-14: ODU 5 IBCR comparison for the Improve F option 70
Table 4-15: ODU 5 social appraisal 71
Table 4-16: Summary of potential environmental impacts in ODU 5 72
Table 4-17: Indicative Partnership Funding Scores for ODU 5 (first major capital scheme) 74
Table 4-18: Summary of ODU 5 Leading Options 75
Table 4-19: ODU 6 economic appraisal 82
Table 4-20: ODU 6 IBCR comparison for the Sustain B option 83
Table 4-21: ODU 6 sensitivity test on Sustain B 83
Table 4-22: ODU 6 social appraisal 84
Table 4-23: Summary of potential environmental impacts in ODU 6 85
Table 4-24: Summary of ODU 6 Leading Options 86
Table 4-25: ODU 7 economic appraisal 93
Table 4-26: ODU 7 IBCR comparison 94
Table 4-27: ODU 7 social appraisal 95
Table 4-28: Summary of potential environmental impacts in ODU 7 96
Table 4-29: Indicative Partnership Funding Scores for ODU 7 (first major capital scheme) 97
Table 4-30: Summary of ODU 7 Leading Options 98
Table 4-31: ODU 9 economic appraisal 107
Table 4-32: ODU 9 IBCR comparison 108
Table 4-33: ODU 9 social appraisal 109
Table 4-34: Summary of potential environmental impacts in ODU 9 110
Table 4-35: Indicative Partnership Funding Scores for ODU 9 (first major capital scheme) 111
Table 4-36: Summary of ODU 9 Leading Options 112
Table 4-37: ODU 10 economic appraisal 118
Table 4-38: ODU 10 IBCR comparison 118
Table 4-39: ODU 10 social appraisal 120
Table 4-40: Summary of potential environmental impacts in ODU 10 121
Table 4-41: Indicative Partnership Funding Scores for ODU 10 (first major capital scheme) 122
Table 4-42: Summary of ODU 10 Leading Options 123
Table 4-43: ODU 11 economic appraisal 129
Table 4-44: ODU 11 social appraisal 130
Table 4-45: Summary of potential environmental impacts in ODU 11 131
Table 4-46: Summary of ODU 11 Leading Options 133
Table 5-1: ODU 12 economic appraisal 143
Table 5-2: ODU 12 social appraisal 144
Table 5-3: Summary of potential environmental impacts in ODU 12 145
Table 5-4: Indicative Partnership Funding Scores for ODU 12 146

Table 5-5: Summary of ODU 12 Leading Options 147
Table 5-6: ODU 13 economic appraisal 154
Table 5-7: ODU 13 social appraisal 155
Table 5-8: Summary of potential environmental impacts in ODU 13 156
Table 5-9: Indicative Partnership Funding Scores for ODU 13 158
Table 5-10: Summary of ODU 13 Leading Options 159
Table 6-1: ODU 14 economic appraisal 173
Table 6-2: ODU 14 social appraisal 175
Table 6-3: Summary of potential environmental impacts in ODU 14 176
Table 6-4: Indicative Partnership Funding Scores for ODU 14 178
Table 6-5: Summary of ODU 14 Leading Options 179
Table 7-1: ODU 15 economic appraisal 183
Table 7-2: Summary of ODU 15 Leading Options 184
Table 8-1: ODU 16 economic appraisal 193
Table 8-2: ODU 16 social appraisal 194
Table 8-3: Summary of potential environmental impacts in ODU 16 195
Table 8-4: Indicative Partnership Funding Scores for ODU 16 197
Table 8-5: Summary of ODU 16 Leading Options 198
Table 8-6: ODU 17 economic appraisal 207
Table 8-7: ODU 17 social appraisal 208
Table 8-8: Summary of potential environmental impacts in ODU 17 209
Table 8-9: Indicative Partnership Funding Scores for ODU 17 210
Table 8-10: Summary of ODU 17 Leading Options 211
Table 8-11: ODU 18 economic appraisal 220
Table 8-12: ODU 18 social appraisal 221
Table 8-13: Summary of potential environmental impacts in ODU 18 222
Table 8-14: Indicative Partnership Funding Scores for ODU 18 224
Table 8-15: Summary of ODU 18 Leading Options 225
Table 9-1: Summary of Draft Leading Options (- shows where funding has not been calculated or an option not identified) 227
Table 9-2: Strategic links between ODUs 233
Table A-0-1: ODU 3 economic appraisal sensitivity test +10% cost increase for Adaptation / Resilience A 238
Table A-0-2: ODU 3 economic appraisal sensitivity test +25% cost increase for Adaptation / Resilience A 238
Table A-0-3: ODU 4 economic appraisal sensitivity test +10% cost increase for Sustain C 239
Table A-0-4: ODU 4 economic appraisal sensitivity test +25% cost increase for Sustain C 239
Table A-0-5: ODU 4 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options 240
Table A-0-6: ODU 4 economic appraisal sensitivity test +10% cost increase for Improve D, E, F 241
Table A-0-7: ODU 4 economic appraisal sensitivity test +25% cost increase for Improve D, E, F 242
Table A-0-8: ODU 5 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options 243
Table A-0-9: ODU 6 sensitivity test, Sustain B with and without PLP included 244
Table A-0-10: ODU 7 economic appraisal sensitivity test +10% cost increase for Improve A (200yr SoP) 245
Table A-0-11: ODU 7 economic appraisal sensitivity test +25% cost increase for Improve A (200yr SoP) 245
Table A-0-12: ODU 7 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options 246
Table A-0-13: ODU 9 economic appraisal sensitivity test +10% cost increase for Sustain A (200yr SoP) 247
Table A-0-14: ODU 9 economic appraisal sensitivity test +25% cost increase for Sustain A (200yr SoP) 247
Table A-0-15: ODU 9 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options 248
Table A-0-16: ODU 10 economic appraisal sensitivity test +10% cost increase for Improve A (200yr SoP) 249
Table A-0-17: ODU 10 economic appraisal sensitivity test +25% cost increase for Improve A (200yr SoP) 249
Table A-0-18: ODU 10 economic appraisal sensitivity test +0.9m crest height cost increase for all Improve Options 250
Table A-0-19: ODU 12 economic appraisal sensitivity test +10% cost increase for Improve A 251
Table A-0-20: ODU 12 economic appraisal sensitivity test +25% cost increase for Improve A 251
Table A-0-21: ODU 12 economic appraisal sensitivity test 50% reduction in beach nourishment costs 251
Table A-0-22: ODU 13 economic appraisal sensitivity test +10% cost increase for Improve C 252
Table A-0-23: ODU 13 economic appraisal sensitivity test +25% cost increase for Improve C 252
Table A-0-24: ODU 13 economic appraisal sensitivity test 50% reduction in beach nourishment costs 253

Table A-0-25: ODU 14 economic appraisal sensitivity test +10% cost increase for Managed Realignment A..... 254
Table A-0-26: ODU 14 economic appraisal sensitivity test +25% cost increase for Managed Realignment A..... 254
Table A-0-27: ODU 16 economic appraisal sensitivity test +10% cost increase for Managed Realignment C 255
Table A-0-28: ODU 16 economic appraisal sensitivity test +25% cost increase for Managed Realignment C 255
Table A-0-29: ODU 16 economic appraisal sensitivity test 50% reduction in beach nourishment costs..... 256
Table A-0-30: ODU 17 economic appraisal sensitivity test +10% cost increase for Improve C 257
Table A-0-31: ODU 17 economic appraisal sensitivity test +25% cost increase for Improve C 257
Table A-0-32: ODU 18 economic appraisal sensitivity test +10% cost increase for Improve A and B 258
Table A-0-33: ODU 18 economic appraisal sensitivity test +25% cost increase for Improve A and B 258
Table A-0-34: ODU 18 economic appraisal sensitivity test 50% reduction in beach nourishment costs..... 259

1. Introduction

1.1 Overview

AECOM has been commissioned by Bournemouth, Christchurch and Poole (BCP) Council to develop a Flood and Coastal Erosion Risk Management (FCERM) Strategy for the coastal frontage at Christchurch Bay & Harbour (herein referred to as 'The Strategy'). The Strategy extent is the coastal frontage between Hengistbury Head (immediately to the east of Hengistbury Head Long Groyne) and the landward (western) end of Hurst Spit. Within Christchurch Harbour, the Strategy extent is to Tuckton Bridge on the River Stour and Knapp Mill on the River Avon (see Figure 1-1).

Figure 1-1: Map of Strategy area

The aim of The Strategy is to provide an integrated plan for the Christchurch Bay & Harbour frontage, delivering sustainable and long-term management for coastal flood and erosion risks over the next 100 years. The Strategy is being developed collaboratively by AECOM, and the Project Board consisting of officers of BCP Council, New Forest District Council (NFDC) and the Environment Agency (EA).

1.2 This Report

This report provides details of the Short List to Leading Option appraisal, undertaken in the development of The Strategy. This part of the appraisal followed on from the development of the Short List. Details of the previous phases of option appraisal are presented in the Strategy Option Development Unit Report (AECOM, 2022), Long List Report (AECOM, 2022) and Short List Report (AECOM, 2023). More details of the option development and appraisal process are provided in Section 2) of this report.

This is the fourth iteration of this report which presents the Leading Options for the Strategy. The previous iteration of this report included details of the draft Leading Options and was consulted on with stakeholders and the public in summer 2023. In addition, pre-application advice was received from the Environment Agency's Large Project

Review Group (LPRG) in Autumn 2023. Minor modifications to the options have been made accounting for the feedback received and this latest version of the report presents the updated Leading Options.

This report has the following key sections:

1) Introduction
2) Overview of option development and appraisal process
3) Short List Option to Leading Option Appraisal – Strategy Management Zone 1
4) Short List Option to Leading Option Appraisal – Strategy Management Zone 2
5) Short List Option to Leading Option Appraisal – Strategy Management Zone 3
6) Short List Option to Leading Option Appraisal – Strategy Management Zone 4
7) Short List Option to Leading Option Appraisal – Strategy Management Zone 5
8) Short List Option to Leading Option Appraisal – Strategy Management Zone 6
9) Summary of Draft Leading Options and Strategic Links.

1.3 Stakeholder Engagement

Stakeholder engagement has been used to inform the development of the Strategy in every phase. Feedback reports from the stakeholder engagement activities can be found at Christchurch Bay and Harbour Flood and Coastal Erosion Risk Management (FCERM) Strategy – Have your Say – Bournemouth, Christchurch and Poole Council (bcpcouncil.gov.uk).

To date, five rounds of stakeholder engagement have been carried out as part of the development of The Strategy. Each round of engagement has had a different focus, as described below:

- Engagement round one: raising awareness of the Strategy and to seek data to inform the Strategy baseline.
- Engagement round two: presentation of Strategy baseline findings and to seek any further information that may alter the baseline.
- Engagement round three: options identification workshops to identify and discuss all possible Long List options with stakeholders, the appraisal process and the criteria by which the Long List would be appraised.
- Engagement round four: presentation of the proposed Short List options to key stakeholders and the public to seek views on the proposed Short List before undertaking further detail appraisal. In addition, stakeholders and the public were invited to tell the project team if they thought options that had been discounted from the long list should be reconsidered.
- Engagement round five: in the summer of 2023 a consultation on the draft Leading Options was undertaken to key stakeholders and the public to seek views and feedback. The draft Leading Options have since been reviewed and this report has been updated accordingly.

Each stage of the stakeholder engagement has provided valuable information to the project team that has informed and fed into the option development and appraisal process. For example, during round one, 93% of respondents agreed with the Council's aim to adopt a Strategy to help manage flood and coastal erosion risk over the next century. The top concerns from respondents during round one was the increasing frequency of storm events and sea level rise caused by climate change, maintenance of existing coastal protection assets, loss of beach material, tidal flooding and cliff instability. The majority of these concerns have been addressed by the leading options selected in each unit (subject to funding).

A summary of the feedback provided by stakeholders in each round of engagement has been made available on the project's 'Have your Say' website, along with summary information, display boards and draft technical reports. Key findings from the most recent engagement; the consultation on the draft Leading Options, are presented in the Engagement Round 5 report (BCP Research and Consultation Team, 2023).

One further round of engagement with stakeholders is planned at the end of the Strategy (round 6). The will be informing people how their feedback has helped shape the final Strategy adopted by BCP / NFDC / EA.

2. Option Development and Appraisal

2.1 Overview of the approach

The option appraisal for The Strategy has been undertaken across a spatial framework comprising six Strategy Management Zones (SMZs) and eighteen smaller Option Development Units (ODUs). A map showing the SMZ locations is shown in Figure 2-1. Maps showing the individual ODUs are provided further on in this report. The Strategy Option Development Unit Report (AECOM, 2022) provides further details of the development of the spatial framework for the appraisal.

The appraisal has been undertaken in stages and these stages are shown in Figure 2-2. This report summarises stages 6 to 8, which involved:

- Further development of the Short List Options in each ODU, with respect to the areas defended, the type of local level measures used and the timing of these interventions over the next 100 years.
- Appraisal of the Short List Options in each ODU, considering the economic feasibility (option costs, option benefits and funding potential), potential environmental impacts and potential social impacts.

Stages 1 to 5 are summarised in the Long List and Short List Reports (AECOM, 2023).

The outcome of Stages 6 to 8 was the identification of a National Economic Leading Option in each ODU. In some ODUs a Local Aspirational Leading Option and/or Backup Option were also identified.

National Economic Leading Option

- The **National Economic Leading Option** is the leading option identified by following the Environment Agency's Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG, 2022). This guidance provides a comprehensive step by step approach for selecting leading options for managing coastal flood and erosion risks.
- By following FCERM-AG, the National Economic Leading Options will be eligible for public FCERM-Grant in Aid (GiA) funding, although for most of the Strategy area there is still a funding shortfall for the capital schemes and further contributions would be required for delivery. An indication of how much public funding from FCERM Grant in Aid (GiA) may be available has been calculated for the National Economic Leading Options. The public GiA funds are distributed on a national basis according to the Outcome Measures that each option delivers.

Local Aspirational Leading Option

- In some circumstances the National Economic Leading Option may not be preferable for local decision makers and / or stakeholders and in these situations a **Local Aspirational Leading Option** has also been identified.
- The Local Aspirational Leading Options take into account the local opportunities, wants and needs to provide more comprehensive options that deliver greater or wider benefits. The Local Aspirational Options typically have a higher cost than the equivalent National Economic Leading Options and therefore represent an aspirational option that could be delivered instead of the National Economic Leading Option should additional funding be found from non-GiA sources.

Backup Option

- On a national basis, funding availability is recognised as a constraint for delivering FCERM options and schemes. This is representative of the situation in the Strategy area and in most cases, both the National Economic Leading Option and Local Aspirational Leading Option for each ODU would not be fully funded by FCERM-GiA. Significant funding shortfalls for both the leading National and Local options are common. It is the aspiration of both BCP and NFDC to work with funding partners to secure the additional funding to deliver the Strategy, however, it is recognised that this may not always be possible. Therefore, for each ODU where there is a large funding shortfall for the major capital scheme (i.e. > several £million) a **Backup Option** has also been identified.
- The Backup options do not typically involve large capital schemes to upgrade the standard of protection of defences and are instead focussed on more frequent defence maintenance / refurbishments. This means that the Backup options typically have lower present value cost than the National Economic / Local

Aspirational options and would be more deliverable as there would not be a large one-off funding shortfall associated with a major capital scheme and instead smaller scale and less costly (but more frequent) interventions would be needed.

The draft Leading Options were consulted on with stakeholders and the public during round 5 of the stakeholder engagement process in summer 2023. In addition, pre-application feedback from the Environment Agency's LPRG was received. The Leading Options presented in this latest iteration of the report have been updated following the feedback that was received and form the final Strategy being submitted for Council and LPRG approval.

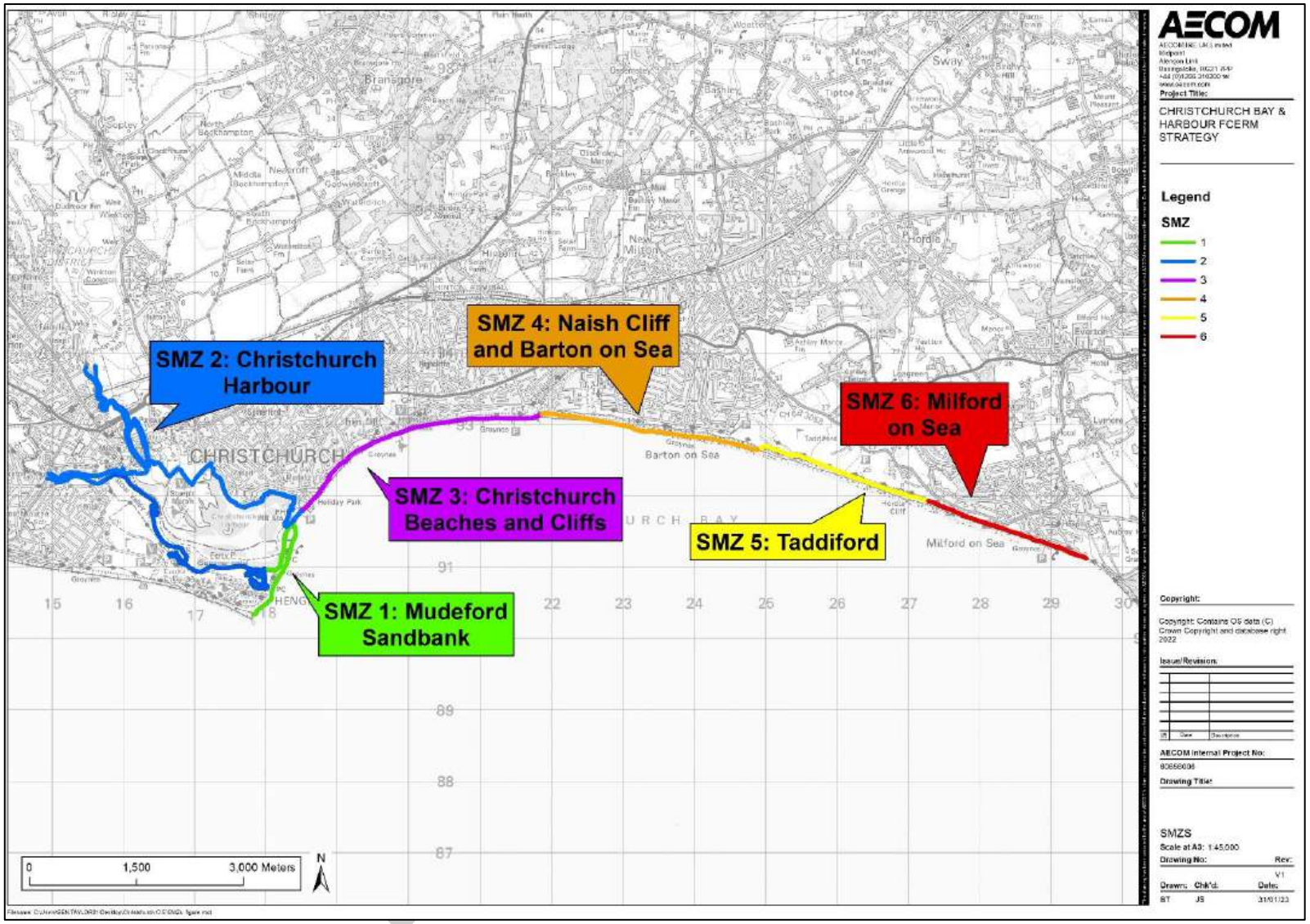

Figure 2-1: Location of the SMZs

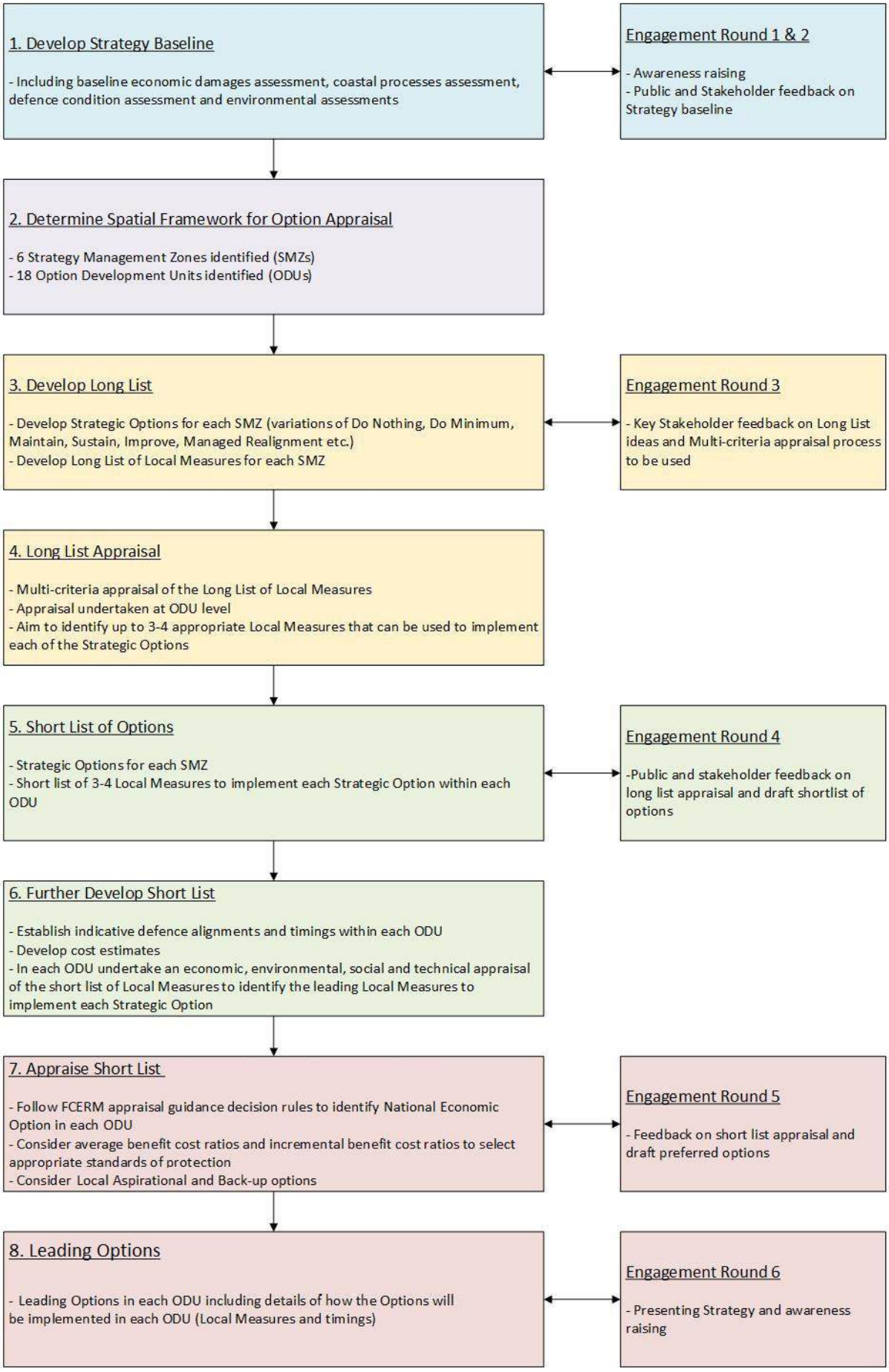

Figure 2-2: Flowchart showing the Strategy Option development and appraisal process

2.2 Further Development of Short List Options

This section provides details of stage 6 of the appraisal process which involved developing the Short List Options further so that the Leading Options could be identified.

The key output from stages 1-5 of the option development and appraisal process was a short list of Strategic Options for each SMZ and a short list of defence measures in each ODU that could be used to deliver the Strategic Options (see Short List Report (AECOM, 2023)). The Long to Short List appraisal screened out any unviable options that were not technically feasible, were likely to have large negative environmental impacts or were not likely to be acceptable to the public or stakeholders.

Following completion of stage 5, further work was then undertaken to develop the short list options in more detail. This involved considering how the defence measures on the short list could be combined and sequenced through time, to create coherent options for managing the flood and erosion risks in each ODU in line with the intent of each Strategic Option.

Details for each of the Strategic Options in each ODU were developed so that each option had an outline of which type of local defence measures would be used, the areas that would be defended and the approximate timing of the interventions. Timings of measures and interventions were developed based on the three time epochs in the Strategy:

- Epoch 1: between 2024-2044
- Epoch 2: between 2044-2074
- Epoch 3: between 2074-2124

The key factors that were used to combine and sequence the measures were:

- Intent of the Strategic Option – the intent of the Strategic Options varies and this influences the type of defence measures that are appropriate.
- Type and location of risk – risks vary by ODU and also often within ODUs, influencing which of the Short List of measures are appropriate in each location. For example, in some locations the dominant risk is from flooding, whereas in other areas it is from erosion.
- Onset of risk – the timing of the risk to properties and other assets from flooding and erosion varies by ODU and new defence measures may not be required immediately in every location.
- Residual life of existing defences – the residual life of the existing defences may influence the timing of the initial intervention.

A collaborative project workshop was held between AECOM, BCP, NFDC and the Environment Agency during which the project team discussed the draft combination / sequences of measures for each of the Strategic Options on the short list. In general there was agreement on the draft versions, but some modifications were made and the project team agreed on which measure combinations / sequences to take forward.

In some locations different versions of the same Strategic Options were developed. For example, there may be two versions of the ‘Improve’ Strategic Option within an ODU. Differences are often related to different areas of an ODU being defended, or different types of defence measures being used, for example using new hard defences such as rock revetments or softer engineering solutions such as beach management.

As part of the development of options, the potential environmental impacts of the options were assessed in the Strategic Environmental Appraisal (SEA). The SEA considered environmental impacts of each option against a range of environmental categories, including biodiversity / geodiversity, climate change, landscape, historic environment, land / soil / water resources, population / communities and transport / movement.

Stakeholders provided feedback into the environmental appraisal and option development throughout the process. For example. During stakeholder engagement round 2, stakeholders were made aware of the Strategy area’s environmental designations, listed buildings, scheduled monuments and conservation areas. The stakeholders provided feedback on which categories the SEA was considering and during engagement round 3 key stakeholders considered the long list option appraisal process and asked to ensure that environmental enhancements were considered in the process, alongside ecology, landscaping, cultural heritage and carbon.

2.3 Selecting the National Economic Leading Option

This section provides details of stage 7 of the appraisal process.

The first step of stage 7 involved identifying the National Economic Leading Options in each ODU using the process outlined in the FCERM-AG (Environment Agency, 2022). The key steps for selecting the Leading Option according to FCERM-AG are outlined below. For each of the ODUs Cost Benefit Analysis (CBA) was used to determine the National Economic Leading Option. Through discussions with the Environment Agency it was determined that cost Effectiveness Analysis (CEA) was not appropriate.

As per FCERM-AG, it is typical to use CBA to appraise options at the strategic level where multiple FCERM problems across a large, interconnected area are being considered. CBA balances the range of costs and benefits allowing the appraiser to identify the nationally leading option. There are two different approaches that can be used for CBA, depending on the risks at the location being considered.

For options that are primarily focussed on creating a reduction in the flood risk there are four key steps:

1. **Establish the whole life costs and benefits of the options**: Remove any options with an average benefit cost ratio (ABCR) <1 from the remainder of the appraisal. Take forward the options with an ABCR >1.

2. **Organise the options and select the leading economic option:** Organise the options with an ABCR >1 into a list based on reducing Annual Exceedance Probability of flooding (AEP) – improving Standard of Protection (SoP). The AEP for the onset of flooding will vary depending on where it is in a floodplain. The AEP can either be defined by the event probability that the economic impacts start (typically used in inland flood options and sheltered coastal areas) or the event probability that exceeds allowable overtopping rates (typically applied to coastal frontages with significant wave action).

   Once organised, the incremental benefit cost ratio (IBCR) between options is then used to select the SoP that provides best value for money. The selected option (and SoP) is classified as the provisional leading economic option.

   The IBCR is calculated as the difference in option benefits between two options divided by the difference in option costs between the options.

3. **Test for uncertainty:** Using results from a sensitivity analysis, consider whether the choice of the leading economic option needs to change to account for the uncertainties. If the provisional leading economic option stays the same in the sensitivity tests, do not change the option choice. However, if the sensitivity tests are showing that the choice of the provisional leading economic option changes under the test, consider a range of next steps, including whether to change choice of the leading option or to adapt the option to minimise the impact of uncertainties.

4. **Determine National Economic Leading Option:** The leading economic option at the end of step 3 is identified as the provisional National Economic leading Option.

For options that cannot be ordered by AEP, step 2 of the process uses Net Present Value (NPV) to organise the options rather than reducing probability of flooding. Examples of options that cannot be ordered by AEP within the Strategy are coastal erosion focussed options (where a flood risk SoP is not provided) or strategic based options that deal with different areas within an ODU or other risk factors such as defending historic landfill sites. For this approach, step 2 involves:

2. **Organise the options and select the leading economic option:** Organise the options with an ABCR >1 into a list based on increasing NPV. The leading economic option is the option with the highest NPV.

Steps 1, 3 and 4 remain the same for options that are reducing the erosion risk.

For the Strategy appraisal, the FCERM-AG approach was applied with the following additional provisions:

- When the options under consideration were solely focussed on managing flood risk, two different SoPs were considered in step 2; a 1 in 75 year standard and a 1 in 200 year standard. These standards were used as they represent the boundaries of the IBCR thresholds in the FCERM-AG and a recommendation for the SoP can therefore be made in the Strategy. In order to select the 1 in 200 year standard as the leading economic option, the IBCR needs to be greater than 3 relative to the 1 in 75 year standard.

- Once the provisional National Economic option had been selected, the results of the Strategic Environmental Appraisal (SEA) and Social Appraisal were considered. If the provisional National Economic Leading Option was likely to have major negative environmental impacts that could not be reasonably mitigated, then the choice of option was reconsidered, and the next best National Economic Option was identified. Similarly, if the provisional National Economic Option was likely to have major negative social impacts and not be supported by stakeholders then the choice of option was revisited.
- The purpose of cross checking against the SEA and social appraisal at this stage was not to change the choice of the National Economic Leading Option to the one that had the greatest social or environmental benefits, but rather to determine whether the provisional National Economic Leading Option would have major negative impacts on these categories that could not be reasonably mitigated, leading to the Strategy not meeting its objectives and a lack of support for the Strategy. In most cases, a Local Aspirational Leading Option was also identified, which typically provides greater social / environmental benefits relative to the National Economic Leading Option.

2.4 Selecting the Local Aspirational Leading Option

In some ODUs, the National Economic Leading Option may not be preferable for local decision makers or communities, and there may be compelling local reasons to choose an alternative option from the short list.

The next step of stage 7 of the appraisal was to consider whether a ‘local choice' option was also required.

FCERM-AG outlines how a local choice option can be selected as the overarching leading option to replace the National Economic Leading Option if the additional expenditure for the local option is fully funded. Given that the Strategy represents the initial part of the overall appraisal process and funding for subsequent projects has yet to be secured, the local choice option has been termed the ‘Local Aspirational Leading Option’ in the Strategy. This reflects the intent of the project team to secure funding if possible but acknowledges that at this stage the Local Aspirational Leading Option does not fully replace the National Economic Leading Option.

To decide whether a Local Aspirational Leading Option was required for an ODU, the project team considered the evidence collected during rounds 1-4 of stakeholder engagement to identify the key local opportunities, wants and needs for each ODU. In cases where a Local Aspirational Leading Option has been selected, these have been listed in the relevant section of this report to provide justification for the decision.

Not all ODUs have a Local Aspirational Option. If the key objectives and local needs are met with the National Economic Leading Option then a Local Aspirational Option was not identified.

In many cases in the Strategy, the difference between the National Economic Leading Option and the Local Aspirational Leading Option within an ODU is often related to timing. For example, the National Economic Leading Option may not recommend a new coastal defence until epoch 2 or 3 when the risk increases and the economic case provides justification to do so. However, there may be a local preference to construct a new defence sooner than this, for example, in epoch 1 to avoid losses or impacts on assets in the interim. Typically the earlier timing of capital interventions negatively impacts the benefit cost ratios of options as the cost of the capital intervention are discounted less than capital interventions undertaken at a later stage.

With respect to FCERM-GiA availability for the Local Aspirational Leading Options, this will be capped at the amount of FCERM-GiA available for the National Economic Leading Option. Any Local Aspirational Leading Options will need to secure funding for all other costs.

2.5 Partnership Funding

Although not typically required or undertaken at this strategic stage, an indicative Partnership Funding assessment was undertaken to understand potential affordability challenges for the National Economic Leading Options and Local Aspirational Leading Options for the Strategy

2.5.1 Partnership Funding

FCERM schemes in England are typically jointly funded from central government funding known as FCERM-Grant in Aid (FCERM-GiA) and other funding sources, such as private contributions, local levy, council funds and others. This arrangement is known as Partnership Funding.

The amount of FCERM-GiA that a scheme is eligible for is based on a series of DEFRA Outcome Measure (OM) targets. There are four OMs under which projects can attract FCERM-GiA:

- **OM1**: All benefits arising as a result of the investment, less than those valued under the other outcome measures;
- **OM2**: Households moved from one category of flood risk to a lower category;
- **OM3**: Households better protected against coastal erosion; and,
- **OM4**: Statutory environmental obligations met through flood and erosion risk management.

The Environment Agency has prepared a standard spreadsheet Partnership Funding calculator (2020 version) to calculate the level of FCERM-GiA available to a scheme based on a series of input parameters. These include whole life option costs, benefits (OM1) and the number of properties moving from one flood risk band to another (OM2s). The Partnership Funding calculator provides a GiA contribution (£) and an initial 'Raw' OM score which can be used to assess the likelihood of a scheme attracting Partnership Funding. The GiA contribution represents a theoretical maximum funding value that could be available based upon the outcomes delivered by the scheme.

A key output of the Partnership Funding calculator is the Partnership Funding score (%). Broadly this percentage shows the amount of the option cost that is eligible to be covered by GiA. The remaining % of the cost would need to be covered by non-GiA sources, such as private or other public sector contributions. In order to be eligible for the GiA contribution, any shortfall in funding needs to be secured, so that the adjusted Partnership Funding score reaches 100%.

For more details and definitions of each term used in the Partnership Funding calculator please refer to the Partnership Funding guidance documents (2021).

2.5.2 Indicative Partnership Funding Assessment

At this Strategy stage, it was only possible to undertake a high level / indicative assessment of Partnership Funding, rather than a detailed assessment. This is because the Partnership Funding calculator is intended to be used to assess funding availability for individual schemes and cannot be directly applied to long term strategic options that involve a series of separate schemes over a 100 year appraisal period.

Rather than applying the Partnership Funding calculator to the Strategy Leading Options as a whole, instead the Partnership Funding calculator has been used to estimate the amount of GiA funding that could be available for **the major capital scheme within each option**.

For the majority of the National Economic and Local Aspirational Leading Options, the major capital scheme does not occur in year 0 (i.e. present day), but typically occurs later on in the appraisal period (e.g. in epoch 2 or 3). In these situations, in order to establish an indicative Partnership Funding score for the major capital scheme, it has been necessary to 'jump forward' in time in the appraisal period. To do this it requires a number of assumptions and introduces uncertainty (hence why the assessment is only indicative). The following assumptions were made in the assessment:

- The base date for the calculation has been shifted so that it starts at the time of the major scheme. For example, for a major capital scheme at the start of epoch 3, the base date for the calculation was shifted to be year 50.

- For capital schemes that rely on other parts of the option being implemented before the scheme, for example, maintenance of existing defences, refurbishment of existing defences or defence lengthening, it has been assumed that the costs and benefits of these earlier interventions have already occurred. These costs have not been included as costs in the Partnership Funding calculators but would still occur and need to be funded prior to the major capital schemes.
- For schemes that reduce flood risk and lead to OM2s, the base date for the OM2s at risk before the scheme was taken to be the properties at risk at the base date (not present day).
- Many schemes in the Strategy reduce erosion risk either by stabilising the position of the coastline / cliff top or by reducing the rate of erosion. To calculate the erosion benefits from a different base date, it was first necessary to work out the erosion damages in an undefended scenario if the scheme didn't take place. This is straightforward if the scheme is planned in year 0 as the baseline Do Nothing erosion zones could be used from today's base date. However, if the scheme was not planned until epoch 2 or 3, an assumption had to be made on the coastline position at that point in time. In these situations, the damages / benefits from the original baseline erosion zones were assumed to apply. For example, if an erosion scheme was planned in epoch 3, the Do Nothing damages in epoch 3 were assumed to apply to calculate the benefits, despite uncertainty as to where the cliff line may be at the start of epoch 3 (it could be seaward or landward of the projected line depending on the management interventions prior to this point in time). This is a reasonable assumption, as in a situation where prior management slowed the rate of cliff erosion and the baseline cliff position at the start of epoch 3 was seaward of the baseline erosion zone position, without a new scheme in place catch-up erosion would likely occur resulting in a similar progression of erosion relative to the Do Nothing scenario.
- The calculations also assume that the funding rules between now and the time of the initial intervention would be unchanged. This is considered unlikely as the funding rules change frequently and are related to central government funding arrangements for FCERM schemes, that can change subject to political changes / objectives / economic climate.

There is a considerable uncertainty in using the Partnership Funding calculator in this way and therefore the calculations should be used for illustration purposes only to indicate approximate / hypothetical funding availability and the possible scale of contributions required to implement the major schemes as part of the options.

These funding amounts presented in this report are not precise and should not be used to inform long term investment decisions. A range of factors can change between the time of writing this report and when schemes may be implemented.

2.6 Selecting a Backup Option

The final step of stage 7 of the appraisal process was to consider whether a Backup Option or multiple Backup Options were required in an ODU.

This decision was informed primarily by the results of the indicative Partnership Funding Assessment that was undertaken on the National / Local Options within an ODU. If a significant funding shortfall was expected then a Backup Option was identified because the funding shortfall introduced uncertainty as to whether the National / Local Options may be deliverable.

In addition, a Backup Option was also considered if there was residual uncertainty around technical, social, or environmental viability of the Leading Options.

2.7 Summary of Appraisal Process

Figure 2-3 overleaf provides a flowchart that summarises the key steps in the Option Appraisal Process from the Short List Options to the Leading Options for the Strategy.

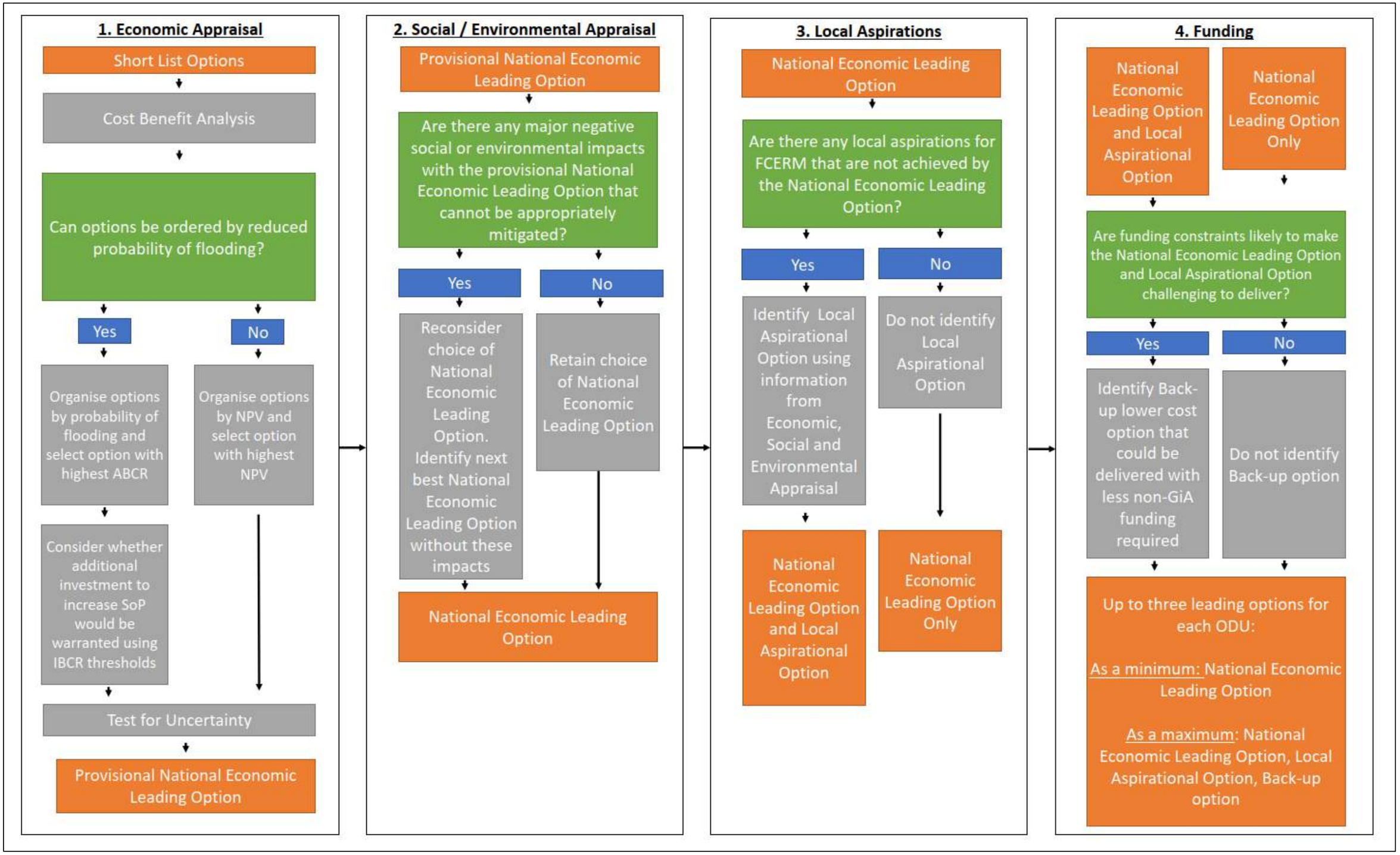

Figure 2-3: Option Appraisal Summary Flowchart

2.8 Adaptive Capacity of Options

2.8.1 Adaptive Capacity

Adaptive capacity is the ability to adjust to future change in order to take advantage of opportunities that arise and appropriately manage additional risks that are presented. The Strategy option appraisal has embedded adaptive capacity into the appraisal decision making framework and option selection process. This will help the FCERM teams deliver the Strategy over the next 100 years despite a range of future uncertainties.

There are numerous uncertainties relating to FCERM at the coastline. However, the key uncertainties in delivering the Strategy over the next 100 years are considered to be:

- **Climate change** – the rate and magnitude of climate change is highly uncertain over the next century, influencing the amount of sea level rise and changes to wave climate. The rate of climate change will determine the flood and erosion risk along the Strategy frontage.
- **Funding –** the amount of funding that could be available from both public and private sources for FCERM related activities is also uncertain. A high level estimate of potential FCERM-GiA that could be available has been undertaken as part of the option appraisal, but funding rules could change. Acquiring full funding for FCERM schemes is also influenced by project cost. Costs have the potential to change significantly over short periods of time (as illustrated by the high rate of inflation between 2022-2023) and are influenced by global and national macro-economic factors beyond the control of the local FCERM teams.
- **Potentially contaminated land** – there are a number of historic landfill sites located along the Strategy coastline. There is uncertainty as to whether these sites contain contaminated materials and site investigations are required to either confirm the presence of or rule out contamination risk.
- **Land ownership / consenting** – there are numerous land owners along the Strategy frontage. This presents uncertainties relating to maintenance responsibilities and support / consenting for options.
- **Future development** – future development could occur in the Strategy area, potentially leading to additional sources of funding at certain locations or changes in stakeholder views of FCERM options.

FCERM has always faced the challenges of decision making in the face of multiple uncertainties, including in the climate, the economy and society. Traditionally these have been addressed by adopting a precautionary approach, acting as early as possible to manage potential risks but with typically high costs. For example, constructing a new coastal defence right away with a large freeboard allowance to account for potential increases in climate change that could occur.

Rather than following a precautionary approach, the Strategy has also identified options that follow a managed adaptive approach. A managed adaptive approach is more flexible and capable of addressing challenges and opportunities as they arise. Managed adaptive approaches typically provide greater resilience to negative changes (e.g. more climate change than anticipated) and enable opportunities to arise from positive future changes (e.g. changes to FCERM policy, improved scientific knowledge, more funding availability etc.). In addition, following a managed adaptive approach helps to avoid potential abortive investment if future scenarios don't develop as anticipated.

To facilitate options that have a managed adaptive approach, the Strategy appraisal has:

- **Developed and appraised options on an epoch basis** – three time epochs have been used in the Strategy options; the short term (2024-2044), the medium term (2044-2074) and the long term (2074-2124). Each option developed and appraised includes details of what interventions are planned in each epoch. If climate change occurs more quickly or slowly than currently anticipated, then interventions set out on each option can be brought forward or delayed accordingly. This ensures that options have in-built adaptive capacity to respond to changes in climate change as they occur.
- **National Economic, Local Aspirational and Backup Options** – many of the ODUs have all three option types included as leading options and the amount of funding that can be secured will help shape which option is implemented. Funding is recognised as a key uncertainty and therefore having the choice of up to three leading options in each location provides the FCERM teams with different pathways that can be taken subject to funding availability. Furthermore, should risks change (e.g. if climate change occurs faster than anticipated)

or funding become available, it is entirely possible for option choices to change over time and to move between the leading options as required. For example, if funding is not initially envisaged to be available for an area, the Backup Option could be delivered in the short term. However, hypothetically if funding rules were to change in epoch 2 and more funding became available, there could be a shift to the National Economic or even Local Aspirational Leading Option at that point in time.

- **Uncertainty** – as part of the options appraisal sensitivity tests have been undertaken on key variables such as cost increase or sea level rise. This has ensured that the leading options identified developed are robust with multiple key uncertainties.

Whilst managed adaptive options have been included in the appraisal, they have not always been selected as the leading options. In some situations the leading option for an ODU is to undertake a precautionary 'improve' option whereby defences would be raised to the full height required to provide a desired SoP in 100 years' time. Where these options have been identified the decision has generally been driven by cost effectiveness, often related to the type of defence being considered. When designing these improve options during concept / outline design it is recommended that the design includes foundations / capacity for the defences to be further raised in the future if sea levels rise faster than currently anticipated. This ensures the option can be robust / reliable / adaptable despite the future uncertainty in climate change projections.

2.8.2 Adaptive Pathways

Figure 2-4 below presents an illustration of the adaptive capacity of the options developed in this Strategy. It shows options in a hypothetical ODU scenario. The epoch by epoch breakdown of the National Economic, Local Aspirational and Backup Options are shown as well as the different adaptive pathways that could be taken through the various options. Decisions on which route to take would be subject to changing risks, opportunities and funding availability.

In the figure, the solid arrows are the anticipated route through each option at the start of the Strategy implementation period and would be as they are described in the option development and appraisal. However, there are two dotted arrows shown on the figure, illustrating hypothetical examples of how the FCERM delivery team could change course between options as risks change or more funding became available.

For example, the purple dashed line illustrates one potential change of course that could occur. In this hypothetical example, initially, at the start of the delivery period the back-up option was implemented as there was insufficient funding to deliver the National Economic Option or Local Aspirational Leading Option. However, in epoch 2 the funding rules are altered and more funding becomes available meaning that it is viable to construct a new defence, as planned as part of the Local Aspirational Leading Option. Therefore, there is a change in course and the new defence is delivered.

Alternatively, the red dashed line illustrates another potential change that could occur. In this example a decision may be made initially to start with the National Economic Leading Option. This option involves constructing upgraded defences in epoch 3 as flood risk is not expected to impact a significant number of properties until then. However, over the course of epoch 1, new updated modelling becomes available which suggests that flood risk is much more significant than original expectations and many more properties are at risk. Therefore, a shift in approach is required and funding is secured through partnership working to undertake the new defence upgrade sooner and deliver the Local Aspirational Leading Option.

The National Economic and Local Aspirational options present various adaptive pathways that can be followed through the Strategy implementation. When selecting the options in each location all options have been strategically viewed to not cause detriment to neighbouring locations. Section 9.2 provides an overview of the strategic links between ODUs and potential impact on options in neighbouring locations if options are not delivered.

Similar illustrations to the example provided in Figure 2-4 have been prepared for each of the ODUs. In addition a Strategy Action and Implementation Plan has also been developed that outlines the key decisions and trigger points for implementing the various adaptive pathways in each location. These decisions and trigger points have been included on Adaptive Pathway decision tree illustrations for each ODU. Refer to the Strategy Action and Implementation Plan for more details.

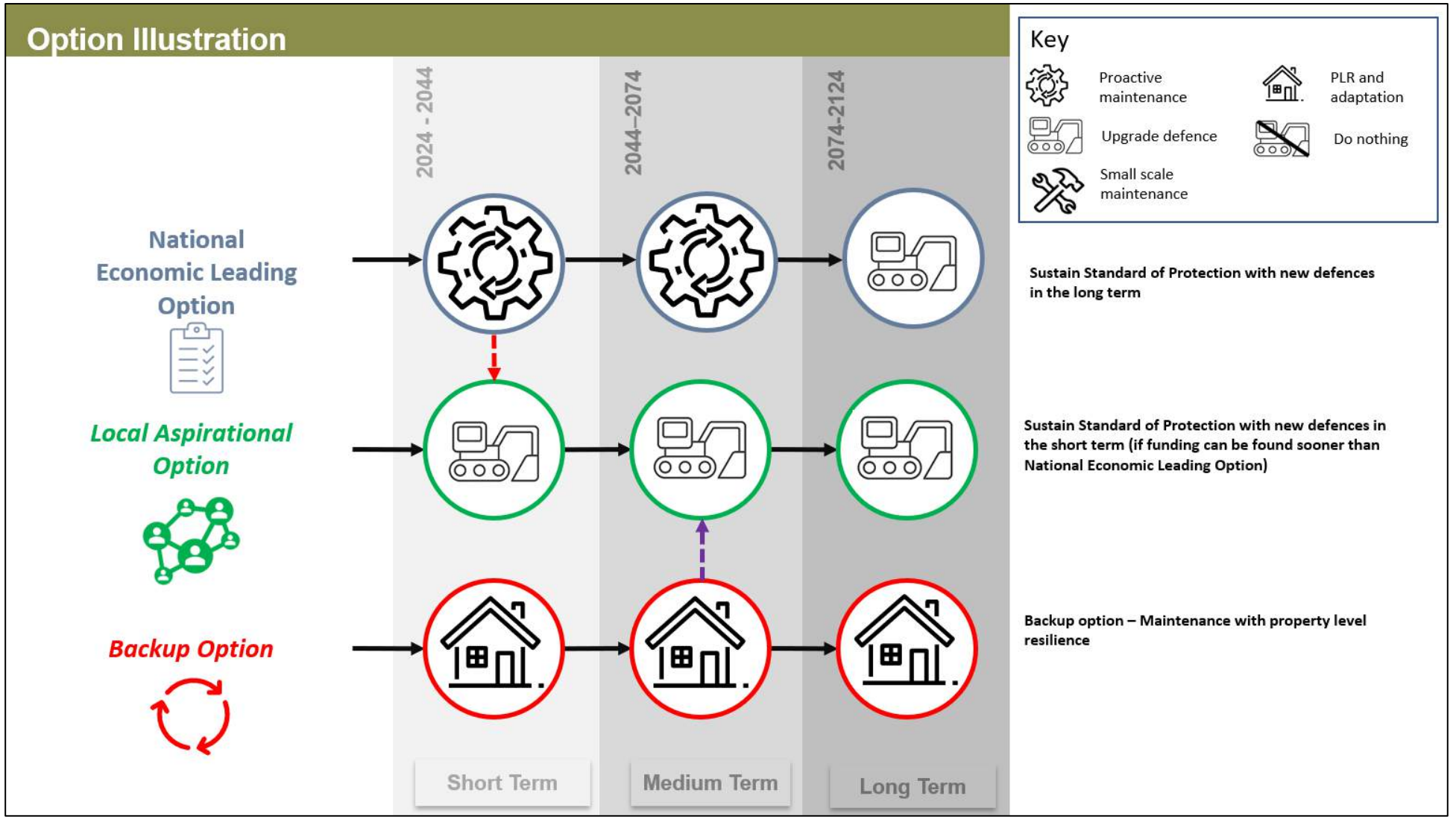

Figure 2-4: Option illustration showing hypothetical routes through the Leading Options

3. Strategy Management Zone 1

3.1 Overview

SMZ 1 (Mudeford Sandbank) includes ODU 1 and ODU 2 and covers Hengistbury Head to the east of the Long Groyne and Mudeford Sandbank. Both the open coast and harbour sides of Mudeford Sandbank are included in this SMZ. Figure 3-1 below shows the location of the ODUs within SMZ 1.

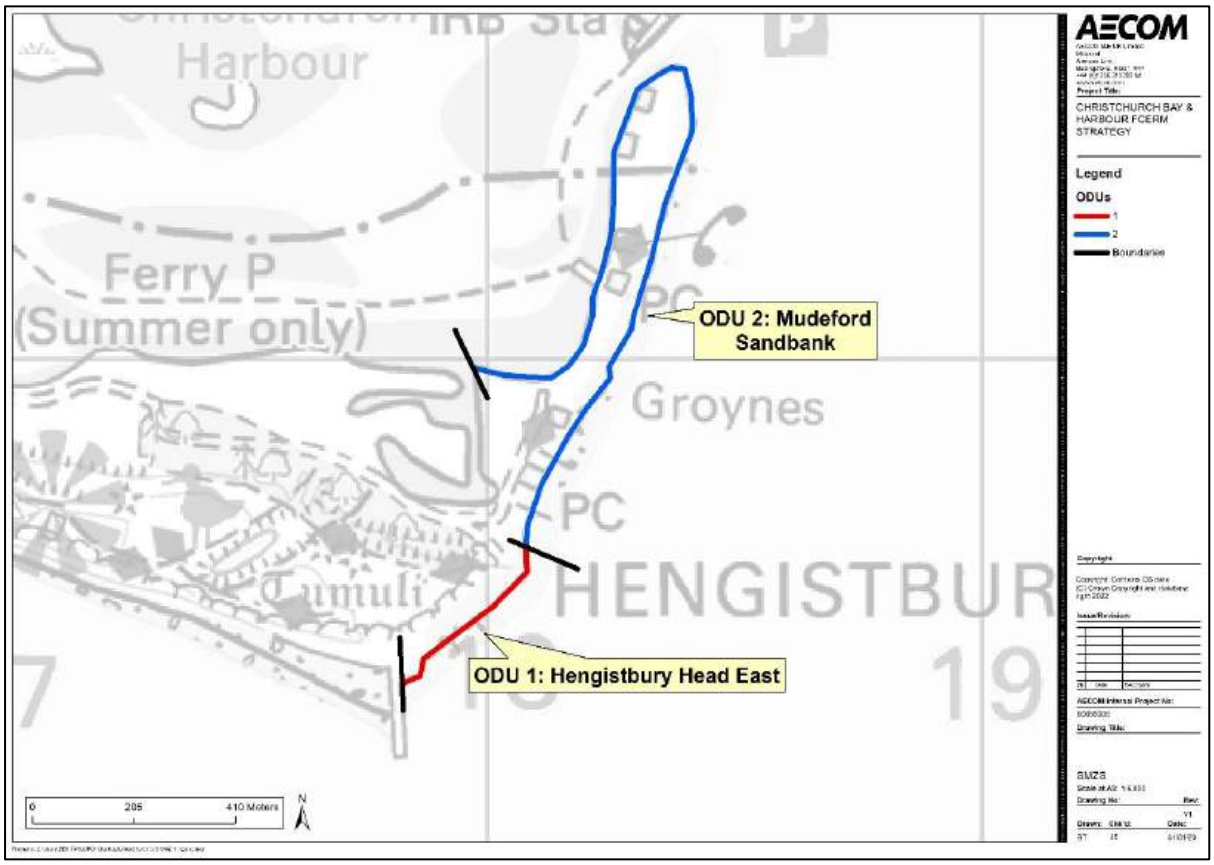

Figure 3-1: Location of ODUs within SMZ 1

The key feature in SMZ 1 is Mudeford Sandbank. The Sandbank has several businesses on it, as well as many beach huts and is an important area for recreation and amenity. The Sandbank also provides shelter to Christchurch Harbour, helping to reduce wave action within the harbour and flood risk. The entrance to Christchurch Harbour is located at the north end of the Sandbank and is known as 'the Run'. It is the sole access point into the harbour from the sea and is a key navigation route for commercial and leisure craft. There are also buried utilities beneath the Sandbank that pass beneath the Run across to Mudeford Quay.

Hengistbury Head Long Groyne is located at the west of ODU 1 and forms the western boundary of the Strategy frontage. The Long Groyne plays a critical role in reducing costal erosion in Poole Bay and is a stabilising feature for Christchurch Bay. The entire structure is due to be repaired and raised in height in the coming years to help provide erosion protection for the next 100 years. Strategic decisions for the Strategy are dependent on the ongoing function of the Long Groyne in stabilising Hengistbury Head, retaining beach material from Poole Bay and providing an anchor point at the coastline.

3.2 ODU 1 – Hengistbury Head East

ODU 1 is 400m long and is located immediately to the east of Hengistbury Head Long Groyne. Hengistbury Head has higher topography than adjacent areas and provides a stabilising influence on the shape of Poole and Christchurch Bay by acting as an 'anchor point'. The lower lying areas either side of Hengistbury Head (Double Dykes to the west and Mudeford Sandbank to the east) are at risk of breaching without FCERM which would invite uncertainty to the future hydrodynamics and flood risk in the area. Within the Strategy area, the erosion rate of the coastline in ODU 1 is likely to have an impact on the position and integrity of Mudeford Sandbank.

Rock armour and gabions provide protection to the toe of the cliffs, although these defences are in a poor condition with an estimated residual life < 10 years. Also, a series of rock groynes are easily overtopped during storm events, whilst the path in front of the cliffs can also be overwashed (which is a key works access route for the Long Groyne, and from an amenity perspective a link for walks between Solent Beach and Mudeford Sandbank). There are no FCERM Do Nothing Damages in this unit and the SMP policy for this unit is for Managed Realignment of the cliff line. The intent of this policy is to allow further erosion of the eastern cliff face, whilst ensuring it does not rollback as to align with Mudeford Sandbank which could reduce sediment supply to the spit and increase the likelihood of breaching.

It is important that the appraisal for this area considers the impact to Mudeford Sandbank and that a disconnect in the position of the coastline is not created. There is uncertainty as to the impact of long term erosion in ODU 1 on the wider coastline. Erosion could risk morphological changes occurring at the root of Mudeford Sandbank with the possibility of a breach forming in this location if the cliffs were to erode far enough inland. Likewise, erosion at ODU 1 could also risk outflanking the Hengistbury Head Long Groyne to the west, potentially reducing the effectiveness of this structure and impacting the integrity of the overall defence system in Poole Bay. Both the Mudeford Sandbank and Hengistbury Head Long Groyne are key strategic features for the overall coastal morphology of the area and provide a coast protection function to the bay and harbour. Mudeford Sandbank provides shelter to Christchurch Harbour and as noted above, the Long Groyne is integral to stability of Poole Bay and more locally may impact breach risk at Double Dykes, and hence with implications for fetch distance / wave exposure in the harbour (e.g. Stanpit).

The key features in ODU are shown in Figure 3-2.

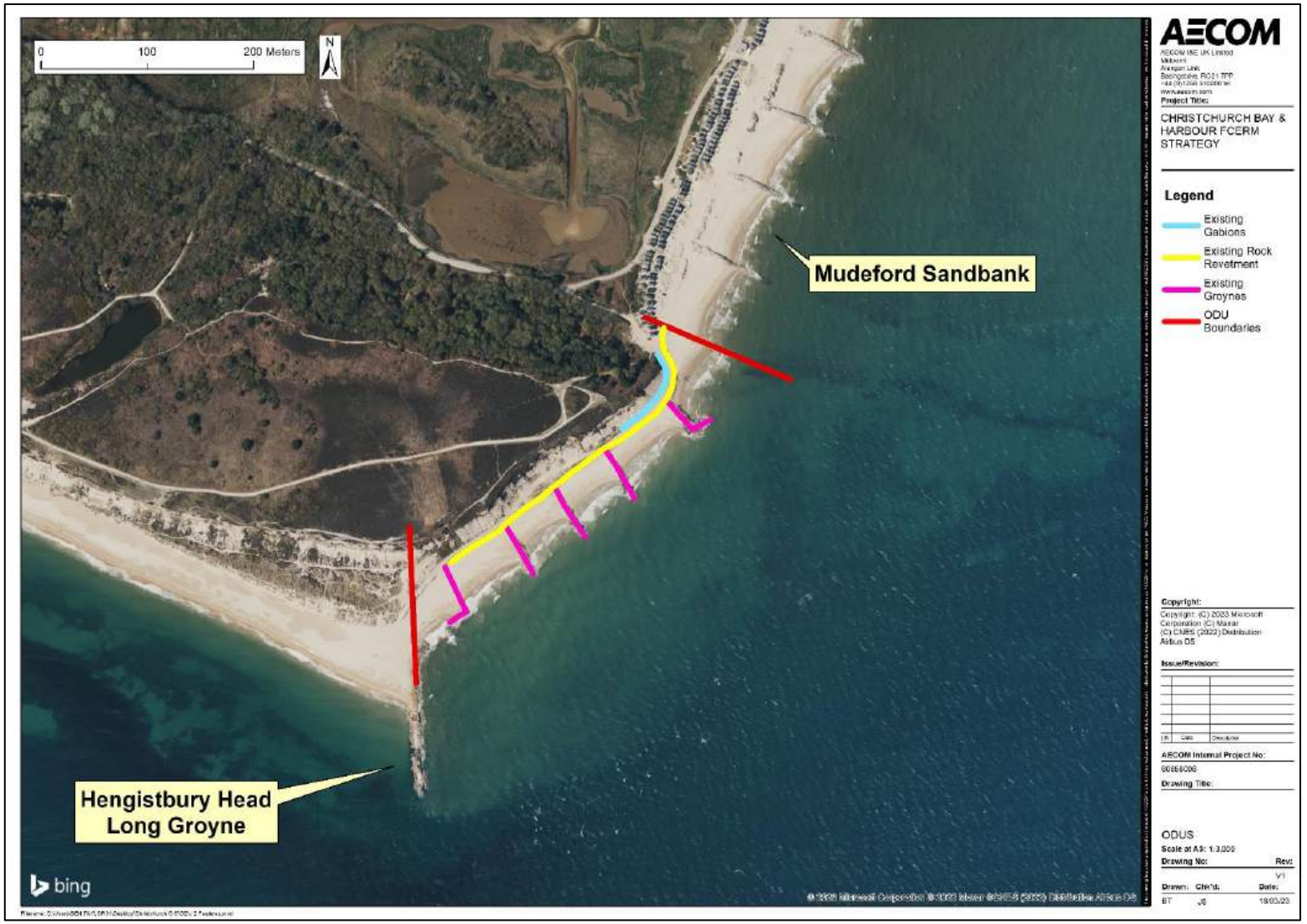

Figure 3-2: Key features in ODU 1

3.2.1 Short List of Options

The Short List of Strategic Options for ODU 1 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 3-3 is a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the appraisal and concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 1 this would result in failure of the groynes, rock revetment and gabions once these structures reach the end of their service life. This would likely lead to the base of the cliffs in ODU 1 being more exposed to waves which could lead to an increase in the erosion rate of the cliff face.

Over time with anticipated sea level rise, the rate of erosion would be expected to increase due to increased exposure of the cliff toe. There is a risk in this location that if erosion were to proceed in an uncontrolled manner, then a disconnect between the coastline in this location and Mudeford Sandbank could occur, as well as outflanking of the Hengistbury Head Long Groyne. This could have broader implications on the morphology and coastal protection around Christchurch Harbour and also Poole Bay.

The Do Nothing option may include health and safety measures to make safe the existing defences as they fail.

Do Minimum

The Do Minimum Strategic option would involve undertaking reactive small scale maintenance to the existing defences in this unit. This would typically take the form of patch and repair maintenance whereby localised damage to the defence is repaired on an ad-hoc basis.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reach the end of their service lives the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis. In ODU 1 there is minimal benefit for the Do Minimum option relative to the Do Nothing in the long term given that it would not involve sustaining the FCERM service of the defences for an extended period and erosion risk to the cliff line would increase over time. Similar to the Do Nothing scenario, this option could potentially lead to impacts on the wider morphology in adjacent areas.

Managed Realignment

The Managed Realignment approach would involve maintaining the existing defences at the toe of the cliff and beach through proactive maintenance and refurbishments. Beach recycling would also be undertaken to help sustain beach levels in this location, providing support to the linear defences to help reduce the amount of maintenance required.

This approach would help to slow and control the rate of the cliff erosion in the future so that the erosion would not lead to outflanking of Hengistbury Head Long Groyne or to a disconnect in the shoreline position with Mudeford Sandbank.

With this approach the erosion of the cliff top would not be stopped entirely because whilst the cliff toe would be defended, the cliff face would still be subject to other erosion processes such as weathering. However, it would significantly reduce the rate of erosion relative to the Do Nothing scenario and ensure this area is managed proactively and that the defences continue to provide an FCERM function.

For the purposes of costing it has been assumed that the existing defences in this unit would be refurbished in epoch 1, then at regular intervals throughout the remainder of the appraisal period. Smaller scale patch-repair maintenance would also be undertaken regularly as required, as would beach recycling depending on the monitoring results of beach levels in this location.

The Hengistbury Head Long Groyne forms the west boundary of this unit and the Strategy area. Management of the Long Groyne is part of a separate Strategy and it has been assumed that this will remain in place based on the knowledge of allocated funding going towards repairing the structure in the coming years.

Improve

The aim of the Improve approach would be to reduce the erosion rate of the cliffs in this location so that any further erosion would be minimal. This would be achieved by improving the rock groyne and rock revetment defences at the cliff toe in the future (e.g. raising these structures at a point in time in the future) so that they provided a more robust defence against future sea level conditions.

The Improve approach would be more costly than the Managed Realignment approach. For the purpose of costing it has been assumed that the during epoch 1 the existing defences would be refurbished (as per the Managed Realignment Option). However in epoch 2 new larger toe defences (rock revetment) and groynes would be constructed to provide a more robust defence to the cliff toe.

The Hengistbury Head Long Groyne forms the west boundary of this unit and the Strategy area. Management of the Long Groyne is part of a separate Strategy and it has been assumed that this will remain in place based on the knowledge of allocated funding going towards repairing the structure in the coming years.

Figure 3-3: ODU 1 options

3.2.2 Economic Appraisal

Cost benefit analysis

Table 3-1 below presents the economic costs, damages and benefits of each option. Given that there are no calculated national damages or benefits for any of the options in this location it has not been possible to calculate the ABCR or NPV. The lowest cost option in this location is Do Nothing and therefore this has been selected as the provisional National Economic Leading Option.

Table 3-1: ODU 1 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	0	0	-	-	X
Do Minimum	340	0	0	-	-340	
Managed Realignment	2,823	0	0	-	-2,823	
Improve	3,240	0	0	-	-3,240	

Sensitivity tests

The main uncertainty with the options in this location relate to option cost. However, given that there are no option benefits in this location there is little merit in sensitivity testing the option costs as it would not impact the choice of provisional National Economic Leading Option (no option cost less than Do Nothing).

3.2.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 1 frontage include:

- Indicates overall support for each of the defence measures on the short list with each of the measures having more 'agree' than 'disagree' responses. Maintenance / repairs, beach recycling, sand dune enhancements and rock groynes were among the options with the most 'agree' responses.
- The short list measure voted most important was beach recycling.

Table 3-2 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 3-2: ODU 1 social appraisal

Option(s)	Comments
Do Nothing	Do Nothing does not appear to align with stakeholder / public feedback. Could result in failure of existing defences and potential impacts in adjacent areas (i.e. Mudeford Sandbank). Walking away from existing defences unlikely to be supported.
Do Minimum	Do Minimum would involve small scale maintenance / repairs. Compared to the Do Nothing scenario this better aligns with the feedback from stakeholders (for example, support for Maintenance / Repairs). However the long term evolution of the unit is uncertain with this option and in the long term this option may not be supported.
Managed Realignment	The Managed Realignment option would involve refurbishment and ongoing patch-repair to existing defences as well as beach recycling. Each of these measures were among the measures with the most 'agree' responses during the previous round of engagement.
Improve	Similar defence measures to the measures included in the Managed Realignment approach.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 3-3 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options generally are expected to have negative impacts on many of the environmental categories considered. For example, uncontrolled erosion of the area could have impacts on the landscape and the historic environment as the headland forms part of the 'Multi-period landscape of the Hengistbury Head scheduled monument'. Furthermore, there could be impacts in the population and communities and transport and movement categories due to loss of public footpath / access to the area.

By controlling / slowing the rate of erosion relative to the Do Nothing / Do Minimum scenario, the Managed Realignment option could have positive impacts across a range of the environmental categories and no major negative impacts have been identified for this option. Controlling the rate of erosion would be expected to benefit the Dorset Heath and Dorset Heathlands SAC / SPA sites whilst also ensuring the geological interest of the SSSI was maintained. Minor negative impacts expected on the historic environment category.

The Improve option could have beneficial impacts across most categories, with positive impacts noted for the historic environment, population and communities and transport and movement categories. Overall the improve option would be expected to have a neutral impact on the biodiversity / geodiversity category as it would involve limiting future erosion of the cliff which could negatively impact the condition of the cliff face SSSI (currently favourable with exposure of geological features) but conversely help defend the Dorset Heath and Dorset Heathlands SAC / SPA sites. Minor negative impacts expected on the historic environment category.

Table 3-3: Summary of potential environmental impacts in ODU 1

Option(s)	Summary of Environmental Impacts
Do Nothing, Do Minimum	Could lead to negative impacts across a variety of categories, including climate change / historic environment / landscape, population and communities and transport and movement.
Managed Realignment	Could lead to positive impacts across wide range of categories. Potential for positive impact in the biodiversity category as erosion would be in a controlled manner but would still occur. This would provide more control over erosion of the Dorset Heaths SAC and Dorset Heathlands SPA site whilst not negatively impacting the geological interest of the SSSI site. Minor negative impacts in historic environment category but an improvement on Do Nothing / Do Minimum.
Improve	Could lead to positive impacts across wide range of categories but also negative impacts in categories such as Landscape. Neutral impact expected in the biodiversity / geodiversity category. Minor negative impacts expected in historic environment category but an improvement on Do Nothing / Do Minimum.

3.2.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified the Do Nothing option as being the National Economic Leading Option.

Both the Do Nothing and Do Minimum options are likely to have negative environmental impacts across a variety of categories. The main impacts will relate to an eroding cliff face in the future. This could impact the amenity value of the area which could reduce the numbers of visitors / recreation users. The health and safety risks of an eroding cliff face could be mitigated through health and safety provisions to limit access. From a historic environment perspective, erosion of the cliff could impact the 'Multi-period landscape of the Hengistbury Head scheduled monument', although the long term evolution is uncertain.

From a social perspective, the Do Nothing option is unlikely to be acceptable as it would involve walking away from existing defences that are currently providing an FCERM function. The Do Minimum option may be a better solution as it involves only a relatively small investment (small scale patch-repairs as required) and may have better support by the local community and stakeholders in the short term. In the long term there is unlikely to be much difference between the two options as small scale patch-repair will not be able to maintain the condition of the defences in the medium / long term and they will eventually fail.

Overall, due to the presence of existing defences that are in working order and providing an FCERM function, it is not considered acceptable to recommend the Do Nothing option as the National Economic Leading Option in this location. The next lowest cost option is the Do Minimum option and therefore this has been identified as the National Economic Leading option in ODU 1. It is not appropriate to select a higher cost option (i.e. Managed Realignment or Improve) as the National Economic Leading Option due to the significant additional investments required for these options which are not justified as no economic benefits are generated by these options on a national basis.

However, given the uncertainties about the morphological evolution of this area with uncontrolled erosion of the cliff in the medium and long term (which would occur with Do Minimum in the medium / long term), and the potential impacts that this could have on Mudeford Sandbank and Hengistbury Head Long Groyne, there is a local aspiration to do more to manage the risks along this part of the coastline. Therefore a Local Aspirational Option has also been selected.

Local Aspirational Leading Option

The key social, environmental and FCERM objectives of the Strategy for this location would be achieved by the Managed Realignment option. The Managed Realignment would help manage the rate of erosion of the cliff in the short, medium and long term to ensure that the rate of cliff erosion is minimised / controlled. This approach does not need to stop erosion completely, but instead ensure that the rate of erosion does not progress at a speed that could threaten the long-term success of Hengistbury Head Long Groyne or the integrity of Mudeford Sandbank. For this reason, the Managed Realignment Option has been selected as the Local Aspirational Leading Option.

3.2.5 Funding

No indicative Partnership Funding calculations have been undertaken for this location because the National Economic Leading Option is Do Minimum (which would not be eligible for FCERM-GiA) and the Local Aspirational Option does not generate any national economic benefits (and would also not be eligible for FCERM GiA).

Non-GiA sources of funding will therefore be required to deliver the Leading Options in this location.

3.2.6 Local Benefits

Whilst the Local Aspirational Option will not generate any nationally eligible economic benefits, it is likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 3-1. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £7million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the Local Aspirational Option (Managed Realignment) could help avoid these damages to the local economy (creating equivalent local economic benefits). When these local benefits are considered, it strengthens the economic case of this option.

3.2.7 Summary

Table 3-4 below summarises the leading options in ODU 1.

Table 3-4: Summary of ODU 1 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Do Minimum: small scale repairs to existing defences (i.e. patch-repairs)	340	0
Local Aspirational	Managed Realignment: Control the rate of cliff erosion by maintaining existing defences and undertaking beach recycling	2,823	0

Alignment with SMP

The National Economic Option of Do Minimum is not in line with the SMP policy for the area. However the Local Aspirational Option of Managed Realignment is in line with the SMP policy for the area. The option would allow further erosion of the eastern cliff face, whilst ensuring it does not rollback as to align with Mudeford Sandbank which could reduce sediment supply to the spit and increase the likelihood of breaching. Through actively managing the rate of erosion, the area could also continue to be used for amenity and recreation.

3.3 ODU 2 – Mudeford Sandbank

ODU 2 covers the entirety of Mudeford Sandbank (including the open coast and harbour side). The Sandbank is fronted by rock groynes along its length (seaward side) and the narrowest part of the Sandbank has a small seawall. There is a potential risk of the Sandbank breaching in the future and there is a strategic link between the Sandbank and the coastal processes within the harbour.

There are beach huts located along the Sandbank and several non-residential properties that are serviced by buried services that pass beneath the Sandbank and the Run to Mudeford Quay. Over the next 100 years the Do Nothing PV damages are estimated to be between £0.1-0.2million. This value does not include potential damages to the beach huts from flooding or erosion. Damages to beach huts are not eligible to be counted as part of the economic assessment for FCERM Strategies or Schemes given they are not permanent dwellings or properties. However, there is a local economic benefit from the beach huts which generate rental income for BCP and should be considered when selecting the Local Aspirational option for this area.

The SMP policy for the open coast part of the unit is to Hold the Line in the short term, then Managed Realignment in the medium and long term, with the intent to allow gradual rollback of the Sandbank in line with sea level rise. The harbour side policy is for Managed Realignment, to allow rollback of the Sandbank.

Mudeford Sandbank is an important feature to the overall morphology of the harbour and there is considerable uncertainty as to what the impact would be in the harbour if the Sandbank were to undergo significant changes, such as breaching, flattening or rollback. The end of the Sandbank is located at the entrance to the harbour (The Run) and changes to the position of the Sandbank could lead to significant impacts on the wider morphology of the area, the channel direction, flow velocities, sediment transport, vessel navigation and health and safety. Furthermore, if the Sandbank were to change orientation or rollback this could lead to step-changes or significantly more flood risk within the harbour itself as it could increase exposure to certain wave conditions or tidal currents. Rollback of the Sandbank would also impact the buried services beneath the Sandbank which may need to be moved to a new position and could also risk Gundimore, as realignment of the Sandbank could impact the fixed / hard structure on the other side of the Run.

The key features in ODU 2 are presented in Figure 3-4 below.

Figure 3-4: Key Features in ODU 2

3.3.1 Short List of Options

The Short List of Strategic Options for ODU 2 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 3-5 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

For ODU 2 a Strategic Option that involved relocating assets off the Sandbank (businesses and beach huts) and allowing the Sandbank to rollback was considered by the project team. The aim of this option would be to reduce the impact of future Sandbank movement to the businesses and amenity / tourism attraction of the area. However, this option was ruled out because there is insufficient space nearby to move the assets to and it would be challenging to recreate the same setting / character that draws tourism and visitors to the location. In addition, Hengistbury Head has a number of important international designations and is also a scheduled monument. Therefore assets could not be moved in this vicinity without negatively impacting these features.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 2 this would result in failure of the groynes, seawall and rock revetment once these structures reach the end of their service life. This would likely lead to the erosion of the Sandbank and there is uncertainty as to how the Sandbank morphology would evolve under this scenario. There is risk of breaches in the Sandbank developing, the Sandbank rolling back into the harbour, changes to the Sandbank orientation and navigational impacts to the Run. Buried services which are located beneath the Sandbank and connect to Mudeford at Mudeford Quay (ODU 11) would likely be impacted. There is also a broader risk of changes to the flood risk within the harbour if the morphology of the Sandbank changes significantly.

Over time with anticipated sea level rise, the flood risk to the Sandbank itself would increase under the Do Nothing scenario with extensive inundation of the harbour side of the Sandbank from return periods in 2044. The feasibility of maintaining the beach huts and businesses on the Sandbank would decrease in the future with sea level rise.

Due to the risks to properties, infrastructure (e.g. utilities connections etc.) and the potential for broader morphological impacts, doing nothing is not an acceptable solution in this location and would not be in line with the SMP policy for the area. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum Strategic option would involve undertaking reactive small scale maintenance to the existing defences in this unit. This would typically take the form of patch and repair maintenance whereby localised damage to the defence is repaired on an ad-hoc basis.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reach the end of their service lives the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis. In ODU 2 there is minimal economic benefit for the Do Minimum option relative to the Do Nothing. In the long term, once the existing defences fail the Sandbank would be subject to natural evolution (similar to Do Nothing) and flood risk on the Sandbank itself would also increase over time. Similar to the Do Nothing scenario, this option could lead to potentially impacts on the wider morphology, navigation and flood risk in adjacent areas.

Maintain

The Maintain Option would aim to sustain the FCERM service of the Sandbank to the wider area and would look to hold the form of the Sandbank over time. This will aim to keep the Sandbank broadly in its existing position.

In epochs 1 and 2 this would be achieved through the ongoing repair and capital refurbishment of the existing seawall, rock groynes and rock revetment. In addition, the beach recycling activities on the Sandbank could be undertaken to ensure beach levels are sustained and the risk of breaching is reduced. The requirement for beach recycling will be informed by beach monitoring and will be subject to the amount of material naturally passing into this area from around the Long Groyne to the west. If beach recycling is required then the source of material will

need to be determined. Excavating material from the eastern end of the Sandbank could have adverse effects on the natural Run formation so sites such as Christchurch Beaches or to the west of the Long Groyne could be used (assuming these areas have high volumes of material and could be used as a source without impacting their FCERM function).

Beach management of the Sandbank could be supported by encouraging development of sand dunes to further stabilise and provide natural protection to beach huts and infrastructure. Vegetation planting / dune fencing could be installed to help with this process.

In epoch 3, as sea level rise increases, it is likely that a beach nourishment capital scheme would be required to sustain beach levels in line with sea level rise. This would be undertaken alongside the continued maintenance / refurbishment of the existing defences which would help to retain beach material in the desired position. For the purposes of costing, it has been assumed that approximately 90,000m^3 of material would be required at the start of epoch 3, with half of this amount again being required later in epoch 3. However, no beach design has been undertaken as part of the Strategy and therefore the volumes of material area likely to change during design. In addition, the timing of the intervention should be informed by beach monitoring.

In undertaking this option, the risk to wider morphological changes, navigation impacts, impacts to buried services and health and safety risks would be reduced relative to the Do Nothing scenario.

It is likely that as part of the Maintain option the beach huts on the Sandbank would need to be adjusted / raised / moved in the future to accommodate a higher crest level. This would likely be in epoch 3 when substantially more material is added to the Sandbank with the beach nourishment scheme.

Improve

The Improve option would also aim to sustain the FCERM service of the Sandbank to the broader area and hold the current position of the Sandbank over time.

In epochs 1 and 2 this would be achieved with the same approach as the Maintain option, via repair and capital refurbishment of the existing seawall, rock groynes and rock revetment, as well as beach recycling activities and encouraging the development of sand dunes.

However, in epoch 3, the Improve option would aim to upgrade the defences to provide a more robust defence system than the Maintain approach. This would likely involve constructing a new larger rock revetment along the length of the Sandbank, rock groynes and a beach nourishment scheme. This approach would provide contingencies in the defence system and so that it would not be reliant on just the beach / crest level to provide the flood and erosion defence. The new rock revetment would provide a secondary defence in case successive storms led to a drawdown in beach volumes and would provide more certainty in the long term.

In undertaking this option, the risk to wider morphological changes, navigation impacts, impacts to buried services and health and safety risks would be reduced relative to the Do Nothing scenario.

Similar to the Maintain option it is likely that the beach huts on the Sandbank would need to be adjusted / raised / moved in the future to accommodate a higher crest level. This would likely be in epoch 3 when substantially more material is added to the Sandbank with the beach nourishment scheme.

Managed Realignment

The Managed Realignment option would also aim to sustain the FCERM service of the Sandbank but would allow a degree of rollback to occur in a controlled manner (i.e. the rollback would not be unconstrained / left to occur naturally).

This would be achieved through the same approach as the Maintain Option in epochs 1, 2 and 3 and would involve initial repair / refurbishments / beach recycling and encouraging sand dune formation, followed by beach nourishment later in the Strategy period. Existing rock defences such as groynes and the rock revetment could be moved over time to encourage / control the rollback process and beach recycling would be undertaken to move material into the desired locations.

There is considerable uncertainty on the impacts of this option on non FCERM aspects such as navigation in the harbour and disruption / damage to buried services (which may need to be moved). The approach may not be supported by local communities / stakeholders due to the disruption and changes that could occur with this approach.

With the rollback approach, there would be a range of options for the beach nourishment scheme. For example it could involve placement of material on the harbour side of the Sandbank, creating space for the beach huts to be moved. Placement options would need to be assessed during scheme development, considering the pros / cons of different approaches, such as the impact on environmental designations.

With rollback of the Sandbank there could potentially be erosion damages / loss of the two permanent properties (businesses) on the Sandbank as the seaward edge of the Sandbank would be expected to retreat over time. However, the beach huts and the income that they generate is likely to be sustained if they are proactively moved as part of this approach.

Maintain and Adaptation

The Maintain and Adaptation option is the same as the Maintain option with the addition of property level protection to the permanent properties on the Sandbank to reduce flood risk. This is likely to be an effective defence against lower return period events during epochs 1 and 2, however, with sea level rise the effectiveness of the property level protection may be reduced as potentially deep flooding is expected on the Sandbank during most return periods considered in epoch 3 (e.g. >1m deep).

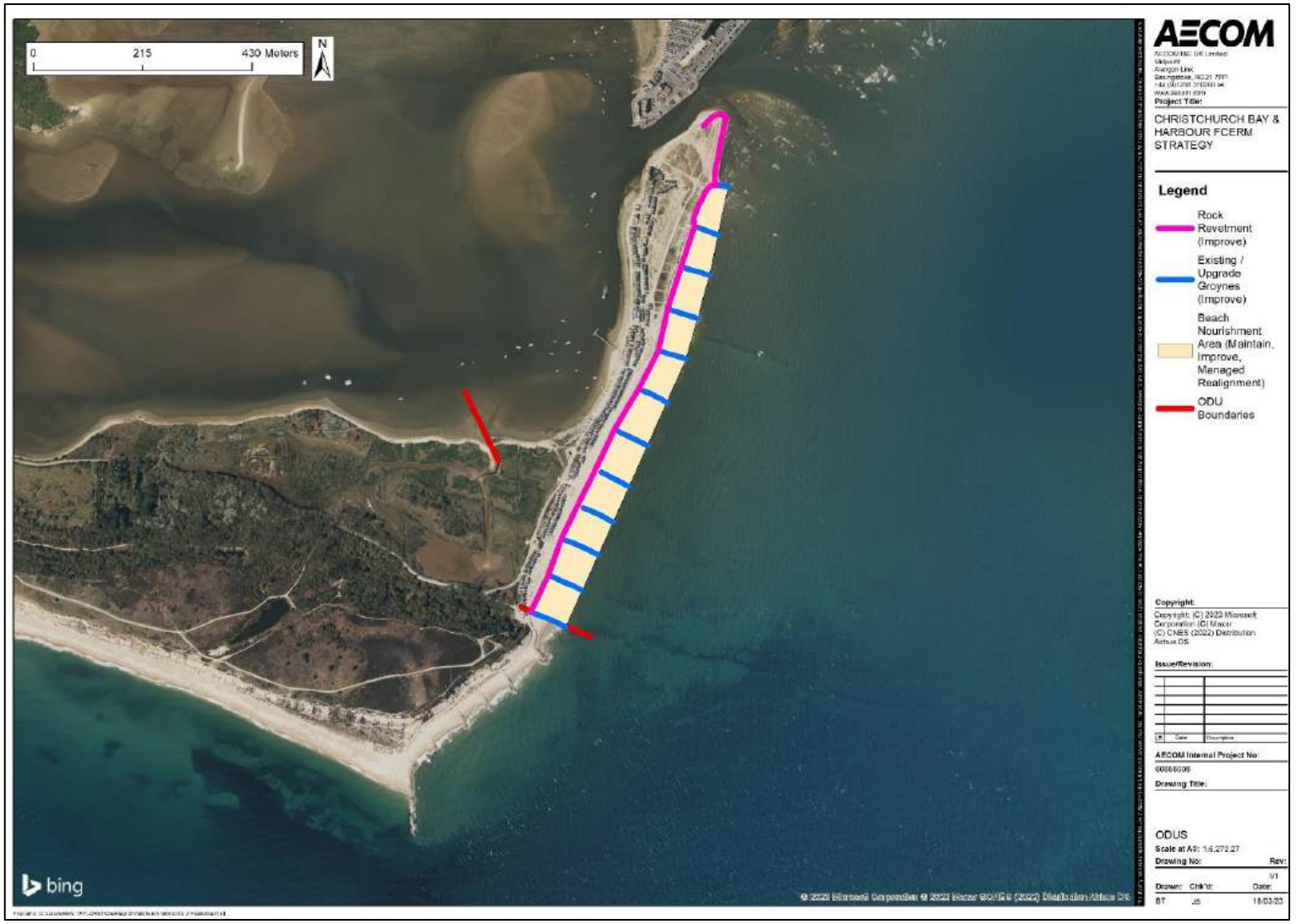

Figure 3-5: ODU 2 options

3.3.2 Economic Appraisal

Cost benefit analysis

Table 3-5 below presents the economic costs, damages and benefits for each option. As can be seen, the option costs outweigh the option benefits for each of the Do Something options. This is due to the lack of economic damages / benefits that can be counted for Mudeford Sandbank on a national basis. Other local economic benefits are likely to be associated with the Do Something options but are not eligible to be counted in this comparison. Each of the Do Something options has a negative NPV and therefore the Do Nothing option has been selected as the provisional National Economic Leading Option.

Table 3-5: ODU 2 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	153	0	-	-	X
Do Minimum	680	153	0	-	-680	
Maintain and Adaptation	5,456	64	89	0.02	-5,367	
Maintain	5,382	153	0	-	-5,382	
Managed Realignment	5,382	153	0	-	-5,382	
Improve	6,933	8	145	0.02	-6,788	

Sensitivity tests

The main uncertainty with the options in this location relate to option cost. However, given that the leading economic option is the Do Nothing option (which does not have a cost), there is little merit in sensitivity testing the option costs of the other options as it would not impact the choice of the provisional National Economic Leading Option (as no option will cost less than Do Nothing).

3.3.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 2 frontage include:

- Indicates overall support for each of the defence measures on the short list with each of the measures having more 'agree' than 'disagree' responses. Maintenance / repairs, beach recycling, sand dune enhancements, rock groynes and beach nourishment were among the options with the most 'agree' responses.
- The short list measure with most responses indicating it was most important was maintenance and repairs.

Table 3-6 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 3-6: ODU 2 social appraisal

Option(s)	Comments
Do Nothing	Do Nothing does not appear to align with stakeholder / public feedback. Could result in failure of existing defences, increased flood risk to properties and other assets in this location as well as large scale morphological changes / impacts to navigation / services. Walking away from existing defences unlikely to be supported.
Do Minimum	Do Minimum would involve small scale maintenance / repairs. Compared to the Do Nothing scenario this better aligns with the feedback from stakeholders (for example, support for Maintenance / Repairs). However over the long term evolution the defences will fail and the Sandbank would be left to evolve naturally, leading to similar impacts to Do Nothing. In the long term unlikely to be supportive of this option.
Maintain, Maintain + Adaptation	The maintain option would involve refurbishment and ongoing patch-repair to existing defences as well as beach recycling and beach nourishment. Each of these measures were among the measures with the most 'agree' responses during the previous round of engagement.
Improve	In addition to the measures included in the Maintain approach, the Improve option would also include upgraded rock groynes and a new rock revetment. The rock revetment had more 'agree' responses than 'disagree', however, it was the short list option with the most 'disagree' responses which indicates differing viewpoints on this measure from the public. It is therefore uncertain if this approach would be supported.
Managed Realignment	Same measures as the Maintain option so similar findings from the engagement feedback. However, the intent of this option (i.e. controlled rollback) would cause disruption to beach huts / properties on the Sandbank so this approach may not have same level of support as Maintain.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 3-7 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options could have negative impacts on most of the categories considered. This is due to the uncertain morphological evolution of the Sandbank with these options, as well as the increased flood and erosion risk to the Sandbank itself.

The Maintain and the Maintain with Adaptation options could have positive impacts across a range of categories as the risk of widespread morphological changes would be reduced as well as the erosion risk (and flood risk for the Maintain with Adaptation option). This could lead to a positive impact on a wide range of categories such as landscape, historic environment, population and communities. There could also be a positive impact on biodiversity and geodiversity as these options seek opportunities for sand dune restoration / creation which could help improve habitat areas and lead to biodiversity net gain. No major negative impacts have been identified as likely for the Maintain and Maintain with Adaptation options.

The Improve option could have positive impacts across a wide range of categories due to the reduced flood and erosion risk. Similar impacts to the Maintain options would be expected and this option also includes opportunities for sand dune restoration / creation.

The Managed Realignment option could have similar positive impacts to the Maintain and Improve options. However an uncertain impact on the biodiversity / geodiversity category could occur due to the risk of the Sandbank moving into / displacing the existing saltmarsh habitat located in the harbour. In addition, minor negative impacts could occur in the historic environment category due to exposure of the eastern boundary of the scheduled monument at Hengistbury Head.

Table 3-7: Summary of potential environmental impacts in ODU 2

Option(s)	Summary of Environmental Impacts
Do Nothing, Do Minimum	Negative impacts across a variety of categories, including climate change / historic environment / population and landscape.
Maintain, Maintain + Adaptation	Positive impacts across wide range of categories including landscape, historic environment, population and communities and biodiversity / geodiversity. Would help to ensure the continuing function of the Sandbank for amenity and recreation purposes.
Improve	Positive impacts across wide range of categories including landscape, historic environment, population and communities and biodiversity / geodiversity.
Managed Realignment	Positive impacts across wide range of categories (similar to Maintain option) but uncertain impact on biodiversity / geodiversity as it is unclear how potential rollback of the Sandbank may impact habitats and species in the harbour. Minor negative impact in historic environment category.

3.3.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified the Do Nothing option as being the National Economic Leading Option.

The Do Nothing option is likely to have a range of negative impacts, including to the environment, flood risk and to navigation. The morphological changes to the harbour that could arise with this options is very uncertain. Due to the risks to properties, infrastructure (e.g. utilities connections etc.) and the potential for broader morphological impacts, doing nothing is not an acceptable solution in this location and would not be in line with the SMP policy for the area.

There are existing defences on the Sandbank that currently provide an FCERM function and therefore it is not considered acceptable to recommend walking away and identifying the Do Nothing option as the National Economic Leading Option in this location. Instead the next lowest cost option is the Do Minimum option and this has therefore been identified as the National Economic Leading Option in ODU 2.

The Do Minimum option would aim to use small scale maintenance (e.g. patch-repair) to extend the service life of the existing defences for as long as possible. However, in the medium and long term, this will not be sustainable and as the existing defences fail the risks associated with the Do Nothing scenario would be expected to occur with Do Minimum. Despite this the Do Minimum option appears to be a better solution that the Do Nothing option as it involves only a relatively small investment and may have better support by the local community and stakeholders in the short term. It is not appropriate to select a higher cost option (i.e. Maintain or Improve) as the National Economic Leading Option due to the significant additional investments required for these options which are not justified on economic grounds.

There is a large amount of uncertainty as to what would happen if the Sandbank were to significantly change orientation, breach or rollback in an unconstrained manner. In the long term the Do Minimum option would do little to manage the risks of these processes and the morphological evolution of the Sandbank could occur in a similar way to the Do Nothing scenario. This could have a potential impact on flood risk in the harbour,

navigation, recreation and amenity and utilities, and therefore there is a local aspiration to do more to manage the risks along this part of the coastline. Therefore a Local Aspirational Leading Option has also been identified.

Local Aspirational Leading Option

The Maintain with Adaptation option has been identified the Local Aspiration Leading Option. This option would reduce the flood risk to the permanent properties on the Sandbank as well as maintain the form of the Sandbank over time to reduce the risks to navigation, buried services and environment. By controlling the position of the Sandbank over time the option would also provide a benefit to the beach huts which would otherwise be lost / damages under the Do Nothing / Do Minimum scenario.

With respect to managing flood risk on the Sandbank, from an economic standpoint, there is not an economic justification to provide a long length of defence to defend relatively few permanent properties and therefore targeted property level protection is the only realistic viable option from an economic perspective. This is the approach that the Maintain with Adaptation option takes.

The SEA and social appraisal did not identify any major negative impacts associated with this option and therefore it is confirmed as the Local Aspirational Leading Option.

3.3.5 Funding

No indicative Partnership Funding calculations have been undertaken for this location because:

- The National Economic Leading Option is Do Minimum which would not be eligible for FCERM-GiA.
- The Local Aspirational Leading Option is higher cost than the National Economic Leading Option and therefore GiA would not be available for the difference in cost.

Non-GiA sources of funding will therefore be required to deliver the Leading Options in this location.

3.3.6 Local Benefits

Whilst the Local Aspirational Option will not generate any nationally eligible economic benefits, it is likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 3-5. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £14million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the Local Aspirational Option (Maintain with Adaptation) could help avoid a significant proportion of these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of this option.

3.3.7 Summary

Table 3-8 below summarises the leading options in ODU 2.

Table 3-8: Summary of ODU 2 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Do Minimum: small scale repairs to existing defences (i.e. patch-repairs)	680	0
Local Aspirational	Maintain with Adaptation: sustain the FCERM service of the Sandbank by holding its form over time and aiming to keep it broadly in its current position. Achieved through beach nourishment and defence maintenance. Property level protection to permanent properties on the Sandbank.	5,456	0

Alignment with SMP

The SMP policy for the Sandbank is Managed Realignment. However, the Managed Realignment option was not selected as the Local Aspirational Leading Option in this unit because of the considerable uncertainty on the impacts of this option on non FCERM aspects such as navigation in the harbour and disruption / damage to buried services (which may need to be moved). In addition the Managed Realignment option may not be supported by local communities / stakeholders due to the disruption and changes that could occur with this approach. It is recommended that the SMP policy is reviewed following adoption of the Strategy as part of the SMP refresh process.

4. Strategy Management Zone 2

4.1 Overview

SMZ 2 (Christchurch Harbour) includes ODU 3 to ODU 11 and covers the coastline around Christchurch Harbour, up to Knapp Mill on the River Avon and Tuckton Bridge on the River Stour. Figure 4-1 below shows the location of the ODUs within SMZ 2.

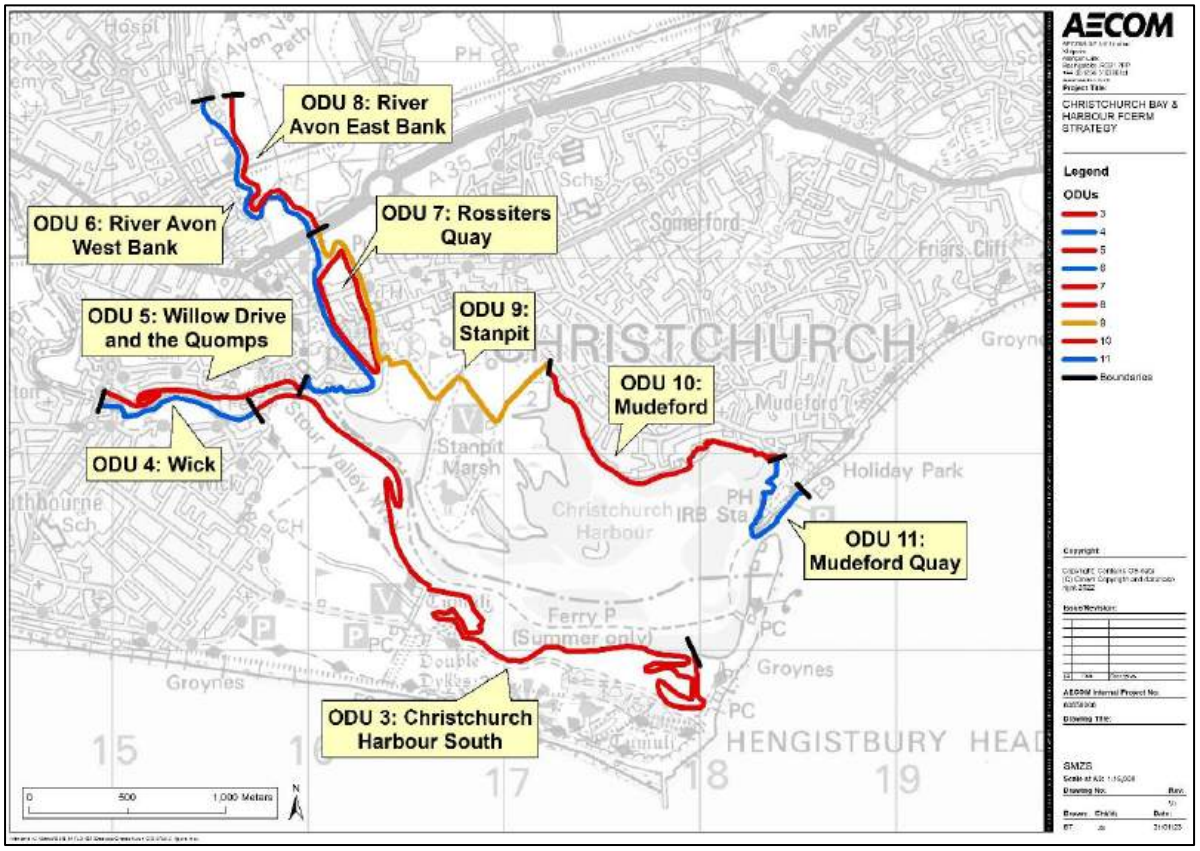

Figure 4-1: Location of ODUs within SMZ 2

SMZ 2 is a sheltered harbour environment and generally the main risk of coastal flooding is from tidal inundation rather than wave overtopping. There is also a risk from fluvial flooding from the River Avon and River Stour. There are many ODUs within SMZ 2 where residential properties and business are located very close to the shoreline. This introduces complexities such as space constraints and access requirements to the shoreline that need to be considered when constructing new defences or upgrading existing defences. In order for flood risk mitigation to be successful in this location, there will need to be collaboration between land owners, owners of private defences and the flood risk management authorities to address the flood risk.

There are numerous environmental designations around the harbour area, both land based and marine based. In most areas any encroachment of the defences into the intertidal areas would likely not be permitted. There are several areas in the SMZ which are historic landfill sites and therefore if these areas are not protected, and begin to erode, there is a risk that potentially contaminated material could be released (although further work is required to confirm if this may be the case or not). Many opportunities for environmental enhancements exist within the SMZ, such as saltmarsh restoration and landscaping. As the option appraisal develops the environmental enhancements will be considered further and incorporated into the options as appropriate.

The SMP policies vary around the harbour frontage but the overall intent within the harbour is to maintain a general policy of Hold the Line to the important areas of development but to also ensure opportunity for natural adaption of the different habitats. The SMP policies around the harbour are described in the introduction to each ODU in the sections below and more information can be found in the SMP documents.

4.2 ODU 3 – Christchurch Harbour South

ODU 3 is over 5km long and covers the south side of Christchurch Harbour. The ODU is largely undefended with the only formal coastal defence being a 70m section of quay wall / seawall adjacent to Hengistbury Head Sailing Club / Hengistbury Head Outdoor Education Centre. There are very few properties in ODU 3 and therefore only a small number of properties are at risk from coastal flooding. The SMP2 erosion zones do not cover much of this ODU and therefore the risk of erosion is largely unknown. Given the sheltered estuary environment of this location the rates of erosion in the future are expected to be low.

Of particular note in ODU 3 are the two historic landfill locations in this unit, located just to the east of Double Dykes and at Wick The site at Wick is located adjacent to the shoreline. It is unclear if there is potentially contaminated land in these historic landfill sites and therefore further studies are required to investigate the contamination status of these areas in the future. There is also an access road to Hengistbury Head that is situated in close proximity to the shoreline just to the east of Double Dykes. Despite low erosion rates in ODU 3, the Wick historic landfill site and access road could potentially erode in the future if left undefended. The Do Something options consider how to defend these areas if funding is available.

Over the next 100 years the total PV damages for this unit are estimated to be approximately £1million under the baseline Do Nothing scenario. This includes potential damages associated with erosion of the historic landfill sites and flood damages to a small number of properties.

The SMP policy for ODU 3 is No Active Intervention from the present day. This approach aligns with the Do Nothing Strategic option. Implementation of any of the other Strategic options would be a deviation away from the recommended SMP approach.

Figure 4-2 shows the key features in ODU 3.

Figure 4-2: Key features in ODU 3

4.2.1 Short List of Options

The Short List of Strategic Options for ODU 3 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 4-3 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences are not undertaken. In ODU 3 most of the frontage is currently undefended and therefore erosion would be expected to occur, albeit at a low rate due to the sheltered harbour environment. However, this could lead to the erosion of the access road to Hengistbury Head as well as to the historic landfill site at Wick. The Do Nothing scenario forms the baseline for the option appraisal and is in line with the SMP policy for the area. Under the Do Nothing scenario the existing quay wall / seawall at Hengistbury Head Sailing Club would be expected to fail at the end of its residual life. The structure condition and service life is unknown so the timing of potential defence failure is uncertain. The Do Nothing option may include health and safety measures to make safe the existing quay wall / seawall at Hengistbury Head Sailing Club if it were to fail in the future.

Do Minimum

The Do Minimum Strategic option would involve undertaking reactive small scale maintenance to the existing quay wall / seawall defence at the Hengistbury Head Sailing Club / Hengistbury Head Outdoor Education Centre. This would typically take the form of patch and repair maintenance whereby localised damage to the defence is repaired on an ad-hoc basis.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defence reaches the end of its service life the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis.

The Do Minimum also permits undertaking works to ensure health and safety compliance of defences that fail as part of this option. For example, clearance of failed defences and or removing access to unsafe areas.

In ODU 3 there is no economic benefit for the Do Minimum option relative to the Do Nothing scenario. This is because the existing quay wall / seawall defence does not provide any flood risk benefit to the Sailing Club / Outdoor Education Centre buildings and the building is set far enough back inland to not be at immediate risk of erosion if the defence were to fail (approximately 40m). In addition the historic landfill sites are currently undefended so Do Minimum would not be focussed in these areas.

Maintain A

The focus of the Maintain A option is to provide localised erosion defences to the access road to Hengistbury Head and also small scale patch-repair works to the existing quay wall / seawall at Hengistbury Head Sailing Club / Outdoor Education Centre. For the purposes of costing, the cost for localised shoreline armouring adjacent to the access road has been included in the option from epoch 1. It has been assumed that the shoreline armouring would be in the form of products such as 'Armorloc', mattress gabions or similar. These are typically lower cost products relative to new quay walls / seawalls and given the sheltered harbour environment in this location this type of defence is considered suitable.

The Maintain A option would not lead to a reduction in flood risk and therefore the small number of properties in ODU 3 would still be at risk from flooding. The road access to Hengistbury Head has not been valued in the economic appraisal and therefore the benefits for this option are the same as Do Minimum.

As part of this option it is also recommended that opportunities for saltmarsh restoration / creation are explored. Potential areas where this could occur could be to the north of the Hengistbury Head access road.

Maintain B

The focus of the Maintain B option is to provide erosion defences to the Wick historic landfill site as well as to the access road to Hengistbury Head. It would also involve small scale patch-repair works to the existing quay wall / seawall at Hengistbury Head Sailing Club / Outdoor Education Centre. For the purposes of costing, the cost for

shoreline armouring along the full length of shoreline adjacent to the Wick historic landfill site has been included, as well as localised armouring adjacent to the access road. Both defences would be constructed in epoch 1. Similar to Maintain A, it has been assumed that the shoreline armouring would be in the form products such as 'Armorloc', mattress gabions or similar. These are typically lower cost products relative to new quay walls / seawalls and given the sheltered harbour environment in this location this type of defence is considered suitable for reducing erosion risk.

The Maintain B option would aim to prevent erosion of the historic landfill site at Wick but would not prevent leaching of potentially contaminated material. To provide a defence against leaching a significantly more costly impermeable structure or remediation of the landfill site would be required. Further studies are required at the historic landfill sites to establish if potentially contaminated materials are present and whether leaching may be an issue.

Similar to Maintain A, the Maintain B option would not lead to a reduction in flood risk and therefore the small number of properties in ODU 3 would still be at risk from flooding.

As part of this option it is also recommended that opportunities for saltmarsh restoration / creation are explored. Potential areas where this could occur could be to the north of the Hengistbury Head access road.

Adaptation / Resilience A

The focus of the Adaptation / Resilience A option is to provide property level protection defence measures to the small number of properties at risk of flooding within ODU 3. The property level protection would be required from epoch 1 onwards. The Adaptation / Resilience A option does not include any erosion defences and therefore erosion could occur at the access road to Hengistbury Head and Wick historic landfill site in the future.

As part of this option it is also recommended that opportunities for saltmarsh restoration / creation are explored. Potential areas where this could occur could be to the north of the Hengistbury Head access road.

Adaptation / Resilience B

Adaptation / Resilience B includes the same Property Level Protection measures as Adaptation / Resilience A, but also includes the same localised erosion defences and defence maintenance as Maintain A. This option would therefore provide some protection to the properties from flooding through local resilience measures but would also provide erosion protection to the road access to Hengistbury Head. The road access to Hengistbury Head has not been valued in the national economic appraisal and therefore the benefits for this option are the same as Adaptation / Resilience A. There would however be local economic benefits associated with the continued access for recreation to Hengistbury Head associated with this option.

As part of this option it is also recommended that opportunities for saltmarsh restoration / creation are explored. Potential areas where this could occur could be to the north of the Hengistbury Head access road.

Adaptation / Resilience C

Adaptation / Resilience C includes the same Property Level Protection measures as Adaptation / Resilience A, but also includes the same localised erosion defences and defence maintenance as Maintain B. This option would therefore provide some protection to the properties from flooding through local resilience measures but would also provide erosion protection to the road access to Hengistbury Head as well as the Wick historic landfill site. As per the Maintain B option, the defence would reduce erosion risk but would not reduce the risk of leaching from the historic landfill.

As part of this option it is also recommended that opportunities for saltmarsh restoration / creation are explored. Potential areas where this could occur could be to the north of the Hengistbury Head access road.

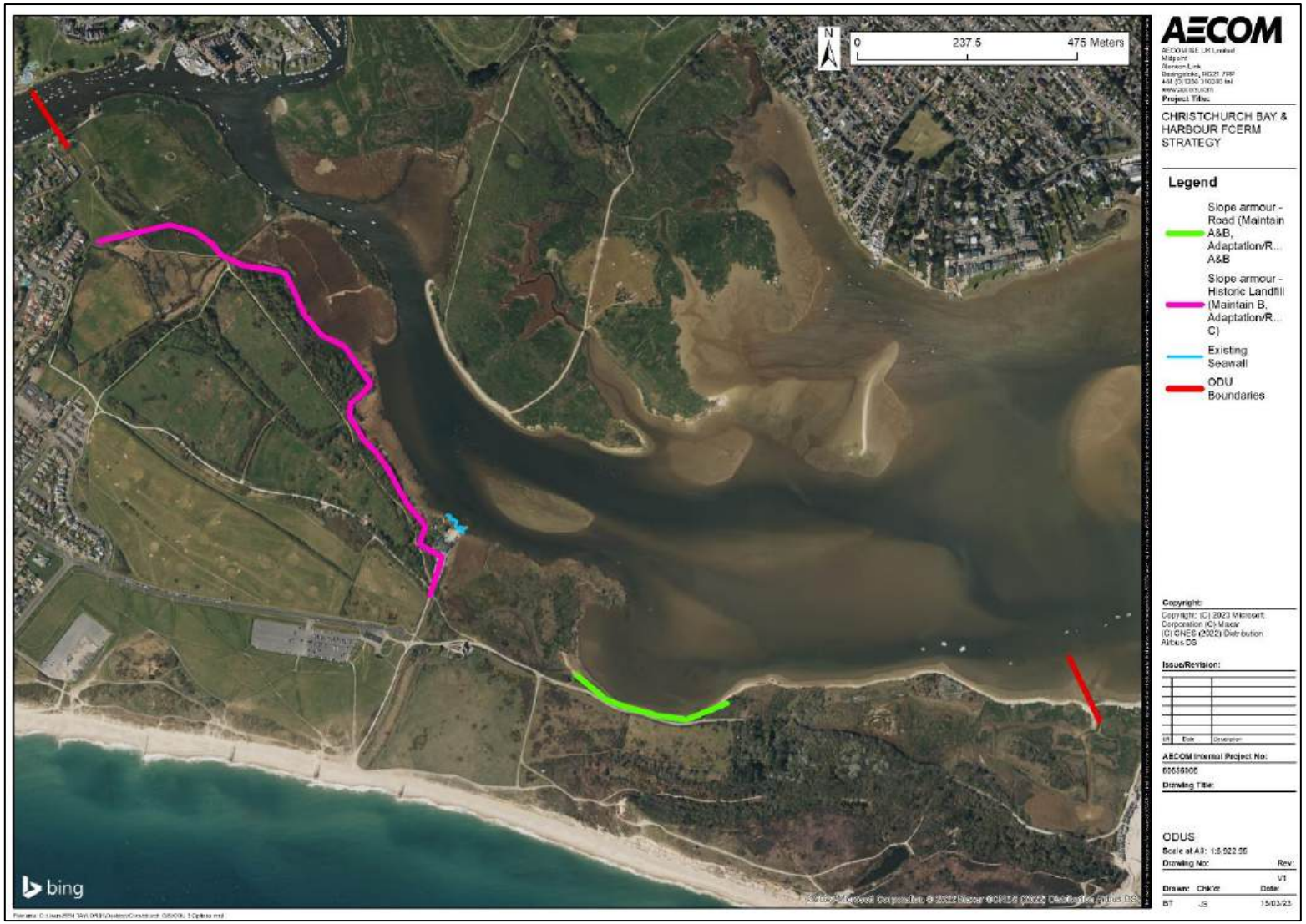

Figure 4-3: ODU 3 options

4.2.2 Economic Appraisal of Options

Cost benefit analysis

Table 4-1 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 3 cannot be ordered based on AEP and have therefore been ordered according to the NPV. The Adaptation / Resilience A option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

Table 4-1: ODU 3 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Adaptation / Resilience A	118	331	669	5.67	551	X
Adaptation / Resilience B	253	331	669	2.64	416	
Adaptation / Resilience C	776	189	811	1.05	35	
Do Nothing	-	1,000	0	-	-	
Do Minimum	44	1,000	0	-	-44	
Maintain A	204	1,000	0	-	-204	
Maintain B	727	857	143	0.20	-584	

Sensitivity tests

The main uncertainty with the options in this location relate to option cost. A sensitivity test has been undertaken to test the choice of options in ODU 3 with a cost uplift of 10% and 25% for Adaptation / Resilience A (the provisional National Economic Leading Option). Appendix A provides a summary of the results.

The sensitivity tests indicate that with a 10% and 25% cost increase for this option, the choice of National Economic Leading Option would remain unchanged. The Adaptation / Resilience A option would still have an ABCR of 4.5 for a 25% increase in cost. The choice of Adaptation / Resilience A as the provisional National Economic Leading Option has therefore not been changed as a result of the sensitivity tests.

4.2.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 3 frontage include:

- Indicates general support for the defence measures on the short list, including small scale maintenance / repairs, saltmarsh restoration, slope armour, setback embankment / floodwall
- The options with the most ‘agree’ responses were small scale maintenance / repairs, saltmarsh restoration and slope armour.
- Small scale maintenance / repairs was the short list measure that most respondents thought was most important.

In addition to the feedback from the public and stakeholders, through discussions with the BCP FCERM team other key social considerations for this location have been identified such as the continued access to Hengistbury Head. Currently the main access road is in proximity to the shoreline and could be threatened by erosion in the future if left undefended. If funding can be secured there is an aspiration to defend this section of road if possible.

Table 4-2 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 4-2: ODU 3 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public / BCP FCERM team aspirations. Could result in erosion of Hengistbury Head access road leading to access difficulties.
Maintain	Aligns with most supported measure on the short list from the public / stakeholders. However, given most of the frontage is currently undefended, large parts of the frontage may be at risk from erosion, including the Hengistbury Head access road.
Adaptation A	Could result in erosion of Hengistbury Head access road which is contrary to aspiration of BCP FCERM team. However, it is recognised that the access road defence is subject to acquiring funding and therefore Adaptation A which involves property level protection to properties at risk may be supported if no further funding is available.
Adaptation B	This option includes erosion defence (slope armour) which is a defence measure that appeared to be supported in round 4 engagement feedback. It would also defend Hengistbury Head access road which is important to the BCP Council.
Adaptation C	This option includes erosion defence (slope armour) which is a defence measure which appeared to be supported in round 4 engagement feedback. It would also defend Hengistbury Head access road and the historic landfill site.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 4-3 below provides a summary of the appraisal results. The Maintain and Adaptation options are likely to have a positive impacts across a range of categories.

The main uncertainty in this location relates to the contamination status of the historic landfill site at Wick and its potential for erosion. Further site investigations are required to confirm this. However, if the land is found to be contaminated and at risk of erosion then the options that do not defend this site could have negative impacts in the land, soil and water resources category.

With respect to the biodiversity / geodiversity category, the Do Nothing, Do Minimum and Adaptation A options do not include erosion defences and therefore erosion could lead to habitat loss of the Dorset Heaths SAC and Dorset Heathlands SPA sites. The Maintain A and B and Adaptation B and C options have a neutral score. The erosion defences at the access route to Hengistbury Head would prevent erosion of the Dorset Heaths SAC and Dorset Heathlands SPA, helping to preserve the integrity of these designations. However, there is potential for some habitat loss depending on the defence alignment that is used for the erosion defence. The alignment will need to be determined during further design work.

For each of the Do Something options there is an opportunity to explore saltmarsh restoration / creation in this location. If saltmarsh was to be restored / created, this could provide an additional positive environmental benefit and potential for biodiversity net gain.

Table 4-3: Summary of potential environmental impacts in ODU 3

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Impact on majority of categories is uncertain. Of note is the unknown contamination status of Wick historic landfill site. The site is not retained by a structure / likely has a low erosion risk but this is uncertain. Therefore uncertainties as to impact of leaving this area undefended. Erosion could lead to habitat loss of Dorset Heaths SAC and Dorset Heathlands SPA therefore a negative impact on biodiversity category.
Maintain A / Adaptation B	Positive impact on variety of categories such as land, soil and water resources, population and communities and transport and movement.
Maintain B / Adaptation C	Positive impact on variety of categories including on land, soil and water resources, population and communities and transport and movement.
Adaptation A	Uncertain impacts in some categories. Positive impact on climate change and populations and communities but potential minor negative impact in the biodiversity category as no erosion defences which could lead to minimal amounts of habitat loss of Dorset Heaths SAC and Dorset Heathlands SPA (although this would be replaced with intertidal).

4.2.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified the Adaptation / Resilience A option as the National Economic Leading Option.

The SEA has not identified any major negative environmental impacts for this option and the option has similar positive impacts to the other Do Something options. Minor negative impact in the biodiversity category due to potential for small amounts of erosion of designated sites (however, intertidal habitat would be created due to this). There is uncertainty with the contamination status of the historic landfill site at Wick and further site investigations are required to confirm the contaminated status. If the land is found to be contaminated then there could be a negative impact associated with erosion of the historic landfill site on the land, soil and water resources category. However, this impact is uncertain at this stage and therefore the findings of the SEA do not lead to a change the choice of the provisional National Economic Leading Option.

The social appraisal indicated that there are likely to be more favourable options from a social perspective for example, Adaptation B or Adaption C. However, these options would require additional funding and are therefore considered as a Local Aspirational Leading Option during the next stage.

Based on the above points, the Adaptation / Resilience A option is confirmed as the National Economic Leading Option.

Local Aspirational Leading Option

Based on discussions with the BCP Council the key aspirations for FCERM options in this location include:

- To defend the road access to Hengistbury Head. The road is an important transport link that is heavily used by visitors to the area and for recreation as well as access to coastal defences for ongoing maintenance. It is also the primary evacuation route from the Sandbank should there be an emergency event. There is limited scope to move the road further inland if it were to erode.
- Subject to findings of further investigations into the contamination status of Wick historic landfill, there could be an environmental driver to defend the site from erosion.

The Adaptation / Resilience C option would deliver on both of these drivers and therefore has been selected as the Local Aspirational Leading Option. This is subject to the findings from site investigations at Wick and assumes that the historic landfill site poses a contamination risk if it were to erode. It is noticeable that the economic case for this option is marginal, with an ABCR of 1.05 and NPV of £35k. The sensitivity tests indicate that the ABCR would drop to below unity if the PV cost of the option were to increase by 25% or 50%. Delivery of this option is therefore subject to the ABCR being greater than unity.

If site investigations at Wick indicate that the historic landfill site does not pose a contamination risk if it were to erode, the Local Aspirational Leading Option would revert to the Adaptation / Resilience B option. This option would defend the road access to Hengistbury Head but would not include any new defences for Wick historic landfill site. The economic case for the Adaptation / Resilience B option is more robust than the Adaptation / Resilience C option, with the ABCR staying above unity for the sensitivity tests.

4.2.5 Funding

There are very few properties at risk from flooding in this location and therefore the availability of FCERM-GiA to fund the leading options in this unit is likely to be very limited. For this reason no indicative Partnership Funding calculations have been undertaken for this location.

Partial or full funding for property level protection measures as part of the leading options may be available from flood resilience grants (subject to eligibility and the cost of individual property level protection measures). Other sources of non-GiA funding for erosion defences will be required.

4.2.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 4-1, the Leading Options are also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 4-1. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £6million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the Leading Options in ODU 3 could help avoid a significant proportion of these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of the Leading Options.

4.2.7 Summary

Table 4-4 below summarises the leading options in ODU 3.

Table 4-4: Summary of ODU 3 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Adaptation / Resilience A: property level protection to properties at risk from flooding	118	Limited amount. To be determined during OBC
Local Aspirational	Adaptation / Resilience C: erosion defences to Wick historic landfill site and access road to Hengistbury Head. Property level protection to properties at risk from flooding	776	Limited amount. To be determined during OBC

Alignment with SMP

The SMP policy for ODU is No Active Intervention. Both the National Economic and Local Aspirational options therefore do not align with the SMP policy. It is recommended that the SMP policy is reviewed following adoption of the Strategy as part of the SMP refresh process.

4.3 ODU 4 – Wick

ODU 4 spans the south side of the River Stour up to Tuckton Bridge around Wick. There are three main types of defence in this unit; a natural verge in the east part of the unit, an earth embankment flood defence around the north east of Wick and a steel sheet pile quay wall in the west of the unit. The large residential area of Wick is located within this ODU and there is also a historic landfill site located to the north of the residential properties in this unit (North of Wick Lane Historic Landfill).

Similar to ODU 3 it is unclear if there is potentially contaminated land in the historic landfill site and therefore further studies are required to investigate the contamination status of this areas in the future. The site is currently defended by a sheet pile quay wall, but without ongoing maintenance this defence will eventually reach the end of its service life and need replacing. The Do Something options consider how to defend this area if funding is available.

Through communications with the Environment Agency it is understood that the earth embankment flood defence in the eastern part of the unit is constructed to a 2070 1 in 200 year SoP. However, the latest flooding modelling for the Strategy suggests that the defence would be outflanked from a present day 1 in 200 year event (and greater) and it would therefore need to be lengthened to provide the desired SoP.

Whilst the present day tidal flood risk is minimal, over time the risk increases with 121 properties at risk in 100 years' time from a 1 in 200 year event. The flood risk will need to be mitigated from both the north and east directions, increasing the length / cost of defence alignment relative to benefits delivered. Over the next 100 years the total PV damages for this ODU are estimated to be over £4.2million.

The SMP policy for ODU 4 is to Hold the Line from the present day with an intent to implement local defence improvements in line with sea level rise. The SMP policy aligns with the Sustain and Improve Strategic options.

Figure 4-4 shows the key features in ODU 4.

Figure 4-4: Key features in ODU 4

4.3.1 Short List of Options

The Short List of Strategic Options for ODU 4 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 4-5 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 4 erosion would be expected to occur initially in the undefended areas, albeit at a low rate due to the sheltered harbour environment. In the areas with existing frontline defences the erosion would be delayed until the defences reached the end of their service life and failed. Erosion could occur at the North of Wick Lane historic landfill once the existing quay wall fails. Over time the flood risk to the ODU would also be expected to increase due to sea level rise. Whilst the flood risk is initially low in this unit, by 2124 approximately 121 properties are expected to be at risk from a 1 in 200 year return period tidal flood event.

Due to the risks to properties, infrastructure (e.g. roads) and historic landfill in ODU 4, doing nothing is not an acceptable solution in this location and would not be in line with the SMP policy for the area. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum Strategic option would involve undertaking reactive small scale maintenance to the existing quay wall and setback embankment defences in this unit. This would typically take the form of patch and repair maintenance whereby localised damage to the defence is repaired on an ad-hoc basis.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reaches the end of their service lives the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis.

In ODU 4 there is minimal economic benefit for the Do Minimum option relative to the Do Nothing scenario. This is because the existing properties are setback from the shoreline and therefore unlikely to be at risk from erosion in the short term. In addition extending the service life of the existing setback defence would do little to improve the flood risk benefits as whilst there is a risk of outflanking the number of properties at risk is small in the first epoch. The only notable benefit of the Do Minimum option would be to delay the failure of the quay wall in the west part of the unit in front of the historic landfill site.

Maintain

In ODU 4 the focus for the Maintain option is to extend the service life of the existing defences through to the end of the Strategy period. This would be achieved through a series of capital refurbishments to the existing defences over time, as required based on the condition and deterioration of the defences. For the purposes of costing, it has been assumed that the first capital refurbishment would be required in the second half of epoch 1 based on the estimated residual life of the defences.

The Maintain option would provide some economic benefits. In the west part of the unit refurbishments of the quay wall would reduce the risk of the asset failing and would help prevent erosion of historic landfill behind. In the east part of the unit, refurbishments of the existing setback embankment would ensure this defence is kept in place over time. The defence would continue to perform a flood defence function, but over time the SoP of the defence would fall as the crest level would not be raised as part of the refurbishments. The benefit area of the defence is also relatively small (focussed in the area immediately behind the defence) due to the defence being outflanked from a present day 1 in 200 year event.

Sustain A

The Sustain A option would involve upgrading the defences over time to provide a defined SoP over the next century. This would be achieved through raising and lengthening the defences in a series of interventions over time to keep pace with sea level rise.

In the west part of the unit a new quay wall / sheet pile wall would be constructed late in epoch 1 (once the existing structure reaches the end of its service life). The new wall would have a raised parapet / crest wall (relative to ground levels) to provide a greater SoP than the existing structure. In addition to providing a flood defence, this new wall would also ensure that the historic landfill to the north of Wick Lane would be defended and would not erode in the future.

In the east part of the unit the existing flood defence embankment would be lengthened early in epoch 1 to reduce the risk of outflanking in this location.

In epoch 2 and 3 the defences would be raised and further lengthened so that the defined SoP is sustained through time. For the purpose of the economic appraisal, the costs and benefits of sustaining two SoPs have been calculated; sustaining a 1 in 75 year SoP and sustaining a 1 in 200 year SoP.

Sustain B

The Sustain B option would involve undertaking repeat capital refurbishments of the existing quay wall in the west part of the unit (similar to the Maintain option in this location). The intent of these interventions would be to ensure the defence is kept in place over time and to prevent erosion of the historic landfill site behind. However, this would not involve raising the crest level of the quay wall and therefore over time there would be increased flood risk to the historic landfill site, with a potential for leaching to occur.

In the east part of the unit the approach would be the same as Sustain A, with the existing flood defence embankment lengthened early in epoch 1 to reduce the risk of outflanking in this location. This would defend the vast majority of properties in the unit from flood risk. In epoch 2 and 3 the embankment would need to be raised and further lengthened so that the defined SoP of this defence is sustained through time. For the purpose of the economic appraisal, the costs and benefits of sustaining two SoPs have been calculated; sustaining a 1 in 75 year SoP and sustaining a 1 in 200 year SoP.

Sustain C

In the east part of the unit the Sustain C option is the same approach as Sustain A and Sustain B – raising and lengthening the existing flood defence embankment over time to keep pace with sea level rise and sustain a defined SoP. This would defend the vast majority of properties in the unit from flood risk and the initial intervention would be in epoch 1 to lengthen the defence to prevent outflanking.

However, in the west part of the unit there would be no capital refurbishments or upgrades to the existing quay wall. Initial patch-repair work would be undertaken during epoch 1 but in epoch 2 the wall would be expected to fail, potentially resulting in the erosion of the historic landfill site to the north of Wick Lane.

Improve A

Improve A follows the same approach as Sustain A, with the exception being that the upgraded defences would be initially constructed to a 2124 SoP. This is a precautionary approach to managing the flood risk (as opposed to the managed adaptive approach followed in the Sustain options). It would result in a higher up-front investment but would mean that repeat interventions over time to raise and lengthen the defences would not be required.

Improve B

Improve B follows the same approach as Sustain B, with the exception being that the upgraded embankment defence in the east part of the unit would be initially constructed to a 2124 SoP (rather than raised and lengthened over time).

Improve C

Improve C follows the same approach as Sustain C, with the exception being that the upgraded embankment defence in the east part of the unit would be initially constructed to a 2124 SoP (rather than raised and lengthened over time).

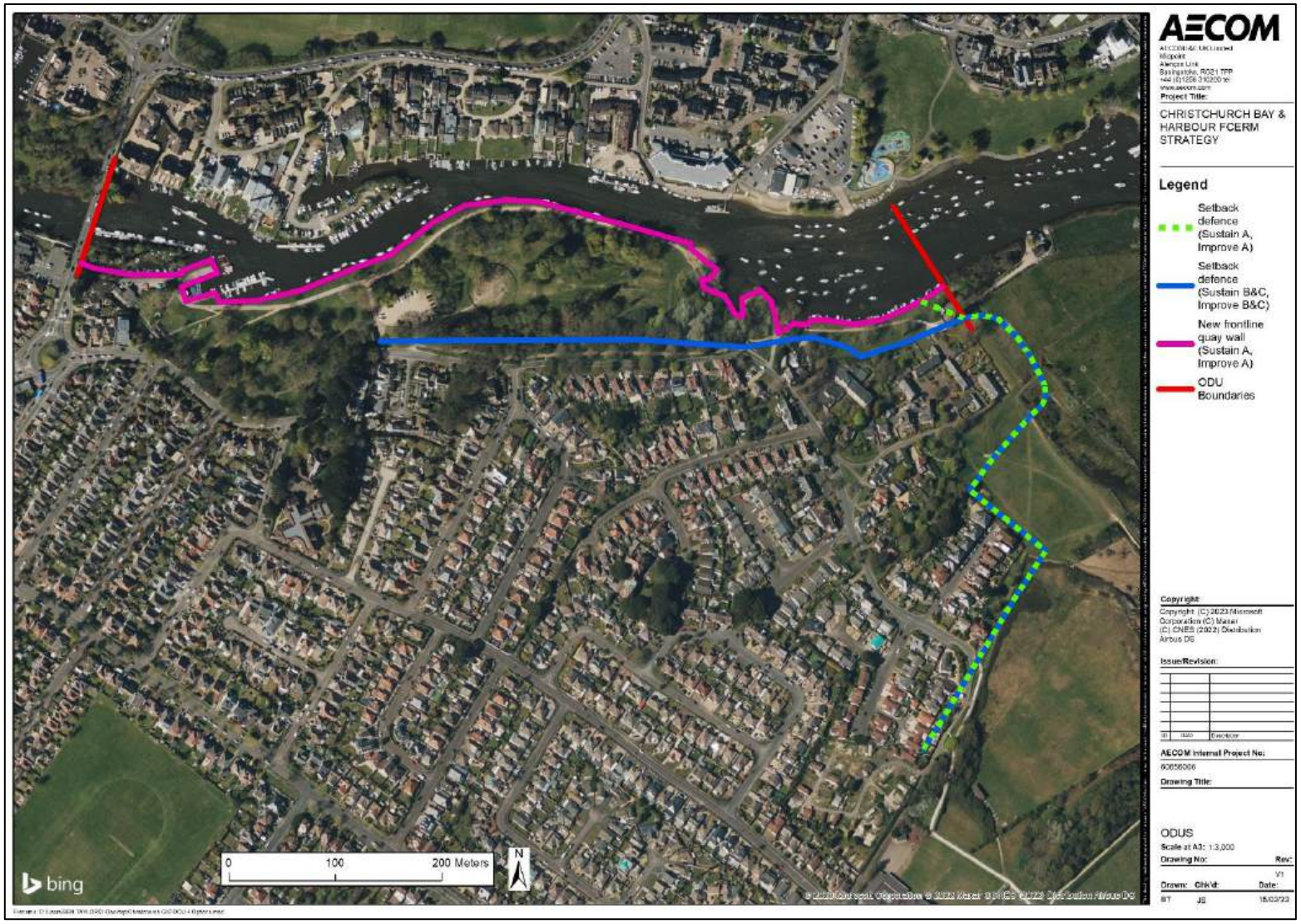

Figure 4-5: ODU 4 options

4.3.2 Economic Appraisal of Options

Cost benefit analysis

Table 4-5 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options in ODU 4 cannot be ordered based on AEP as different areas are being defended in each of the options and the options include erosion defences. The options have therefore been ordered according to the NPV. The Sustain C option has the highest NPV and is therefore selected as the provisional National Economic Leading Option. Only three of the options considered have benefit cost ratios greater than unity (Sustain C, Improve C and Sustain B).

The main difference between Sustain C and Sustain B is that Sustain B includes a series of capital refurbishments of the frontline quay wall in the west part of the unit. This would help to reduce the risk of the quay wall failing in the future, protecting the historic landfill site behind from erosion. The PV cost for these refurbishments is the difference in cost between the options (£2,032k).

Table 4-5: ODU 4 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Sustain C (75yr SoP)	1,468	598	3,586	2.44	2,118	X
Improve C (75yr SoP – end of appraisal period)	2,889	334	3,850	1.33	961	
Sustain B (75yr SoP)	3,499	546	3,638	1.04	139	
Do Nothing	-	4,184	0	-	-	
Do Minimum	340	4,176	8	0.02	-332	
Improve B (75yr SoP – end of appraisal period)	4,919	282	3,902	0.79	-1,017	
Maintain	2,684	4,145	39	0.01	-2,645	
Sustain A (75yr SoP)	6,301	546	3,638	0.58	-2,663	
Improve A (75yr SoP – end of appraisal period)	10,818	282	3,902	0.36	-6,916	

The Sustain C option involves upgrading the flood defences at the eastern part of the unit by raising and lengthening the embankment. Two different SoPs have been considered for this option. The next step of the economic appraisal is to compare the IBCR of the Sustain C option with a 75yr SoP to the 200yr SoP (Table 4-6).

The Improve C option has also been included in the IBCR comparison because Improve C is the same as the Sustain C approach, but with the exception being that the defences would be initially constructed to the 2124 SoP rather than raised and lengthened over time. The Improve C (200yr SoP) option would initially provide a much higher SoP at the time of construction, in excess of 1 in 1000 years.

As per FCERM-AG, in order to move from the Sustain C (75yr SoP) option to the Sustain C (200yr SoP) option the IBCR needs to exceed a value of 3. As can be seen, the IBCR between these standards is 14.2 which is greater than the IBCR threshold and therefore the Sustain C (200yr SoP) is selected as the provisional National Economic Leading Option.

In order to increase the SoP further still and deliver the Improve C (200yr SoP) option, the IBCR value needs to exceed a value of 5 given the much higher initial SoP of the Improve C option. As can be seen, the BCR between Sustain C (200yr SoP) and Improve C (200yr SoP) is below unity so Sustain C (200yr SoP) remains the provisional National Economic Leading Option.

Table 4-6: ODU 4 IBCR comparison for the Sustain C option

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Sustain C (75yr SoP)	1,468	598	3,586	2.44	-	
Sustain C (200yr SoP)	1,490	286	3,898	2.62	14.18	X
Improve C (200yr SoP – end of appraisal period)	3,124	155	4,029	1.29	0.08	

Sensitivity tests

The main uncertainties with the options in this location relate to option cost and the design water level of the defences to provide the desired SoP against flooding. This could be influenced by changes to sea level rise projections or updated understanding of the flood risk at the site.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include a cost uplift of 10% or 25% and also updated costs to account of for an additional 0.9m of sea level rise over the next century. This equates to the difference between the H++ sea level scenario and the sea level rise value used in the Strategy appraisal. Appendix A provides a summary of the results.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Sustain C option to determine how the cost increase would alter the choice of leading options. These sensitivity tests indicate that with both scenarios the choice of the National Economic Leading Option would remain unchanged.

In the sensitivity test focused on design crest level, the crest level increase of 0.9m has been applied to each of Sustain and Improve options to determine whether the cost of any of these options would be more or less sensitive to such design parameter changes and whether this would change the choice of option. As can be seen Sustain C remains the provisional National Economic Leading Option. The economic case of each of the Sustain / Improve options is significantly weaker, with Sustain C being the only of these options with an ABCR greater that unity. However, with such an increase in sea level rise the benefits provided by the options would also increase, which is not included in the comparison and could make more of the options economically viable.

The choice of Sustain C as the provisional National Economic Leading Option has not been changed as a result of the sensitivity tests.

4.3.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 4 frontage include:

- Indicates general support for the majority of defence measures on the short list, including maintenance / repairs, setback embankment, slope armour and a setback floodwall.
- Indicates lack of support for a new sheet pile wall (with more respondents disagreeing than agreeing).

Table 4-7 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 4-7: ODU 4 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public feedback. Could result in failure of existing quay wall and increased flood risk to properties in this location.
Maintain	The maintain option would involve refurbishment and ongoing patch-repair to existing defences. This measure was the measure with the most support in the feedback from the last round of engagement. However, there would be increased flood risk to properties in this location as defences would not be improved, and therefore there could be more support for maintenance as part of a Sustain or Improve option.
Sustain A / Improve A	This option involves a new quay wall (potentially a sheet pile wall) in the west part of the unit (to replace the existing). Whilst this measure had a lack of support in the feedback from the previous engagement round, the context of the intervention (replacing the existing which some respondents to the survey may view as maintenance) makes it unclear whether this approach would be supported or not.
Sustain B / Improve B	This option involves defence measures that are in line with those most supported in the feedback from the last phase of engagement, including maintenance of existing structures and a setback embankment.
Sustain C / Improve C	This option involves improvements (raising / lengthening) to the setback embankment, a measure that appeared to have strong support during the last phase of engagement. However, it would result in failure of the frontline quay wall over time (as it would not be maintained) and it is unclear if the local community / stakeholders would be supportive of this.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 4-8 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options could have negative impacts on the majority of the categories considered. This is due to the increased flood risk with these options, and also for the potential for the quay wall to fail. This quay wall is currently retaining the land behind which is historic landfill, so in the event of the wall failing there is a risk of any materials in the historic landfill site being released into the environment, potentially negatively impacting the land, soil and water resources category in particular. The contamination status of the historic landfill site is unknown and therefore these impacts in the SEA are uncertain. Further site investigations are required to confirm the contamination status. In addition, the area above the historic landfill is used for recreation / parkland so erosion of this area this could negatively impact the population and communities category.

The Maintain option would not reduce the flood risk in the future and therefore negative impacts would be expected across a range of categories. However, it would reduce the risk of erosion of the historic landfill site in the east part of the unit and therefore it could lead to a positive impact in the land, soil and water resources category.

The Sustain A and Improve A options and Sustain B and Improve B options are expected to have the most positive impacts. The Sustain C and Improve C are expected to have negative impacts in the land, soil and water

resources category as well as the population and communities as these options do not include maintenance of the exiting frontline quay wall. However, the land, soil and water resources impacts would be subject to change if site investigations indicate there is no contamination risk from the historic landfill site.

For Sustain A and B, and Improve A and B, new defences in this unit would either be expected to be setback or close to / within the footprint of existing defences which could limit impacts on biodiversity. There is potential to explore biodiversity net gain opportunities as part of the upgraded defences in this location. For example, the setback embankment provides an opportunity to develop a vegetated structure that incorporates features of wildlife interest and habitat creation.

Table 4-8: Summary of potential environmental impacts in ODU 4

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Expected to have major negative impacts across a variety of categories, including climate change / historic environment / land, soil and water resources / population and communities and transport and movement. It is noted that the contamination status of historic landfill site is unknown therefore there are uncertainties with the land, soil and water resources category. Other uncertainties on landscape and biodiversity / geodiversity.
Maintain	Option would not reduce flood risk and therefore negative impacts would be expected across range of categories. However, potential positive benefit in land, soil and water resources due to erosion defence of historic landfill.
Sustain A / Improve A	Positive impacts expected for the majority of categories including land, soil and water resources and transport and movement. Potential negative impact in the landscape category due to potential for higher defences.
Sustain B / Improve B	Positive impacts expected for the majority of categories including land, soil and water resources and transport and movement. Potential negative impact in the landscape category due to potential for higher defences.
Sustain C / Improve C	Could have a potential negative impact on land, soil and water resources and population and communities (both related to failure of quay retaining wall / erosion of land behind). As per the Do Nothing scenario, it is noted that the contamination status of historic landfill site is unknown therefore there are uncertainties with the land, soil and water resources category.

4.3.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified the Sustain C option as the National Economic Leading Option. The IBCR comparison for this option indicates that the 1 in 200 year SoP is justified, rather than the 1 in 75 year SoP.

The SEA identified that the Sustain C option could lead to major negative impacts on land, soil and water resources and also population and communities. The impact to both of these categories is related to failure of the existing quay wall that retains the historic landfill / recreation / park area behind.

However there is uncertainty with the potential negative impact on land, soil and water resources given that the contamination status of the historic landfill site is unknown. Therefore, whilst the erosion of the historic landfill site leads to a major negative impact in the SEA, this may not be the case if site investigations indicate the land does not pose a contamination risk.

The major negative impact on population and communities in the SEA could reasonably be mitigated. For example, following failure of the existing quay wall the site could be made safe from a health and safety perspective and modifications to the public realm (non FCERM related) could be undertaken to ensure the area can continue to be used for recreation / parkland.

As such, whilst the SEA identifies a major negative impact to these two categories, the impact to the land, soil and water resources category is uncertain at this stage and the impact to population and communities could be reasonably mitigated. Therefore the findings of the SEA do not make the Sustain C option unviable at this stage and the choice of the provisional National Economic Leading Option is not changed as a result. If site investigations indicate that there is a contamination risk if the quay wall were to fail, then Sustain C may not be viable.

The social appraisal indicated that the setback embankment defence which is the main aspect of the Sustain C option had support during the previous engagement phase feedback. However, there is uncertainty around whether the local community would be in support of an option which wouldn't prevent failure of the frontline quay wall in the future. Given that there is no clear steer on this at this stage from the social appraisal the findings do not lead to a change to the choice of the National Economic Leading Option.

Based on the above points, the Sustain C option is confirmed as the National Economic Leading Option.

Local Aspirational Leading Option

Given the uncertainty around the historic landfill site and potential negative environmental impacts, there is a local driver to maintain the frontline quay wall in the west part of the unit, subject to securing funding. To achieve this the Local Aspirational Leading Option for this unit is Sustain B. This option would reduce the risk of the quay wall failing in the future and would ensure that the historic landfill site and parkland / recreation area are not eroded.

The Sustain B option would deliver on the SMP policy for the area (Hold the Line), whereas the National Economic Leading Option (Sustain C) may lead to erosion of the land once the quay wall fails and therefore would not deliver the SMP policy.

The economic case for the Sustain B option is marginal as the additional cost for the repeat refurbishment of the quay wall is large relative to the benefits delivered by defending the historic landfill site (in purely monetary terms). The option has an ABCR of 1.04 which indicates it is economically viable. However, significant cost increases could mean that the ABCR falls below unity and would no longer be viable.

4.3.5 Funding

An indicative Partnership Funding Assessment has been undertaken for the major capital scheme for both the Sustain C option (National Economic Leading Option) and Sustain B option (Local Aspirational Leading Option). For both of these options the major capital scheme for the calculations has been taken to be at the start of epoch 3, when the investment to improve the setback embankment (raising and lengthening) is greatest. Each option includes minor interventions prior to this (e.g. in epoch 1 and 2), but the capital costs and benefits of these are much smaller than the intervention in epoch 3 and therefore the funding assessment has focussed on the epoch 3 intervention.

In addition, through discussions with the Environment Agency, it is understood that the existing setback embankment was designed to have a 1 in 200 year SoP in 2070. However, the flood modelling for the area indicates that the embankment is at risk from outflanking from the present day and thus the SoP to the wider area is likely to be much lower than this. Each of the options includes interventions prior to 2070 to upgrade the embankment (lengthening and raising) but it is uncertain what Outcome Measures (OMs) were claimed for the construction of the setback embankment and therefore any improvements to the setback embankment (e.g. lengthening it) prior to 2070 may not be eligible for further OMs and funding calculations may not be valid.

For the epoch 3 intervention for Sustain B, in addition to the upgrade work to the embankment, the cost in the Partnership Funding calculator also includes a capital refurbishment of the frontline quay wall as this is scheduled to occur at the same time in the cost build-up. Refurbishments are also scheduled prior to this during epochs 1 and 2, but it is assumed that these would have been undertaken and funded prior to the epoch 3 funding calculation and costs are therefore not included.

Table 4-9 presents the indicative Partnership Funding scores for the epoch 3 interventions for each of the leading options. As can be seen, the indicative Partnership Funding score for the epoch 3 intervention for Sustain C is 40% and for Sustain B is 20%. Both options would require additional funding, with the amount for the epoch 3 intervention for Sustain C option estimated to be £1,125k and the amount for the epoch 3 intervention for Sustain B being over £3million.

Note that the funding amounts shown in Table 4-9 relate to the epoch 3 intervention only. Other funding would be required to deliver the options up to this point. It is unlikely that much GiA would be available given the existing flood defence embankment and therefore funding would most likely need to come from non-GiA sources to deliver this option over epochs 1 and 2.

Table 4-9: Indicative Partnership Funding Scores for ODU 4 (epoch 3 intervention)

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention*
National Economic Leading Option: Sustain C	1,860	168	2,028	11,536	50 years	40%	735	1,125
Local Aspirational Leading Option: Sustain B	3,787	168	3,955	11,665	50 years	20%	775	3,013

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

4.3.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 4-5, the Local Aspirational Option is also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 4-5. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £6million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the Local Aspirational Option could help avoid a significant proportion of these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of this option.

4.3.7 Summary

Table 4-10 below summarises the leading options in ODU 4.

Table 4-10: Summary of ODU 4 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for major capital intervention (undiscounted cash £k)
National Economic	Sustain C: raise and lengthen existing flood defence embankment in east part of unit over time	1,490	735
Local Aspirational	Sustain B: raise and lengthen existing flood defence embankment in east part of unit over time. In addition, refurbish existing quay wall in the west part of the unit to prevent erosion of historic landfill.	3,499	775

Alignment with SMP

The SMP policy for ODU 4 is to Hold the Line from the present day with an intent to implement local defence improvements in line with sea level rise. The Local Aspirational Option aligns with the SMP policy as it would involve holding the line of the existing defences and reducing flood risk over time. However the National Economic option has the potential to lead to erosion in the west part of the unit (where there is currently the quay wall) and would not align with from the SMP policy. If the Local Aspirational Option cannot be delivered it is recommended that the SMP policy is reviewed in this location.

4.4 ODU 5 – Willow Drive and the Quomps

ODU 5 is located on the north side of the River Stour, from Tuckton Bridge to the eastern end of the Christchurch Quay. A range of defences are located in this ODU with varying condition (between good and poor).

In the west part of the ODU the land use is primarily residential property and gardens with mooring areas. A quay wall (typically sheet pile) is located along the river's edge at the bottom of the gardens in this location. There are two historic landfill sites located in the west part of the unit (Willow Way historic landfill sites).

In the east part of the ODU the land use is the Quomps recreational area that overlays Christchurch Quay historic landfill site. There is a frontline quay wall along this part of the unit, with a setback floodwall located along the landward boundary of the Quomps.

Given the numerous private landowners and existing private defences in this location, for a flood risk mitigation scheme to be successful, there will need to be collaboration between land owners, owners of private defences and the flood risk authorities. Preserving access to the River Stour is a key consideration here – e.g. mooring, pontoon, rowing club access etc. In addition, access over any setback defences is likely to be key, with a large number of flood gates / access steps currently incorporated into the existing setback defence alignment in the east part of the unit.

This ODU has a significant number of properties at risk from tidal flooding; 37 properties are expected to be at risk from a present day 1 in 200 year event. These are primarily located in the west part of the unit that is not currently protected by the setback defence. The number of properties at risk increases to 562 properties in 100 years' time (for a 1 in 200 year event). Over the next 100 years the total PV damages for this ODU are estimated to be over £37 million.

The SMP policy for this area is Hold the Line from the present day, with the intent to maintain and improve the flood defences. The SMP policy aligns with the Sustain and Improve Strategic options and the Maintain then Sustain / Improve Strategic option.

Figure 4-6 shows the key features in ODU 5.

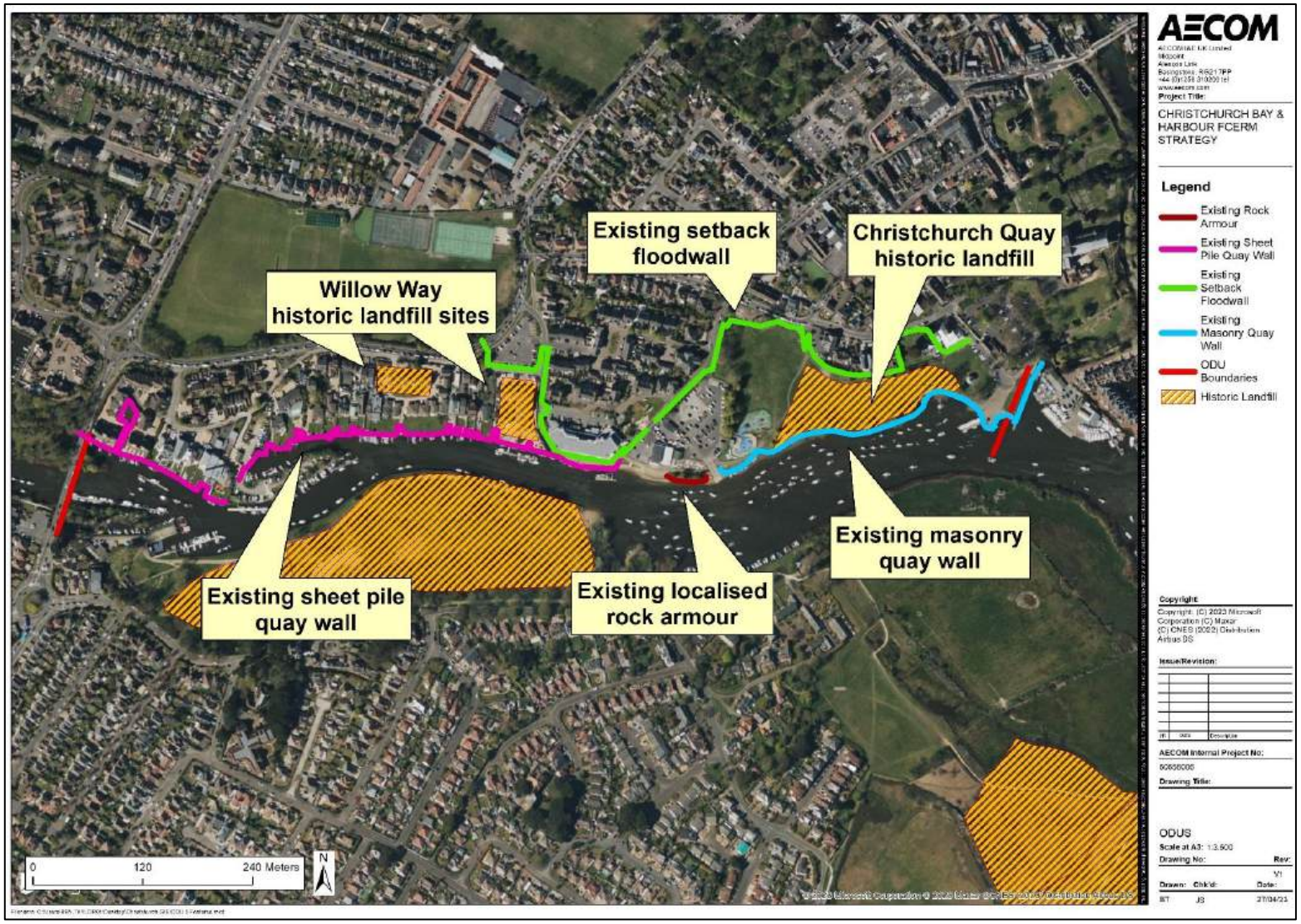

Figure 4-6: Key features in ODU 5

4.4.1 Short List of Options

The Short List of Strategic Options for ODU 5 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 4-7 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 5 erosion would be expected to occur once the existing defences reach the end of their service life and fail. If erosion were to occur in adjacent to the historic landfill sites at Willow Way and Christchurch Quay this could lead to release of potentially contaminated material. Over time the flood risk to the ODU would also be expected to increase due to sea level rise. In the west part of the ODU there are a significant number (50+) properties at risk from flooding in epoch 1 and the risk to these properties would increase over time. In the east part of the unit the existing setback floodwall provides an initial high level of defence (approximately 1 in 200 year SoP) but over time as sea levels rise the SoP would reduce and the defence may also be outflanked at either end, leading to an increase in flood risk.

Due to the risks to properties, infrastructure and historic landfill in ODU 5, doing nothing is not an acceptable solution in this location and would not be in line with the SMP policy for the area. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum option would involve undertaking reactive small scale maintenance to the existing quay walls and setback floodwall defence in this unit. This would typically take the form of patch and repair maintenance whereby localised damage to the defence is repaired on an ad-hoc basis.

This option is likely to extend the service life of the existing raise defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reaches the end of their service lives the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis. Extending the service life of the defences by a several years would help delay the onset of increased flood risk associated with failure of existing defences.

Maintain

In ODU 5 the focus for the Maintain option is to extend the service life of the existing defences through to the end of the Strategy period. This would be achieved through a series of capital refurbishments to the existing defences over time, as required based on the condition and deterioration of the defences. For the purposes of costing it has generally been assumed that the first capital refurbishment would be required in the second half of epoch 1 based on the estimated residual life of the defences. However, the masonry wall in the east part of the unit in front of the historic landfill would be refurbished sooner as required.

The Maintain option would provide some economic benefits. In the west and east part of the unit refurbishments of the frontline quay wall would reduce the risk of the asset failing. This would help prevent erosion of historic landfill behind, particularly in the east part of the unit at Christchurch Quay / the Quomps. In the east part of the unit, refurbishments of the existing setback embankment would ensure this defence is kept in place over time. The defence would continue to perform a flood defence function, but over time the SoP of the defence would fall as the crest level would not be raised as part of the refurbishments. In addition, access gates would be more difficult to operate and may need to be permanently closed in some locations, leading to a loss of access and connectivity with the Quomps and frontage. The setback defence may also be outflanked during large return period events in the future. The impact of this becomes more prominent in epoch 3 where extensive flooding from the west part of the unit outflanks the existing setback defence in the east.

Sustain A

The Sustain A option would involve upgrading the defences over time to provide a defined SoP over the next century. This would be achieved through raising and lengthening the defences in a series of interventions over time to keep pace with sea level rise.

In the west part of the unit the existing frontline quay wall would be upgraded by constructing a new similar structure with a raised parapet / frontline wall to reduce the risk of flooding to the properties behind. Waterside access is key in this location and therefore flood gates / access points would be incorporated into the defence. The upgraded defence would be constructed in epoch 1 and raised over time to keep pace with sea level rise. There is sufficient space in this unit to construct the new frontline defences within the footprint of the existing quay walls. This would ensure minimal encroachment into the river channels to minimise impact on biodiversity / ecology and reduce the potential for detriment fluvial flood risk (by reducing channel capacity). Further work would be required during outline design to confirm this approach.

In the east part of the unit the existing setback floodwall would be raised to sustain a defined SoP. This would be done in a series of interventions, ensuring the SoP was sustained over time. In epoch 2 it would be necessary to lengthen the defence at its eastern end to prevent outflanking. In addition, the existing frontline quay wall in the east part of the unit (Christchurch Quay) would be maintained through a series of refurbishments from epoch 1. The aim of this would be to reduce the risk of the wall failing and to prevent erosion of the historic landfill site behind.

In both the west and east parts of the unit, the defences would need to incorporate deployable defences such as flood gates to preserve access. During the design opportunities to incorporate passive defences such as ramps should be explored to reduce the residual risk associated with deployable defences.

The Strategy flood modelling indicates that in 2124 there could be flood risk from the River Stour to the north-west of the proposed defences, originating from the river bank between Tuckton Bridge and the railway bridge further upstream. The modelling used in the Strategy for this location is uncertain but there could be a potential need for a new defence approximately 100m long to the south of the railway bridge in epoch 3 to prevent outflanking risk to the benefit area.

Sustain B

Similar to Sustain A, Sustain B would involve upgrading the defences over time to provide a defined SoP.

In the west part of the unit the approach would be the same as Sustain A, with the existing frontline quay wall upgraded to provide a flood defence to the properties behind. This would be raised over time to keep pace with sea level rise.

However, in the east part of the unit, rather than raising the setback floodwall (as in Sustain A), a new frontline quay wall would be constructed in epoch 1. This would include a raised parapet / frontline wall to reduce the risk of flooding to the area behind. Waterside access is key in this location and therefore flood gates / access points would be incorporated into the defence. The upgraded defence would be raised over time in epochs 2 and 3 to keep pace with sea level rise. As in the west part of the unit, there is sufficient space to construct the defences within the existing quay wall footprint in this location.

The main benefit of Sustain B is that the new frontline quay wall in the east part of the unit would remove the reliance on the existing quay wall to provide a defence against erosion of the historic landfill. It may also be more technically feasible than Sustain A given the space constraints / visual impacts that may be associated with raising the existing setback wall. There is more space available along the frontline to incorporate a flood defence and there are many landscaping opportunities that could be explored.

In both the west and east parts of the unit, the defences would need to incorporate deployable defences such as flood gates to preserve access.

Similar to Sustain A, there could be a potential need for a new defence approximately 100m long to the south of the railway bridge on the River Stour in epoch 3 to prevent outflanking risk to the benefit area.

Sustain C

It is unclear whether the property owners in the west part of the unit would be supportive of a flood defence scheme which could impact their views and accessibility (which Sustain A and B would likely do). Therefore the Sustain C option has been included as an option should there be local opposition to Sustain A and B.

In the west part of the unit Sustain C would not include any new defences along the frontline alignment. The option costing has included costs for property level protection to the properties at risk in this part of the unit, although it is not clear how effective this may be in the long term given the potential for deep flooding in this

location in the future. To be conservative the benefits of property level protection in this ODU have therefore not been included from epoch 3 in the economic appraisal.

In the east part of the unit Sustain C would involve upgrading the defences as per Sustain A; raising the setback floodwall and refurbishing the existing frontline wall from epoch 1. If a new frontline wall is not constructed in the west part of the unit, in epoch 3 it will be important to prevent outflanking of the defence to the east. Therefore Sustain C includes a new setback defence along the alignment of Willow Drive in the west part of the unit. This would prevent outflanking and reduce the risk to the main benefit area to the east.

In both the west and east parts of the unit, the defences would need to incorporate deployable defences such as flood gates to preserve access.

Similar to Sustain A and B, there could be a potential need for a new defence approximately 100m long to the south of the railway bridge on the River Stour in epoch 3 to prevent outflanking risk to the benefit area.

Sustain D

Sustain D follows the same approach as Sustain A, except the initial upgrade to the defences would occur in epoch 2 rather than in epoch 1. In the interim the existing defences would be maintained and the properties at risk from flooding in the west part of the unit would have property level protection installed as required.

For the costing / benefit calculations it has been assumed that the upgrade would occur at the start of epoch 2, but it could be undertaken later on during the epoch, for example mid-way through epoch 2 subject to rates of climate change / condition of existing defences / funding availability.

Sustain E

Sustain E follows the same approach as Sustain B, except the initial upgrade to the defences would occur in epoch 2 rather than in epoch 1. In the interim the existing defences would be maintained and the properties at risk from flooding in the west part of the unit would have property level protection installed as required.

For the costing / benefit calculations it has been assumed that the upgrade would occur at the start of epoch 2, but it could be undertaken later on during the epoch, for example mid-way through epoch 2 subject to rates of climate change / condition of existing defences / funding availability.

Sustain F

Sustain F follows the same approach as Sustain C, except the initial upgrade to the defences would occur in epoch 2 rather than in epoch 1. In the interim the existing defences would be maintained and the properties at risk from flooding in the west part of the unit would have property level protection installed as required.

For the costing / benefit calculations it has been assumed that the upgrade would occur at the start of epoch 2, but it could be undertaken later on during the epoch, for example mid-way through epoch 2 subject to rates of climate change / condition of existing defences / funding availability.

Improve A

Improve A follows the same approach as Sustain A, with the exception being that the upgraded defences would be initially constructed to a 2124 SoP. This is a precautionary approach to managing the flood risk (as opposed to the managed adaptive approach followed in the Sustain options). It would result in a higher up-front investment but would mean that repeat interventions over time to raise and lengthen the defences would not be required.

Improve B

Improve B follows the same approach as Sustain B, with the exception being that the upgraded defences would be initially constructed to a 2124 SoP (rather than raised and lengthened over time).

Improve C

Improve C follows the same approach as Sustain C, with the exception being that the upgraded defences would be initially constructed to a 2124 SoP (rather than raised and lengthened over time).

Improve D

Improve D follows the same approach as Improve A, except the initial upgrade to the defences would occur in epoch 2 rather than in epoch 1. In the interim the existing defences would be maintained and the properties at risk from flooding in the west part of the unit would have property level protection installed as required.

For the costing / benefit calculations it has been assumed that the upgrade would occur at the start of epoch 2, but it could be undertaken later on during the epoch, for example mid-way through epoch 2 subject to rates of climate change / condition of existing defences / funding availability.

Improve E

Improve E follows the same approach as Improve B, except the initial upgrade to the defences would occur in epoch 2 rather than in epoch 1. In the interim the existing defences would be maintained and the properties at risk from flooding in the west part of the unit would have property level protection installed as required.

For the costing / benefit calculations it has been assumed that the upgrade would occur at the start of epoch 2, but it could be undertaken later on during the epoch, for example mid-way through epoch 2 subject to rates of climate change / condition of existing defences / funding availability.

Improve F

Improve F follows the same approach as Improve C, except the initial upgrade to the defences would occur in epoch 2 rather than in epoch 1. In the interim the existing defences would be maintained and the properties at risk from flooding in the west part of the unit would have property level protection installed as required.

For the costing / benefit calculations it has been assumed that the upgrade would occur at the start of epoch 2, but it could be undertaken later on during the epoch, for example mid-way through epoch 2 subject to rates of climate change / condition of existing defences / funding availability.

Adaptation / Resilience

This option would follow the same approach as the Maintain Option with respect to defence maintenance. However this option would also involve property level protection to the properties at risk from flooding in this unit throughout the appraisal period. However the effectiveness of property level protection in the long term is uncertain in this unit given the potential for deep flooding in this location in the future. To be conservative the benefits of property level protection in this ODU have therefore not been included from epoch 3 in the economic appraisal.

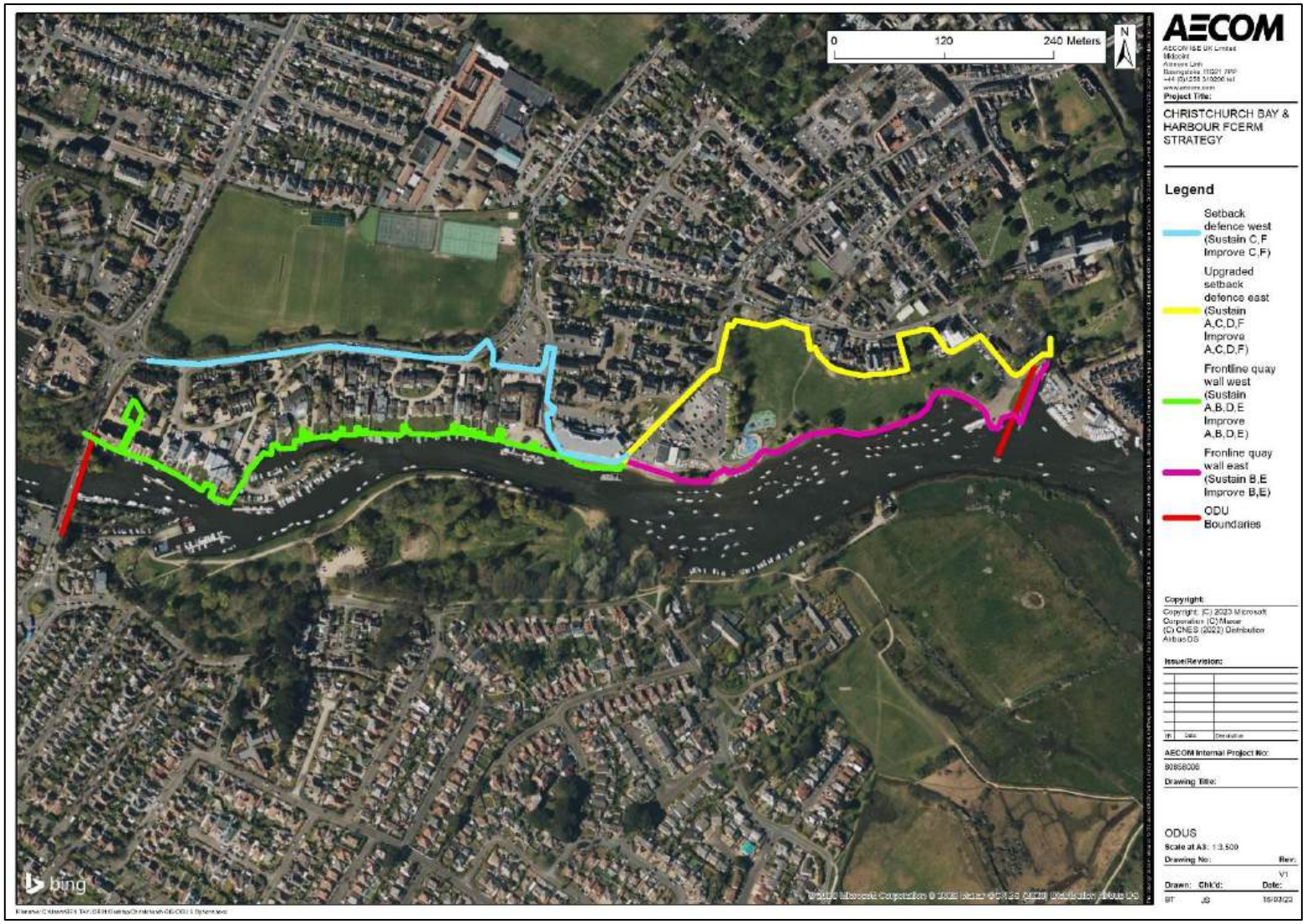

Figure 4-7: ODU 5 options

4.4.2 Economic Appraisal of Options

Cost benefit analysis

Table 4-11 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options in ODU 5 cannot be ordered based on AEP as different areas are being defended in each of the options and the options include erosion defences. The options have therefore been ordered according to the NPV.

It is outlined in FCERM-AG that if many options have similar NPVs, then each of the options can be taken forward for the next step for further consideration. The Improve D, E and F options all have relatively similar NPVs (in relation to the scale of the option costs / benefits) and therefore each has been taken forward as a provisional National Economic Leading Option. The difference in NPVs between Improve D-F is approximately £1.2million, or approximately 5% of the NPV.

Table 4-11: ODU 5 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve F (75yr SoP – end of appraisal period)	11,383	3,532	34,424	3.02	23,041	X
Improve E (75yr SoP – end of appraisal period)	13,953	1,532	36,424	2.61	22,471	X
Improve D (75yr SoP – end of appraisal period)	14,553	1,532	36,424	2.50	21,871	X
Improve C (75yr SoP – end of appraisal period)	13,660	3,517	34,439	2.52	20,779	
Sustain F (75yr SoP)	11,059	6,204	31,752	2.87	20,693	
Sustain E (75yr SoP)	13,943	4,507	33,449	2.40	19,506	
Sustain D (75yr SoP)	16,547	4,507	33,449	2.02	16,902	
Sustain C (75yr SoP)	15,398	6,187	31,769	2.06	16,371	
Improve B (75yr SoP – end of appraisal period)	20,908	1,424	36,532	1.75	15,624	
Improve A (75yr SoP – end of appraisal period)	22,507	1,424	36,532	1.62	14,025	
Sustain B (75yr SoP)	21,130	4,475	33,481	1.58	12,351	
Sustain A (75yr SoP)	24,435	4,475	33,481	1.37	9,046	
Adaptation / Resilience	11,927	21,430	16,526	1.39	4,599	
Do Minimum	340	37,136	820	2.41	480	
Do Nothing	-	37,956	0	-	-	
Maintain	9,079	30,280	7,676	0.85	-1,403	

Two different SoPs have been considered for the Improve Options, the 1 in 75 year SoP and the 1 in 200 year SoP. Table 4-12 to Table 4-14 show a comparison of the benefit cost ratios of these two standards for the Improve D-F options.

For the Improve D-F options the IBCR between the standards is consistently greater than the FCERM-AG IBCR threshold of 3 for moving from a 1 in 75 year SoP to a 1 in 200 year SoP. This indicates that there is a robust economic case to increase the SoP to 1 in 200 years for each of the options. However, given the potential visual impacts a higher defence crest level could have on the landscape in this location, moving to a higher SoP may not be the preferred solution and will need to be investigated during the outline design / business case.

Table 4-12: ODU 5 IBCR comparison for the Improve D option

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Improve D (75yr SoP – end of appraisal period) (A)	14,553	1,532	36,424	2.50	-	
Improve D (200yr SoP – end of appraisal period)	14,702	650	37,306	2.54	5.92	X

Table 4-13: ODU 5 IBCR comparison for the Improve E option

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Improve E (75yr SoP – end of appraisal period) (B)	13,953	1,532	36,424	2.61	-	
Improve E (200yr SoP – end of appraisal period)	14,059	650	37,306	2.65	8.32	X

Table 4-14: ODU 5 IBCR comparison for the Improve F option

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Improve F (75yr SoP – end of appraisal period) I	11,383	3,532	34,424	3.02	-	
Improve F (200yr SoP – end of appraisal period)	11,397	2,750	35,206	3.09	55.86	X

Sensitivity tests

The main uncertainties with the options in this location relate to option cost and the design water level of the defences to provide the desired SoP against flooding. This could be influenced by changes to sea level rise projections or updated understanding of the flood risk at the site.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include a cost uplift of 10% or 25% and also updated costs to account of for an additional 0.9m of sea level rise over the next century. This equates to the difference between the H++ sea level scenario and the sea level rise value used in the Strategy appraisal. Appendix A provides a summary of the results.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Improve D, E and F options to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that the Improve D-F options would remain among the options with the highest NPV.

In the sensitivity test focused on design crest level, the crest level increase of 0.9m has been applied to each of Sustain and Improve options to determine whether the cost of any of these options would be more or less sensitive to such design parameter changes and whether this would change the choice of option. As can be seen Improve D-F options remain the provisional National Economic Leading Option with this test and the ABCR of each of these options remains above unity. The majority of cost build-up for these options is in below ground aspects of the defences (e.g. piling) and therefore increases in crest height have an underweighted influence on the option cost. Whilst there appears to be a robust economic case with a large increase in crest height, the visual / landscape impact of such a crest level could lead to significant environmental / social impacts and therefore may not be a viable route forward. Further engagement would be required in the future if sea level rise progressed in line with the H++ scenario to determine the approach.

The choice of the Improve D-F options as the provisional National Economic Leading Option has not been changed as a result of the sensitivity tests. Each of these options has a benefit cost ratio much greater than unity (typically around 2:1 to 3:1) and therefore each option would still be economically viable with a substantial cost increase (e.g. of 2-3 times).

4.4.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 5 frontage include:

- Indicates general support for all the defence measures on the short list with each measure having more respondents ‘agreeing’ than ‘disagreeing’.
- The short list measures voted most important was Maintenance / repairs, followed by a new frontline seawall (with raised parapet) and crest raising of existing defences.

Given the proximity of potential defences to existing properties and recreation space there is potential for the defences to have visual / landscape impacts, however, the impact is uncertain until alignments are confirmed. It is likely that this could be a key issue for stakeholders when designs are developed further. In the west part of the unit a frontline alignment could have more of an impact on the properties located immediately behind the defences. In the east part of the unit both the setback and frontline alignments could have an impact. It is likely that during design some mitigation could be incorporated into the defences through the use of landscaping / softer engineering materials / glass floodwalls. In the east part of the unit there could be more opportunity for landscaping on the frontline alignment due to the space constraints along the setback alignment.

Table 4-15 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 4-15: ODU 5 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public feedback. Could result in failure of existing defences and increased flood risk to properties and other assets in this location.
Maintain	The maintain option would involve refurbishment and ongoing patch-repair to existing defences. This measure was the measure with the most support in the feedback from the last round of engagement. However, there would be increased flood risk to properties in this location as defences would not be improved, and therefore there could be more support for maintenance as part of a Sustain or Improve option.
Sustain A, D / Improve A, D	These options involve an upgraded frontline quay wall in the west part of the unit and upgrades to the existing setback wall in the east part of the unit. These measures appear to align with the measures that were most supported in the engagement round 4 feedback. Uncertainty around potential landscape impacts of these options.

Option(s)	Comments
Sustain B, E / Improve B, E	These options involve upgraded frontline quay walls along the full length of the unit. These measures appear to align with some of the measures most supported during engagement round 4 (e.g. new seawall with raised parapet). Uncertainty around potential landscape impacts of these options.
Sustain C, F / Improve C, F	This option involves upgraded frontline quay wall in the east part of the unit and a new setback wall in the west part of the unit. Each of these defence measures appeared to have general support in the feedback from the previous round of engagement. Uncertainty around potential landscape impacts of these options.
Adaptation / Resilience	Similar conclusions to the Maintain Option but flood risk would be managed on a property by property basis which is likely to have different levels of support from individual property owners.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 4-16 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options generally could have negative impacts on each of the categories considered. This is due to the increased flood risk with these options, and also for the potential for the quay wall in the east part of the unit to fail (it is already failing in placed and is supported by rock armour), potentially leading to erosion of the historic landfill and recreation space behind. This quay wall is currently retaining the land behind which is historic landfill, so in the event of the wall failing there is a risk of materials in the historic landfill site being released into the environment, potentially negatively impacting the land, soil and water resources category in particular. The contamination status of the historic landfill site is unknown and therefore these impacts in the SEA are uncertain. Further site investigations are required to confirm the contamination status. In addition, the area above the historic landfill is used for recreation / parkland so erosion of this area this option could negatively impact the population and communities category.

The Maintain option would not reduce the flood risk in the future and therefore negative impacts could occur expected across a range of categories. However, it would reduce the risk of erosion of the historic landfill site in the east part of the unit and therefore the option could lead to a positive impact in the land, soil and water resources category. Similar impacts would be expected for the Adaptation / Resilience option.

The Sustain and Improve options could have positive impacts relative to the baseline across most categories. The exception is in the landscape categories where the impact is uncertain as this will depend on alignment and any mitigation / landscaping. In the biodiversity / geodiversity category there is potential for the options to lead to a biodiversity net gain. For example, the refurbished / new frontline walls could be ecologically engineered and be constructed using materials and features that provide important habitats. Likewise, any setback structures could include habitat areas / planting to encourage biodiversity in the area. These opportunities should be investigated during further appraisal /design following the Strategy. Generally in this location there is sufficient space to construct within or close to existing defence footprints in this location and therefore direct encroachment / habitat loss into the marine SPA designation could be limited.

Each of the Sustain and Improve options includes either an upgraded frontline structure or a commitment to maintain the existing frontline structures. Therefore, each option would reduce the chance of the quay wall in east part of the unit failing and exposing historic landfill material, potentially leading to a positive impact in the land, soil and water resources category.

Table 4-16: Summary of potential environmental impacts in ODU 5

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Major negative impacts could occur across a variety of categories, including climate change / historic environment / land, soil and water resources / population and communities and transport and movement. It is noted that the contamination status of historic landfill site unknown therefore uncertainties with the degree of impact to the land, soil and water resources category. Other uncertainties on landscape and biodiversity / geodiversity.

Option(s)	Summary of Environmental Impacts
Maintain	Option would not reduce flood risk and therefore negative impacts could occur across range of categories. However, there could be a potential positive benefit in land, soil and water resources category due to erosion defence of historic landfill.
Sustain A, D / Improve A, D	Potential for positive impact in majority of categories. Uncertain impact on landscape as will depend on alignment and mitigation / landscaping.
Sustain B, E / Improve B, E	Potential for positive impact in majority of categories. Uncertain impact on landscape and historic environment as will depend on alignment and mitigation / landscaping.
Sustain C, F / Improve C, F	Positive impacts could occur in majority of categories. It is noted that there is uncertainty on the impact on population and communities category given that potential for increased risk to properties in west part of the unit landward of the setback defence. Uncertain how this risk may develop with property level protection / sea level rise.
Adaptation / Resilience	Similar impacts to Maintain

4.4.4 Leading Option Selection

National Economic Leading Option

The economic appraisal has identified that the Improve D-F options all have similar economic cases and NPVs and therefore could all reasonably be selected as the provisional National Economic Leading Option.

The SEA has identified that all three of the Improve D-F options generally have positive impacts on the environment and the overall magnitude of impacts is likely to be similar for each option. There are no major negative environmental impacts associated with these options and therefore the SEA does not rule out taking any of the Improve D-F options forward as the National Economic Leading Option.

The social appraisal does not clearly identify a preferred solution and there does not appear to be any major negative social impacts for the Improve D-F options.

For this location the decision is primarily around the preferred defence alignment. There may be a stakeholder preference for a frontline or setback defence in both parts of the unit (west / east) but further engagement is required during the Strategy or follow up outline design work to determine the community and local preference on the alignment. Choice of alignment should consider mitigation such as landscaping that could make some options more feasible to the local community and stakeholders.

Based on the points above, the Strategy has not identified a single National Economic Leading Option for ODU 5. Instead, each of the Improve D-F options have been taken forward. The leading alignment would need to be determined either following the next phase of Strategy engagement or during business case / outline design development when further engagement would take place.

Local Aspirational Leading Option

The Improve D-F options delay the initial major capital scheme until the start of epoch 2. There could be an aspiration to do this capital scheme sooner if funding permits, especially given the poor condition of the current quay wall and the uncertainty as to whether small scale maintenance could sustain the structure until epoch 2. If this is the case, then Improve A-C would be identified as the Local Aspirational Leading Option. These options would provide increased benefits over the course of the Strategy and would also provide more reassurance / confidence in the condition of the quay wall in the east part of the unit during epoch 1.

4.4.5 Funding

There are multiple National Economic Leading Options (Improve D-F) and Local Aspirational Leading Options (Improve A-C) and funding calculations have not been undertaken for each of these options. Instead, an indicative Partnership Funding assessment has been undertaken on the most costly of each of the National and

Local options. This is Improve E option for the National Economic Leading Options and the Improve B option for the Local Aspirational Leading Options. Using the most costly option in the assessment provides a conservative indication of the funding score.

For the calculations the major capital scheme has been assumed to be at the start of epoch 1 for Improve B and at the start of epoch 2 for Improve E. However, for Improve E, as per the option description, the scheme could be undertaken later in the epoch subject to rates of climate change / funding availability / defence condition. The longer the scheme is delayed, typically the greater the amount of FCERM-GiA that will be available as the potential benefits of the scheme in discounted terms would increase.

Table 4-17 presents the indicative Partnership Funding scores for the major capital interventions for each of the leading options. As can be seen, the indicative Partnership Funding score for the Improve E capital scheme is 21% and for the Improve B capital scheme is 13%. Both options would require additional funding, with the amount for the capital intervention for the Improve E option estimated to be over £15.8million and the amount for the capital intervention for the Improve B option being over £17.5million.

Table 4-17: Indicative Partnership Funding Scores for ODU 5 (first major capital scheme)

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention*
National Economic Leading Option example: Improve E	20,125	989	21,114	57,958	80 years	21%	4,327	15,798
Local Aspirational Leading Option example: Improve B	20,125	996	21,121	37,417	100 years	13%	2,536	17,589

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

Backup Option if funding cannot be secured

The size of the funding contribution required to deliver either the National Economic Leading Options (Improve D-F) or Local Aspirational Leading Options (Improve A-C) is significant and this presents a risk to the delivery of these options. If the funding cannot be secured neither option could be delivered. If this were to be the case, then it is recommended that funding opportunities for the Adaptation / Resilience option are sought instead. This option does not have a major capital scheme to improve the defences and instead focusses on frequent defence maintenance / refurbishments as well as property level protection. Overall the option has a lower present value cost than the National Economic and Local Aspirational options (estimated to be approximately PV £12million) of which approximately £3million is related to PLP measures and could potentially be eligible for a partial funding from flood resilience grants.

The Adaptation / Resilience option would not deliver the same level of benefits as the National Economic Leading Options (Improve D-F) or Local Aspirational Leading Options (Improve A-C) and there is uncertainty as to how effective property level protection would be in the long term. However relative to the Do Nothing scenario, it would help to reduce the impacts of flood risk to communities and would provide time for an adaptation plan to be implemented or funding to be sought for a capital intervention.

4.4.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 4-11, the National and Local Aspirational Options are also likely to generate a range of local economic benefits. These local economic benefits are not

eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 4-11. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £12million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National or Local Aspirational Option could help avoid a significant proportion of these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of these options.

4.4.7 Summary

Table 4-18 below summarises the leading options in ODU 5. After the Strategy, engagement with stakeholders is required to determine the appropriate defence alignment in this location. This engagement will guide which option to undertake. Once the alignment is confirmed more detailed appraisal can then be undertaken to provide a clearer picture of implementation timings and funding availability before progressing to a business case.

Table 4-18: Summary of ODU 5 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Improve D-F: upgrade defences to improve SoP against flood risk from epoch 2. Refurbish or replace quay wall in east side of unit to prevent erosion of historic landfill	Varies	Varies – but within region of £4million
Local Aspirational	Improve A-C: upgrade defences to improve SoP against flood risk from epoch 1. Refurbish or replace quay wall in east side of unit to prevent erosion of historic landfill	Varies	Varies - but within region of £2.5million
Backup	Adaptation / Resilience: maintain / refurbish existing defences and undertake property level protection to properties at risk from flooding	11,927	To be determined during subsequent appraisal

Alignment with SMP

The SMP policy for this area is Hold the Line from the present day, with the intent to maintain and improve the flood defences. Each of the leading options aligns with this policy.

4.5 ODU 6 – River Avon West Bank

ODU 6 spans the west bank of the River Avon, from Quay Road (just to the east of the Christchurch Quay to Knapp Mill. The ODU includes the Millstream which runs parallel to the main river channel for most of the unit and provides a source of flood risk. There are a variety of existing defences in this ODU, including a concrete seawall, masonry walls, a sheet pile wall and gabions. These are located primarily at the southern end of the unit. The undefended areas of the frontage to the north are generally characterised by a natural verge.

There are a number of listed buildings in this ODU, including Grade I listed buildings such as Christchurch Priory and the ODU is adjacent to a number of environmental designations. Given the numerous private landowners in this location, for a flood risk mitigation scheme to be successful, there will need to be collaboration between land owners, owners of any private defences and the flood risk authorities.

Through discussions with the Environment Agency Partnership Strategic Overview Team (who lead on the Lower Stour Strategy and also the Lower Avon and Harbour Modelling), it was agreed for the Christchurch Bay and Harbour Strategy to focus on options for managing the tidal flood risk to the south of Christchurch Bypass (the A35). Any areas to the north of this will be considered in the Lower River Avon Strategy instead. Moving up river the tidal influence on the flood risk decreases (it becomes more fluvially dominated) and Christchurch Bypass provides a clear boundary to distinguish between potential benefit areas for the two projects.

The tidal flood risk within this unit is most prominent at the southern end and central area of the unit. Over the next 100 years the total PV damages for this ODU are estimated to be over £7.4 million. An estimated 38 properties are expected to be at risk from a present day 1 in 200 year event in this ODU, increasing to 126 properties in 100 years' time. There are two main areas of flood risk to the south of Christchurch Bypass; at the southern end of the unit around the boatyard at the south eastern part of the unit (at the time of writing this boatyard is known as Elkins Boatyard) and Priory Quay, and in the central part of the unit adjacent to Castle Street. In both areas the numerical modelling indicates that the risk comes from both the main River Avon channel and also the Millstream.

The area is not covered by an SMP policy. However within the Hampshire Avon Catchment Flood Management Plan (2012) (herein referred to as the CFMP) the unit falls within the 'Christchurch Area', in which the plan is to take further action to reduce flood risk, subject to additional appraisal.

Figure 4-8 shows a map of the key features in ODU 6.

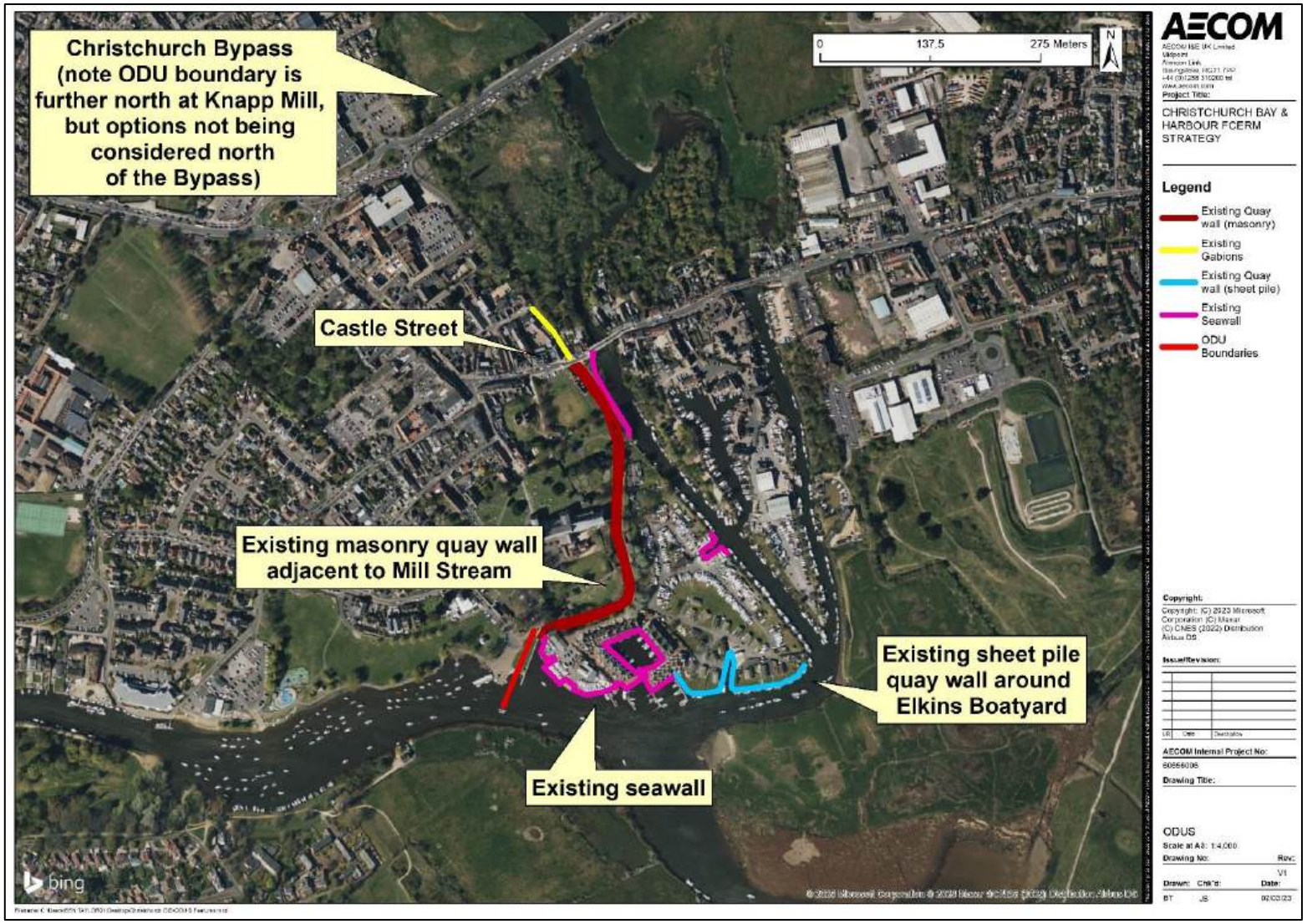

Figure 4-8: Key features in ODU 6

4.5.1 Short List of Options

The Short List of Strategic Options for ODU 6 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 4-9 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 6 erosion would be expected to occur once the existing defences reach the end of their service life and fail. However, given the sheltered harbour environment the rate of erosion would be expected to be very slow. Any erosion is unlikely to impact properties but could lead to public realm degradation as there are many waterside footpaths and access routes in this unit which may become unusable if the defences were to fail.

Over time the flood risk to ODU 6 would also be expected to increase due to sea level rise. The risk is currently greatest at the southern end of the unit around Elkins boatyard. However, in the future the risk will also become more pronounced in the central part of the unit adjacent to Castle Street.

Due to the risks to properties and infrastructure ODU 6, doing nothing is not an acceptable solution in this location. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum option would involve undertaking reactive small scale maintenance to the existing quay walls in this unit. This would typically take the form of patch and repair maintenance whereby localised damage to the defence is repaired on an ad-hoc basis.

This option is likely to extend the service life of the existing quay walls but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reaches the end of their service lives the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis. In ODU 6 there is minimal economic benefit for the Do Minimum option relative to the Do Nothing scenario as the Do Minimum option would not reduce flood risk (there are no raised defences in this unit above the existing quay walls). Extending the service life of the defences by a few years does little to reduce the economic damages over a 100 year period.

Maintain

In ODU 6 the focus for the Maintain option is to extend the service life of the existing defences through to the end of the Strategy period. This would be achieved through a series of capital refurbishments to the existing defences over time, as required based on the condition and deterioration of the defences. For the purposes of costing it has been assumed that the first capital refurbishment would be required in the second half of epoch 1 based on the estimated residual life of the defences.

There are currently no formal raised flood defences in ODU 6 (most the defences are quay walls at ground level) and given that the main risk in ODU 6 is from flooding, the maintain option would provide very minimal economic benefits to properties in this unit.

Sustain A

The Sustain A option would involve constructing new flood defences in epoch 1 and then raising / lengthening them over time to keep pace with sea level rise to provide a defined SoP over the next century.

In epoch 1 a new flood defence would be constructed in the area at the south of the unit. The alignment would need to be decided during outline design, but for the purposes of the Strategy it has been assumed that this would encircle the properties at Priory Quay and Convent Meadows but would exclude the boat storage area at the boatyard (Elkins Boatyard at the time of writing this report) so this could remain water compatible. The defence alignment is likely to be a combination of new frontline / quay walls and setback walls. With the Sustain A option, this new flood defence would be raised in height over time as sea levels rise.

A new defence would also be constructed in epoch 1 in the central part of the unit, close to Castle Street. This would initially be a small length of defence on the bank of the Mill Stream and would defend against flood risk to the area west of the Mill Stream. Over time this defence would need to be lengthened to prevent outflanking and also raised to keep pace with sea level rise. As part of the longer defence, it may be appropriate to construct some of the defence alignment in a setback position adjacent to Castle Street. This would need to be decided upon during outline design. For the frontline structures the defences would be built within or as close to the footprint of the existing bank possible. This would be to ensure minimal encroachment into the river channels to minimise impact on biodiversity / ecology and reduce the potential for detriment fluvial flood risk (by reducing channel capacity). Further work would be required during outline design to confirm this approach.

The option would defend two mixed use (residential and non-residential) areas on the west bank of the Avon and provide significant economic benefits.

Sustain B

The Sustain B option would involve constructing new flood defences in the central part of the unit, close to Castle Street. This would be constructed, raised and lengthened over time as per the Sustain A option.

Sustain B differs to Sustain A in the south of the unit as it would not include a new defence at the south part of the unit at Priory Quay / Convent Meadows. The flood risk in this part of the unit would instead be managed on a property by property basis using property level protection measures. In epoch 3 the depth of flooding is expected to exceed 1m in some locations for most of the return periods modelled and therefore the effectiveness of Property level protection is uncertain. Benefits from property level protection in this area have therefore only been included in epochs 1 and 2.

Many of the properties in the south part of the unit are raised above ground level and therefore the benefits of property level protection may not be required. To be conservative in the Strategy appraisal economics the costs have been included for property level protection for these properties, but property surveys would be required to confirm the requirement on a property by property basis prior to implementation.

Improve A

Improve A follows the same approach as Sustain A, with the exception being that the new defences would be initially constructed to a 2124 SoP. This is a precautionary approach to managing the flood risk (as opposed to the managed adaptive approach followed in the Sustain options). It would result in a higher up-front investment but would mean that repeat interventions over time to raise and lengthen the defences would not be required.

Improve B

Improve B follows the same approach as Sustain B, with the exception being that the upgraded defences would be initially constructed to a 2124 SoP (rather than raised and lengthened over time).

Adaptation and Resilience

This option would involve implementing property level protection to the properties at risk of flooding in this unit. The two key areas where property level protection would be required would be the group of properties in the south of the unit at Priory Quay and Convent Meadows, and in the central part of the unit in the area around Castle Street.

The property level protection would provide defence against shallow flooding and would likely be effective for most return period events during epochs 1-2. During epoch 3 the depth of flooding is expected to increase, with particularly deep flooding (>1m) expected for the larger return period events. The effectiveness of property level protection in these conditions is more uncertain and therefore the economic benefits of property level protection have not been included in the economic appraisal for epoch 3.

It has been assumed that successive interventions of property level protection would be required as the design life is unlikely to last the full appraisal period. The areas shown in Figure 4-9 are for the level of risk in 2124 and property level protection would not be required to all properties in the areas initially.

As outlined above in the Sustain B section, many of the properties in the south part of the unit are raised above ground level and therefore the benefits of property level protection may not be required. To be conservative in the Strategy appraisal economics the costs have been included for property level protection for these properties but

property surveys would be required to confirm the requirement on a property by property basis prior to implementation.

In addition to the property level protection, this option would also involve maintenance of the existing quay walls in the south part of the unit as buildings are in close proximity to these structures and failure of the structures could risk the buildings.

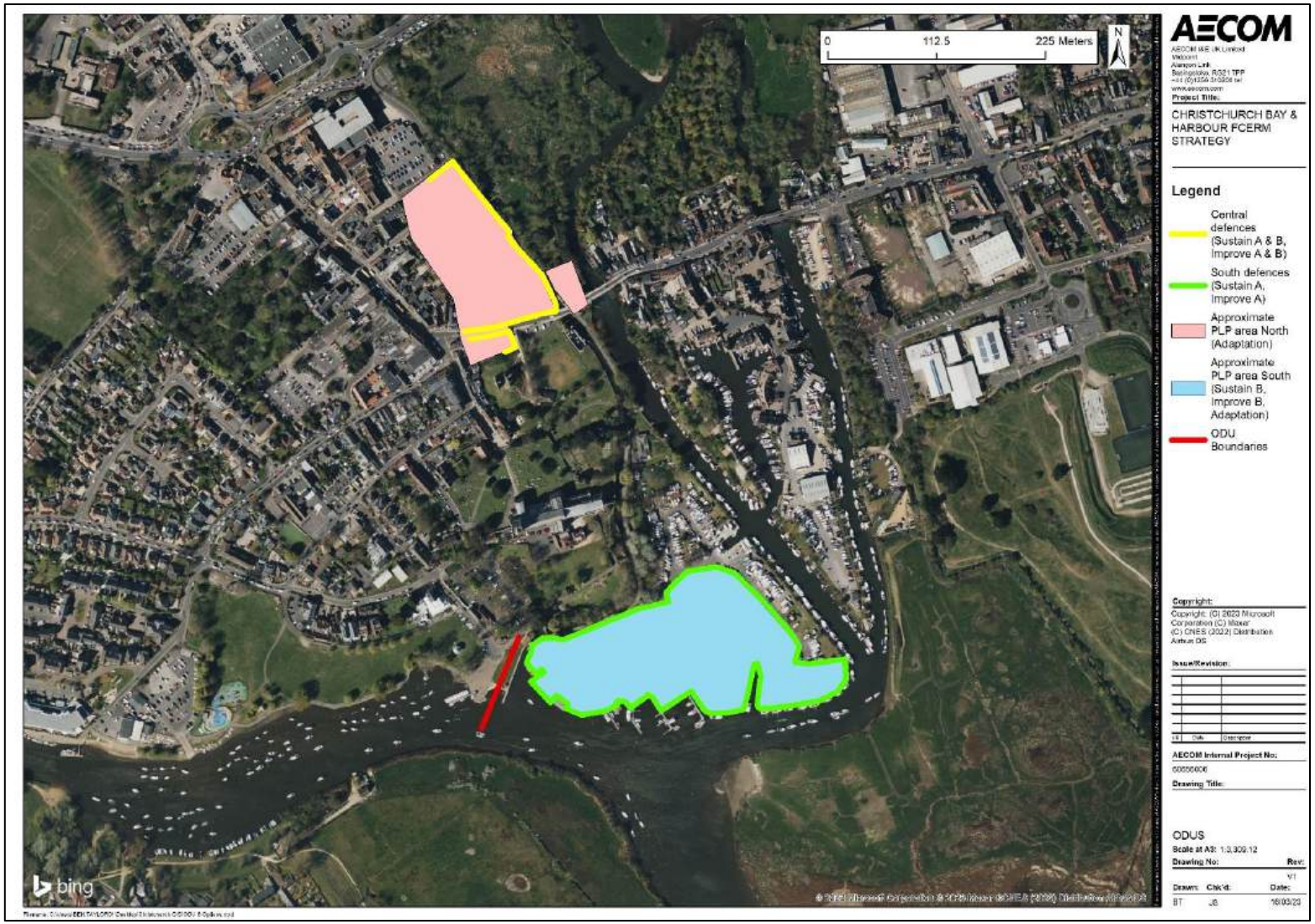

Figure 4-9: ODU 6 options

4.5.2 Economic Appraisal of Options

Cost benefit analysis

Table 4-19 presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options in ODU 6 cannot be ordered based on AEP as different areas are being defended in each of the options with different strategic approaches. The options have therefore been ordered according to the NPV. The Sustain B option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

Table 4-19: ODU 6 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Sustain B (75yr SoP)	3,278	3,771	3,666	1.12	388	X
Adaptation / Resilience	2,802	4,560	2,877	1.03	75	
Do Nothing	-	7,437	0	-	-	
Do Minimum	170	7,437	0	-	-170	
Improve B (75yr SoP – end of appraisal period)	4,988	3,654	3,783	0.76	-1,205	
Maintain	1,519	7,437	0	-	-1,519	
Sustain A (75yr SoP)	7,877	2,918	4,519	0.57	-3,358	
Improve A (75yr SoP – end of appraisal period)	10,252	1,663	5,774	0.56	-4,478	

Two different SoPs have been considered for the Sustain B option, the 1 in 75 year SoP and the 1 in 200 year SoP. The next step of the economic appraisal is to compare the IBCR of the Sustain B option with a 75yr SoP to the 200yr SoP (Table 4-20).

The Improve B option has also been included in the IBCR comparison because Improve B is the same as the Sustain B approach, but with the exception being that the defences would initially be constructed to the 2124 SoP. rather than raised and lengthened over time. The Improve B (200yr SoP) option would initially provide a much higher SoP at the time of construction, in excess of 1 in 1000 years.

As per FCERM-AG, in order to move from the Sustain B (75yr SoP) option to the Sustain B (200yr SoP) option the IBCR needs to exceed a value of 3. As can be seen, the IBCR between these standards is 10.2 which is greater than the IBCR threshold and therefore the Sustain B (200yr SoP) is selected as the provisional National Economic Leading Option.

In order to increase the SoP further still and deliver the Improve B (200yr SoP) option, the IBCR value needs to exceed a value of 5 given the much higher initial SoP of the Improve B option. As can be seen, the BCR between Sustain B (200yr SoP) and Improve B (200yr SoP) is below unity so Sustain B (200yr SoP) remains the provisional National Economic Leading Option.

Table 4-20: ODU 6 IBCR comparison for the Sustain B option

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Sustain B (75yr SoP)	3,278	3,771	3,666	1.12	-	
Sustain B (200yr SoP)	3,303	3,516	3,921	1.19	10.2	X
Improve B (200yr SoP – end of appraisal period)	5,063	3,446	3,991	0.79	0.04	

Sensitivity tests

The main uncertainty associated with the Sustain B (200yr) option in ODU 6 is whether the different parts of the option would be deliverable in isolation. This is of particular importance in this unit given the different pathways and funding mechanisms that could be followed to deliver the different parts of this option.

In the south part of the unit, the property level protection could be delivered by individual property owners with support / coordination from BCP Council. The property owners may have access to flood resilience grants to help with funding. However, the flood defences in the north part of the unit would be a capital scheme, most likely with an aspiration to use FCERM-GiA if available and other funding sources.

If the benefits / costs from the property level protection in the south part of the unit were removed from the overall option, the economic viability of the flood defences in the north part of the unit is uncertain, which would impact FCERM-GiA availability. Therefore a sensitivity test has been undertaken to determine the economic case of the flood defences in the north part of the unit in isolation.

Table 4-21 shows that ABCR for the Sustain B (200yr SoP) option in the north part of the unit only. As can be seen the ABCR is less than unity which indicates that if delivered in isolation, there would be no economic justification to proceed with this part of the option. This is largely due to the relatively long length of new defence required relative to the number of properties being defended. With an ABCR of less than unity, the scheme in the north part of the unit would not be deliverable or eligible for FCERM-GiA.

Table 4-21: ODU 6 sensitivity test on Sustain B

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV
Sustain B (200yr SoP) – full option	3,303	3,516	3,921	1.19	618
Sustain B (200yr SoP) – north part of unit only (no PLP costs or benefits in south part of unit included)	2,352	6,381	1,056	0.45	-1,296

Based on the results of the sensitivity test, the choice of National Economic Leading Option has been amended. The next best option in the economic comparison (Table 4-19) is Adaptation option and this has therefore been selected as the new provisional National Economic Leading Option. This is the option next in the list with an ABCR and NPV greater than unit. No other options have an ABCR greater than unity.

4.5.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 6 frontage include:

- Indicates general support for most of the defence measures on the short list with the following measures having more respondents 'agreeing' than 'disagreeing'; maintenance / repairs, crest raising, deployable defences, setback embankment, setback floodwall, sheet pile wall and land raising. A new seawall had the same amount of 'agree' responses to 'disagree' responses.
- The short list measures with the most responses saying it was most important was Maintenance / repairs by a clear margin.

Given the proximity of potential defences to existing properties and recreation space there is potential for the defences to have visual / landscape impacts. It is likely that this could be a key issue for stakeholders if options with new raised defences are taken forward and designs are developed further. New raised defences in the south part of the unit could have impacts on waterside access (boatyard areas in this location) and appropriate mitigation, such as access points / floodgates, would need to be included in the defences to preserve this function.

Table 4-22 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 4-22: ODU 6 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public feedback. Could result in failure of existing defences and increased flood risk to properties and other assets in this location.
Maintain	The maintain option would involve refurbishment and ongoing patch-repair to existing defences. This measure was the measure that appeared to have the most support in the feedback from the last round of engagement. However, there would be increased flood risk to properties in this location as defences would not be improved, and therefore there could be more support for maintenance as part of a Sustain, Improve or Adaptation option.
Sustain A, Improve A	These options involve upgraded raised defences in the south and central part of the unit. The measures to implement this would most likely be a combination of crest raising, new sheet pile walls and a setback floodwall. These measures all had more 'agree' that 'disagree' responses during the last round of engagement. Raised defences particularly in the south part of the unit could have an impact on waterside access, so would need to incorporate access points / gates. This could have a social impact given the land use of the area (boatyard). There is uncertainty around potential landscape impacts of these options and this could have an impact to the local community.
Sustain B, Improve B	These options involve upgraded raised defences in the north part of the unit, and property level defences in the south part of the unit. The type of defences would be similar to Sustain A / Improve A and therefore the same findings apply. The main difference would be in the south of the unit where raised defences would not be constructed. The potential impact of these defences due to possible impacts on access would therefore be avoided.
Adaptation / Resilience	Property level protection measures are deployable defences and the feedback from the previous round of engagement indicates support for these measures. Access and uncertain landscape impacts would be avoided with this approach.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 4-23 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options could have negative impacts on most of the categories considered. This is due to the increased flood risk with these options, leading to negative impacts in the climate change, historic environment, population and communities and transport and movement categories. The Maintain option would not reduce the flood risk over time and therefore similar impacts would be expected in the medium / long term.

The Sustain A and Improve A options could have major positive impacts across a range of categories as the flood risk would be reduced significantly in the two main areas at risk within the unit (to both properties and public spaces). The exceptions are in the landscape, historic environment and biodiversity/geodiversity categories. With respect to biodiversity, in this unit there is generally a lack of space to construct new defences and some limited encroachment into the designated areas in this location may be unavoidable. A negative score in the biodiversity / geodiversity category has therefore been applied in the SEA but it is noted that this is uncertain and would need to be confirmed during concept / outline design. There could be appropriate mitigation such as using existing defence footprints / buildings as part of the defence system.

The Adaptation / Resilience Option could have minor negative impacts in a range of categories such as climate change, historic environment, population and communities, and transport and movement. Given that the area is widely developed / urbanised there could be flooding to transport links and public spaces in the areas of property level protection. However no major negative impacts have been identified.

Relative to Sustain A and Improve A, the potential benefits of the Sustain B and Improve B are likely to be less prominent. This is because the property level protection measure included as part of these options in the south part of the unit provide a less robust defence against flooding than the new raised defences of Sustain / Improve A.

Table 4-23: Summary of potential environmental impacts in ODU 6

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Could have major negative impacts across a variety of categories, including climate change / historic environment / population and communities and transport and movement.
Maintain	Option would not reduce flood risk and therefore negative impacts would be expected across range of categories.
Sustain A, Improve A	Major positive impacts could occur across wide range of categories due to reduction in flood risk to properties and public spaces. Potential for negative impacts in landscape, historic environment and biodiversity / geodiversity.
Sustain B, Improve B,	Minor positive impacts across could occur across a wide range of categories. Expected to have less of a positive impact than Sustain A in many categories as property level protection in the south part of the unit would not provide same degree of flood defence as permanent defences in the north part of the unit. Potential for negative impacts in landscape, historic environment and biodiversity / geodiversity.
Adaptation / Resilience	This is an urban area that is widely used by members of the public therefore this option could have negative impacts in climate change, historic environment, population and communities and transport and movement categories as property level protection would not defend public spaces.

4.5.4 Leading Option Selection

National Economic Leading Option

After considering the sensitivity tests in the economic appraisal, the Adaptation / Resilience option was provisionally identified as the National Economic Leading Option.

The SEA indicates that the Adaptation / Resilience option could have negative impacts in a range of categories in the future such as climate change, population and communities, and transport and movement. This is mainly due to property level protection not defending public open spaces (limited to individual properties) so there would be impacts to undefended areas during flood events. However, the impacts are expected to be minor and therefore the SEA does not rule out this option.

Based on the feedback obtained from engagement round 4, the defence measures in the Adaptation / Resilience option (Maintain and deployable defences as part of property level protection) appeared to have general support from a stakeholder perspective. In addition, the Adaptation / Resilience option would not impact waterside access (which the Sustain A / Improve A option has the potential to do).

Based on the above points the Adaptation / Resilience option is retained as the National Economic Leading Option. Whilst there are likely to be some negative environmental impacts associated with the option, there are no viable alternative options from an economic standpoint.

No Local Aspirational Option has been identified for this unit because the alternative options do not appear to have a robust economic case after considering the sensitivity tests and could be challenging to deliver.

4.5.5 Funding

There are no major capital schemes to reduce the flood risk included as part of the Adaptation / Resilience option and therefore the availability of FCERM-GiA to fund the options would be very limited. For this reason no indicative Partnership Funding calculations have been undertaken for this location. Partial or full funding for property level protection measures as part of the leading options may be available from flood resilience grants (subject to eligibility and the cost of individual property level protection measures). Funding for maintenance of the frontline walls would be the responsibility of the wall owners / maintainers.

4.5.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 4-19, the National Option is also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 4-19. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £6.5million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National Option could help avoid a proportion of these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of this option.

4.5.7 Summary

Table 4-24 below summarises the leading options in ODU 6.

Table 4-24: Summary of ODU 6 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Adaptation / Resilience: property level protection to properties at risk. Maintenance of quay walls	2,802	To be determined during subsequent appraisal

To support the implementation of the National Option, it is recommended that BCP provide advice to property owners regarding property level resilience and protection measures. This could include details of the grants that may be available to homeowners as well as assisting in liaising / coordinating resilience measures.

Alignment with SMP

This area is not covered by the SMP and therefore a comparison cannot be made.

4.6 ODU 7 – Rossiters Quay

ODU 7 covers the Rossiters Quay island in the River Avon. Bridge Street passes west to east across the Island with properties on either side of the roadway. To the south of the road the Rossiters Quay area is used as a boatyard / waterside access point.

North of Bridge Street, the defences consist of a setback embankment and frontline quay walls. To the south of Bridge Street the defences are primarily frontline quay walls. Flood risk is the key risk in this location but the existing defences appear to provide a high SoP; based on the present day numerical modelling the main area of properties in ODU 7 generally appears to be defended up to at least a present day 1 in 200 year return period event. However, over time with sea level rise the effectiveness of the defences will reduce and by year 100, 57 properties are expected to be at risk from a 1 in 200 year event. The total PV damages for this ODU are estimated to be over £5.4 million.

There is generally a lack of space around ODU 7 and therefore constructing new defences is likely to be technically challenging. This could lead to an increase in estimated cost in this location when more site specific details are considered during outline design / business case development. The viability of the leading option selected for a range of cost increases have been considered in the sensitivity tests.

Continued access to the river as well as the natural creek (Brigands Creek) running through the defences in the north east corner is a key issue to consider. The ODU is adjacent to environmental designations such as SPA and Ramsar sites as well as a SSSI.

Similar to ODU 6, this area does not have an SMP policy as it is not included within the SMP. However within the CFMP (2012) the unit falls within the ‘Christchurch Area’, in which the plan is to take further action to reduce flood risk, subject to additional appraisal.

The key features in ODU 7 are shown in Figure 4-10.

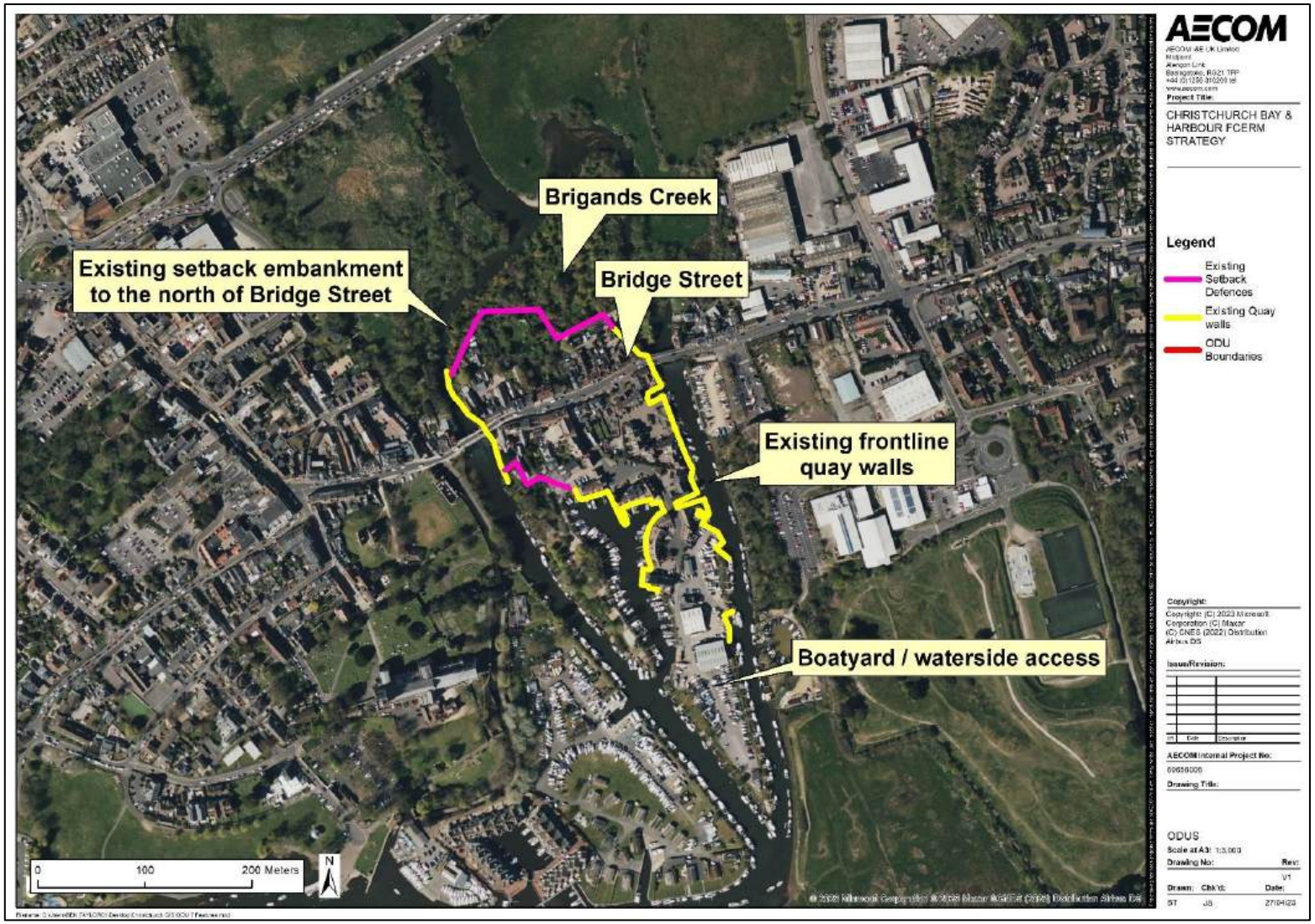

Figure 4-10: Key features in ODU 7

4.6.1 Short List of Options

The Short List of Strategic Options for ODU 7 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 4-11 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. This would eventually result in existing defences and quay walls failing as they reach the end of their service life. In ODU 7 failure of the existing frontline defences could lead to land instabilities / localised erosion in the areas adjacent to the defences. Given the sheltered nature of this location the erosion is not likely to be widespread but could impact the waterside properties. Due to the uncertainties around the magnitude of potential erosion in this location its potential impact has not been considered in the economic appraisal. The economic impact of erosion could be investigated during more detailed scheme design / business case development to provide further justification for the construction of defences in this location.

With the Do Nothing scenario the flood risk to ODU 7 would be expected to increase over time due to sea level rise. The risk is currently greatest at the southern end of the unit around Avon Marina. There are few properties at the southern end of the unit and therefore the economic damages from epoch 1 from flooding area low. Most properties are concentrated around Bridge Street further to the north and the risk from flooding in this location would increase in epoch 2 as existing defences fail. This area around Bridge Street is where the vast majority of the flood risk related damages are concentrated.

Due to the risks to properties and infrastructure (e.g. Bridge Street) in ODU 7, doing nothing is not an acceptable solution in this location. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum option would involve undertaking reactive small scale maintenance to the existing quay walls and raised defences in this unit. This would typically take the form of patch and repair maintenance whereby localised damage to the defence is repaired on an ad-hoc basis.

This option is likely to extend the service life of the existing raised defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reaches the end of their service lives the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis. Extending the service life of the defences by a several years would help delay the onset increased flood risk associated with failure of existing defences.

Maintain

In ODU 7 the focus for the Maintain option is to extend the service life of the existing defences through to the end of the Strategy period. This would be achieved through a series of capital refurbishments to the existing defences over time, as required based on the condition and deterioration of the defences. For the purposes of costing it has been assumed that the first capital refurbishment would be required in the second half of epoch 1 based on the estimated residual life of the defences.

The Maintain option would provide some economic benefit as it would ensure the existing defences would continue to provide a flood risk benefit to the area through the appraisal period. However, over time the standard of protection would reduce due to sea level rise and the defences would become less effective.

Sustain A

The Sustain A option would involve constructing new flood defences in epoch 2 and then raising them over time to keep pace with sea level rise to provide a defined SoP over the next century. New defences are not required sooner than this because the existing defences currently provide a high standard of protection, and through maintenance the service life could be extended through to epoch 2.

It is likely that a combination of new frontline quay walls and upgraded setback defences would be required. For the purpose of the Strategy costing and appraisal it has been assumed that a similar alignment to the existing

defences would be followed, but this would need to be confirmed during outline design / business case development. For the frontline structures the defences would be built within or as close to the footprint of the existing quay walls as possible. This would be to ensure minimal encroachment into the river channels to minimise impact on biodiversity / ecology and reduce the potential for detriment fluvial flood risk (by reducing channel capacity). Further work would be required during outline design to confirm this approach.

In this location there are a number of buildings constructed on the water's edge and it may be that these buildings act as 'defacto defences' as part of the scheme alignment. The residual risk associated with this approach would need to be considered during outline design and options such as flood proofing individual buildings may need to be included. This may be the case in a number of locations in the unit, such as at Brigands Creek where there is limited space available. During the outline design a variety of options should be considered such as infilling Brigands Creek which could be a solution in this part of the unit if other options are not technically feasible. This option is not being proposed or considered likely at this stage but is worth further consideration when more details are available at outline design stage. Options such as this could have negative environmental impacts but could also reduce cost and a full appraisal will be required during outline design.

The option would defend the concentration of properties either side of Bridge Street. However, it would likely not include the boat yard area to the south. Given the water compatibility of this land use, costs for new defences here have not been included. The economic viability of raising the land of this boat yard area has been considered but it would provide a large increase to the scheme cost for minimal economic benefit and therefore is not feasible from purely an economic perspective.

For the costing / benefit calculations it has been assumed that the upgrade would occur at the start of epoch 2, but it could be undertaken later on during the epoch, for example mid-way through epoch 2 subject to rates of climate change / condition of existing defences / funding availability.

Improve A

Improve A follows the same approach as Sustain A, with the exception being that the new defences would be initially constructed to a 2124 SoP. This is a precautionary approach to managing the flood risk (as opposed to the managed adaptive approach followed in the Sustain options). It would result in a higher up-front investment but would mean that repeat interventions over time to raise and lengthen the defences would not be required.

Adaptation / Resilience

This option would follow the same approach as the Maintain Option with respect to defence maintenance. However this option would also involve property level protection to the properties at risk from flooding in this unit throughout the appraisal period. However the effectiveness of property level protection in the long term is uncertain in this unit given the potential for deep flooding in this location in the future. To be conservative the benefits of property level protection in this ODU have therefore not been included from epoch 3 in the economic appraisal.

Figure 4-11: ODU 7 options

4.6.2 Economic Appraisal of Options

Cost benefit analysis

Table 4-25 presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. For ODU 7 it is possible to order the options by reducing probability of flooding because each option has the same benefit area and the options are focussed on how to reduce flood risk. The options have therefore been ordered in this manner. As per FCERM-AG, when ordering by reducing probability of flooding, the provisional National Economic Leading Option is selected as the option with the highest ABCR, in this case Improve A (200yr SoP).

As can be seen, the costs for the Sustain A and Improve A options is very similar. For costing purposes, costs for a sheet pile with a capping wall / parapet have been used for the frontline parts of the option alignment at the water's edge. The majority of the cost for this type of structure is below ground and therefore relatively small increases in the height of the structure above ground lead to small changes in the cost build-up.

Table 4-25: ODU 7 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	5,388	0	-	-	
Do Minimum	340	5,075	313	0.92	-27	
Maintain	1,975	3,716	1,672	0.85	-303	
Adaptation / Resilience	2,630	2,135	3,253	1.24	632	
Sustain A (75yr SoP)	4,031	645	4,743	1.18	712	
Sustain A (200yr SoP)	4,090	210	5,178	1.27	1,088	
Improve A (75yr SoP – end of appraisal period)	4,060	144	5,244	1.29	1,184	
Improve A (200yr SoP – end of appraisal period)	4,118	59	5,329	1.29	1,211	X

Improve A provides the highest SoP of the options considered and whilst it is identified as the provisional National Economic Leading Option, for completeness a comparison of IBCRs between the lower SoP options has been undertaken in Table 4-26.

The Sustain A (200yr SoP) option would provide an initial 200 year SoP when constructed in epoch 2 and this would be sustained through time through via a series of defence raises. However the Improve A option (200yr SoP) would be constructed to a 1 in 200 year SoP for the end of the appraisal period, which would mean that initially at the time of construction the SoP would far exceed the 1 in 200 year SoP and would be in excess of a 1 in 1000 year.

The table shows how the IBCR between the Sustain A (75yr SoP) and the Sustain A (200yr SoP) is 7.37, which is greater than the FCERM-AG IBCR threshold of 3 required to select the 200yr SoP as the leading standard.

The SoP for the Improve A (200yr SoP) would be in excess of 1 in 1000 year when initially constructed, and therefore as per FCERM-AG, an IBCR of >5 is required to move from the Sustain A (200yr SoP) to the Improve A (200yr SoP) option. As shown, the IBCR between Sustain A (200yr) and Improve A is 5.39, which results in Improve A (200yr SoP) being retained as the provisional National Economic Leading Option.

Table 4-26: ODU 7 IBCR comparison

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Sustain A (75yr SoP)	4,031	645	4,743	1.18	-	
Sustain A (200yr SoP)	4,090	210	5,178	1.27	7.37	
Improve A (200yr SoP – end of appraisal period)	4,118	59	5,329	1.29	5.39	X

Sensitivity tests

The main uncertainties with the options in this location relate to option cost and the design water level of the defences to provide the desired SoP against flooding. The cost is uncertain in this location as there are space constraints in this unit which could lead to construction challenges and there is potential for cost increases when site specific details are considered during outline design / business case development. The design water level of the option could be influenced by changes to sea level rise projections or updated understanding of the flood risk at the site.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include a cost uplift of 10% or 25% and also updated costs to account of for an additional 0.9m of sea level rise over the next century. This equates to the difference between the H++ sea level scenario and the sea level rise value used in the Strategy appraisal. Appendix A provides a summary of the results.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Improve A (200yr SoP) option to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that the Improve A (200yr SoP) option would retain an ABCR greater than unity with these level of cost increases but the choice of provisional National Economic Leading Option would change to the Improve A (75yr SoP). However, given that each of the Sustain and Improve options follows a very similar approach, any scenario leading to a cost increase for the Improve (200yr SoP) option would likely also lead to a similar scale of cost increase to the Improve A (75yr SoP) and Sustain A options. Therefore this sensitivity test does not indicate that a change of option choice is required.

In the sensitivity test focused on design crest level, the crest level increase of 0.9m has been applied to each of Sustain and Improve options to determine whether the cost of any of these options would be more or less sensitive to such design parameter changes and whether this would change the choice of option. As can be seen Improve A (200yr SoP) remains the provisional National Economic Leading Option with this test. The majority of cost build-up for the options in this unit is in below ground aspects of the defences (e.g. piling) and therefore increases in crest height have an underweighted influence on the option cost. Whilst there appears to be a robust economic case with a large increase in crest height, the visual / landscape impact of such a crest level could lead to significant environmental / social impacts and therefore may not be a viable route forward. Further engagement would be required in the future if sea level rise progressed in line with the H++ scenario to determine the approach.

The sensitivity tests that have been undertaken do not lead to a change in choice of the provisional National Economic Leading Option in this unit.

4.6.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 7 frontage include:

- Indicates overall support for each of the short list measures on the short list, with each measure having more 'agree' than 'disagree' responses. Measures with the most 'agree' responses were crest raising, maintenance, deployable defences and setback embankment.
- The short list measures voted most important was Maintenance / repairs by a clear margin.

Similar to adjacent ODUs, given the proximity of potential defences to existing properties there is potential for the defences to have visual / landscape impacts. It is likely that this could be a key issue for stakeholders if options with new raised defences are taken forward and designs are developed further.

In addition this unit includes the boatyard area in the south and direct / waterside access for this area would need to be retained. Defences to the north of this location would need to include access points / floodgates that are large enough for boats / vessels to pass through. Any concerns about access could be a key issue for stakeholders for this unit.

Table 4-27 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 4-27: ODU 7 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public feedback. Could result in failure of existing defences and increased flood risk to properties and other assets in this location.
Maintain	The maintain option would involve refurbishment and ongoing patch-repair to existing defences. This measure was the measure that appeared to have lots of support in the feedback from the last round of engagement. However, there would be increased flood risk to properties in this location as defences would not be improved, and therefore there could be more support for maintenance as part of a Sustain, Improve or Adaptation option.
Sustain A, Improve A	These options involve upgraded raised defences along the alignment of the existing defences in this unit. This measure appeared to be a widely supported approach in the feedback from the last round of engagement. However, mitigation would be needed to preserve access, particularly around the boatyard in the south part of the unit to minimise social impacts.
Adaptation / Resilience	Property level protection measures are deployable defences and the feedback from the previous round of engagement indicates support for these measures. Access and uncertain landscape impacts would be avoided with this approach.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 4-28 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options could have negative impacts on most of the categories considered. This is due to the increased flood risk with these options, leading to negative impacts in the climate change, historic environment, population and communities and transport and movement categories. The Maintain option would not reduce the flood risk over time and therefore similar impacts would be expected in the medium / long term.

The Sustain A and Improve A options could have positive impacts across a range of categories as the flood risk would be reduced significantly in the defended areas. The SEA has not identified any potential major negative impacts for these options.

In the SEA there is some uncertainty around the potential impacts of Sustain A / Improve A on the biodiversity/geodiversity category. In this unit there is generally a lack of space to construct new defences and some limited encroachment into the designated areas and therefore habitat loss in this location may be unavoidable. However this is uncertain and would need to be confirmed during concept / outline design as there could be mitigation such as using existing defence footprints / buildings as part of the defence system. To reflect this uncertainty a potential minor negative impact to the biodiversity category has been included in the SEA for these options.

The Adaptation / Resilience Option could have minor negative impacts in a range of categories such as climate change, historic environment, population and communities, and transport and movement. Given that the area is widely developed / urbanised there could be flooding to transport links and public spaces in the areas of property level protection. However no major negative impacts have been identified.

Table 4-28: Summary of potential environmental impacts in ODU 7

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Could have major negative impacts across a variety of categories, including climate change / historic environment / population and communities and transport and movement.
Maintain	Option would lead to increase in flood risk over time potentially leading to negative impacts on a range of categories.
Sustain A, Improve A	Could lead to positive impacts across wide range of categories due to reduction in flood risk to properties and public spaces. However could have a potential negative impact on biodiversity category due to construction in proximity to environmental designations.
Adaptation / Resilience	This is an urban area that is widely used by members of the public therefore this option could have negative impacts in historic environment, climate change, population and communities and transport and movement categories as property level protection would not defend public spaces.

4.6.4 Leading Option Selection

National Economic Leading Option

The economic appraisal identified the Improve A option with a 1 in 200 year SoP as the provisional National Economic Leading Option.

The SEA and the social appraisal have not identified any major negative impacts with this option and therefore it is retained as the National Economic Leading Option. However, there would need to be some design considerations for the upgraded defences in epoch 2 to ensure this option is viable, such as ensuring continued access to the boatyard area and aiming to avoid / minimise encroachment into the river channel.

Furthermore, the potential visual impact of raising defences to the 2124 1 in 200 year SoP could be identified as an issue for the local community and stakeholders during engagement. If this is the case different approaches could be followed to reduce the impact, such as incorporating glass top structures into the design, or shifting the approach to the Sustain A (200yr SoP) option instead. The Sustain A option is economically viable and the defence height would be raised in increments over time, reducing the potential visual impact over the short and medium. Whilst this is not the National Economic Leading Option, it is similar in nature and could be implemented if there is local preference.

4.6.5 Funding

An indicative Partnership Funding Assessment has been undertaken for the major capital scheme in epoch 2 for the Sustain A option.

For the calculations the major capital scheme has been assumed to be at the start of epoch 2, but as per the option description, the scheme could be undertaken later in the epoch subject to rates of climate change / funding availability. The longer the scheme is delayed, typically the greater the amount of FCERM-GiA that will be available as the potential benefits of the scheme in discounted terms would increase. For the purpose of this calculation the cost associated with raising the defences in epoch 3 is included in the maintenance cost.

Table 4-29 presents the indicative Partnership Funding scores for the major capital interventions for the Improve A option. As can be seen, the indicative Partnership Funding score is 8% and additional funding of over £7.3million would be required.

Table 4-29: Indicative Partnership Funding Scores for ODU 7 (first major capital scheme)

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention*
National Economic Leading Option: Improve A	7,991	130	8,121	8,535	80 years	8%	630	7,360

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

Backup Option if funding cannot be secured

The size of the funding contribution required to deliver the Improve A option is significant and this presents a risk to the delivery of this option. If the funding cannot be secured for the option, then it is recommended that funding opportunities for the Adaptation / Resilience option are sought instead. This option does not have a major capital scheme to improve the defences and instead focusses on frequent defence maintenance / refurbishments as well as property level protection. Overall the option has a lower present value cost than the National Economic and Local Aspirational options (option cost estimated to be approximately PV £2.63million) and smaller but more frequent funding would be required which may be more achievable to secure. Of this cost, approximately £650k is related to property level protection measures over the appraisal period and may be eligible for partial funding from flood resilience grants.

The Adaptation / Resilience option would not deliver the same level of benefits as the Improve A option and there is uncertainty as to how effective property level protection would be in the long term. However relative to the Do Nothing scenario, it would help to reduce flood risk in the short term and would provide time for an adaptation plan to be implemented.

4.6.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 4-25, the National Option is also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 4-25. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £8million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National Option could help avoid these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of this option.

4.6.7 Summary

Table 4-30 below summarises the leading options in ODU 7.

Table 4-30: Summary of ODU 7 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Improve A: new flood defences from epoch 2 to improve SoP against flood risk	4,118	630
Backup	Adaptation / Resilience: property level protection to properties at risk. Maintain existing defences	2,630	To be determined during subsequent appraisal

Alignment with SMP

This area is not covered by the SMP and therefore a comparison cannot be made.

4.7 ODU 8 – River Avon East Bank

ODU 8 spans 1.1km along the east bank of the River Avon, from Knapp Mill to Christchurch Bypass. This area is within the original Strategy boundaries, but through discussions with the Environment Agency Partnership and Strategic Overview Team (who are developing the Lower Avon and Harbour Modelling) it was agreed that the options for managing the flood risk in ODU 8 would be developed through future projects focused on the Lower River Avon, rather than the Christchurch Bay and Harbour Strategy.

ODU 8 is in a location that is close to the tidal limit of the River Avon and in this location, it is unclear whether the tidal or fluvial source of flooding is dominant. Over time the risk of tidal flooding is expected to increase but the boundary between the two sources of risk and where they are most dominant is uncertain. The Christchurch Bypass road provided a clear geographical boundary to mark the upstream boundary for the Strategy economic appraisal to ensure there is no double-counting of benefits between this project and any future projects on the Lower River Avon.

Therefore this section of the report does not present a full appraisal of options in this location. A short list of measures are presented for managing the tidal risk, that can be considered / incorporated by future Lower River Avon projects during the option appraisal. However, no economic, social or environmental appraisal has been undertaken on these options and no recommendation for choice of leading options has been made.

The east bank of the River Avon in this ODU is characterised by open space / natural flood plain. The defence along the east bank of the River Avon in this ODU is a natural verge. It does not have a condition grade assigned and is privately maintained.

Some properties and the Stony Lane sewage treatment works are at risk from tidal flooding beyond the area of open space to the east although not until the future. A total of 8 properties in this unit are expected to be at risk from a 1 in 200 year tidal event in 100 years' time. Anecdotally there have been near misses in flooding to these properties during recent flood events. Similar to ODUs 6 and 7, this area does not have an SMP policy as it is not included within the SMP. However within the CFMP (2012) the unit falls within the 'Christchurch Area', in which the plan is to take further action to reduce flood risk, subject to additional appraisal.

There is ample space to construct new defences if required and also potential opportunities to explore habitat restoration / environmental enhancements. Over the next 100 years the total PV damages for this ODU from the tidal flood risk are estimated to be just over £1.4million.

4.7.1 Short List of Options

The Short List of Strategic Options for ODU 8 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 4-12 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario. The frontage is currently undefended and therefore the flood risk would be expected to increase over time due to climate change. The area is particularly sheltered so erosion of the river bank would be expected to be slow, although there is potential for natural morphological evolution of the river channel.

There are only a small number of properties at risk in this location and the main risk of tidal flooding would be to the roads; Christchurch Bypass and the connecting B3347 (Stony Lane).

Do Minimum / Maintain

Given that this location is currently undefended, there is no feasible Do Minimum or Maintain option for this location.

Sustain A

The sustain A option would involve constructing defences on the east bank of the River Avon to reduce the risk of flooding to Christchurch Bypass and the connecting B3347 (Stony Lane). Due to the ample space available the defences would most likely be either a setback floodwall or setback embankment.

The defences would be extended in length and raised in height over time to keep pace with the impacts of sea level rise. The defences would also defend the properties and sewage treatment works at risk in this unit. The properties at risk are located to the west of the B3347 in the north part of the unit, and to the east of the B3347 in the south part of the unit.

Improve A

Improve A would follow the same approach as Sustain A, except the defences would be constructed to the 2124 SoP initially, rather than being raised and lengthened over time to keep pace with sea level rise.

Adaptation / Resilience

This option would involve implementing property level protection measures to the properties at risk in this location. No defences would be provided to the roads at risk of flooding and therefore significant travel disruption would be expected to occur during flood events in the future as the risk to the roads increases.

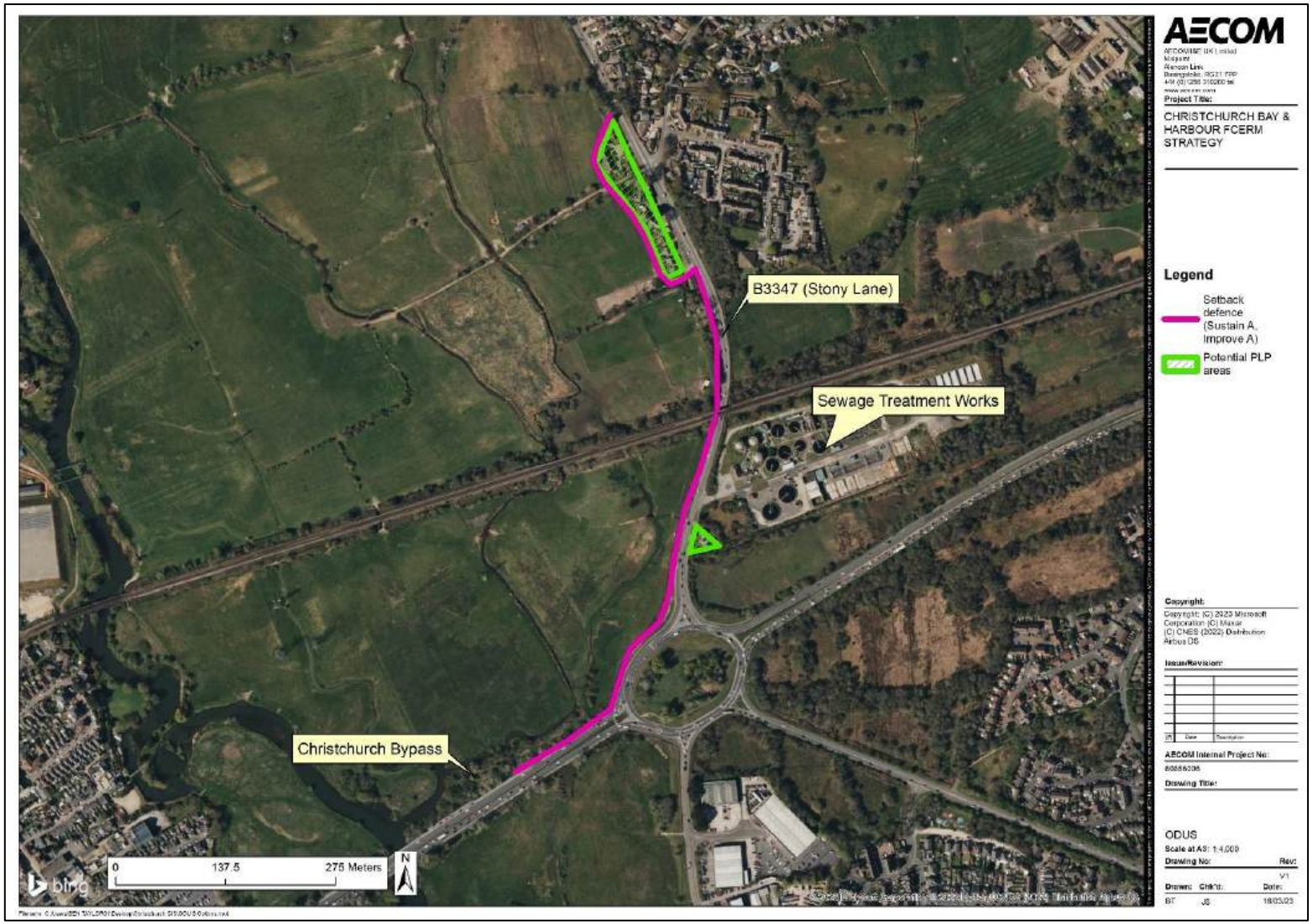

Figure 4-12: ODU 8 options

4.8 ODU 9 – Stanpit

ODU 9 covers the east bank of the River Avon and the north side of Christchurch Harbour, from Christchurch Bypass to Stanpit Marsh car park. The existing defences comprise an earth embankment, masonry wall and sheet pile wall, as well as a large number of flood gates. The undefended areas are lengths of natural verge / river bank.

There are large areas of historic landfill at Two Riversmeet and Stanpit Recreation Ground in the south part of the unit and therefore the management of historic landfill in this ODU is a key driver for options in the area. In 2015 a study was undertaken that confirmed the presence of contaminated materials in the north east corner of the historic landfill site (Geo-Design, 2015). The contamination status of the rest of the site is uncertain but if the survey findings are representative of the wider site, then erosion of the area has potential to lead to environmental impacts. Other factors to consider include the continued importance of access to the area for recreation and potential future development of the commercial area around Bridge Street.

In addition to the historic landfill risk, there are also a large number of properties at risk from flooding in this location. The numerical modelling indicates that the risk to properties is low in the present day. This is largely due to the presence of defences on the bank of the River Avon in proximity to Bridge Street. However, without ongoing maintenance the defences would be expected to fail and therefore the risk to properties increases significantly from epoch 2 onwards. Sea level rise increases the risk over time. In 100 years' time it is expected that 867 properties would be at risk from a 1 in 200 year tidal flood event contributing to the total PV damages for this ODU estimated to be over £39 million.

The area around Stanpit has a Hold the Line policy in the short term, followed by Managed Realignment in the medium and long term. However, the SMP refresh recommended that the policy for this area is revisited / potentially amended to Hold the Line for the medium and long term, to facilitate any management measures considered necessary to defend the historic landfill site. The remainder of the unit does not have an SMP policy as it is outside of the SMP area but is included in the CFMP (2012) 'Christchurch Area', in which the plan is to take further action to reduce flood risk, subject to additional appraisal.

Figure 4-13 shows the key features in ODU 9.

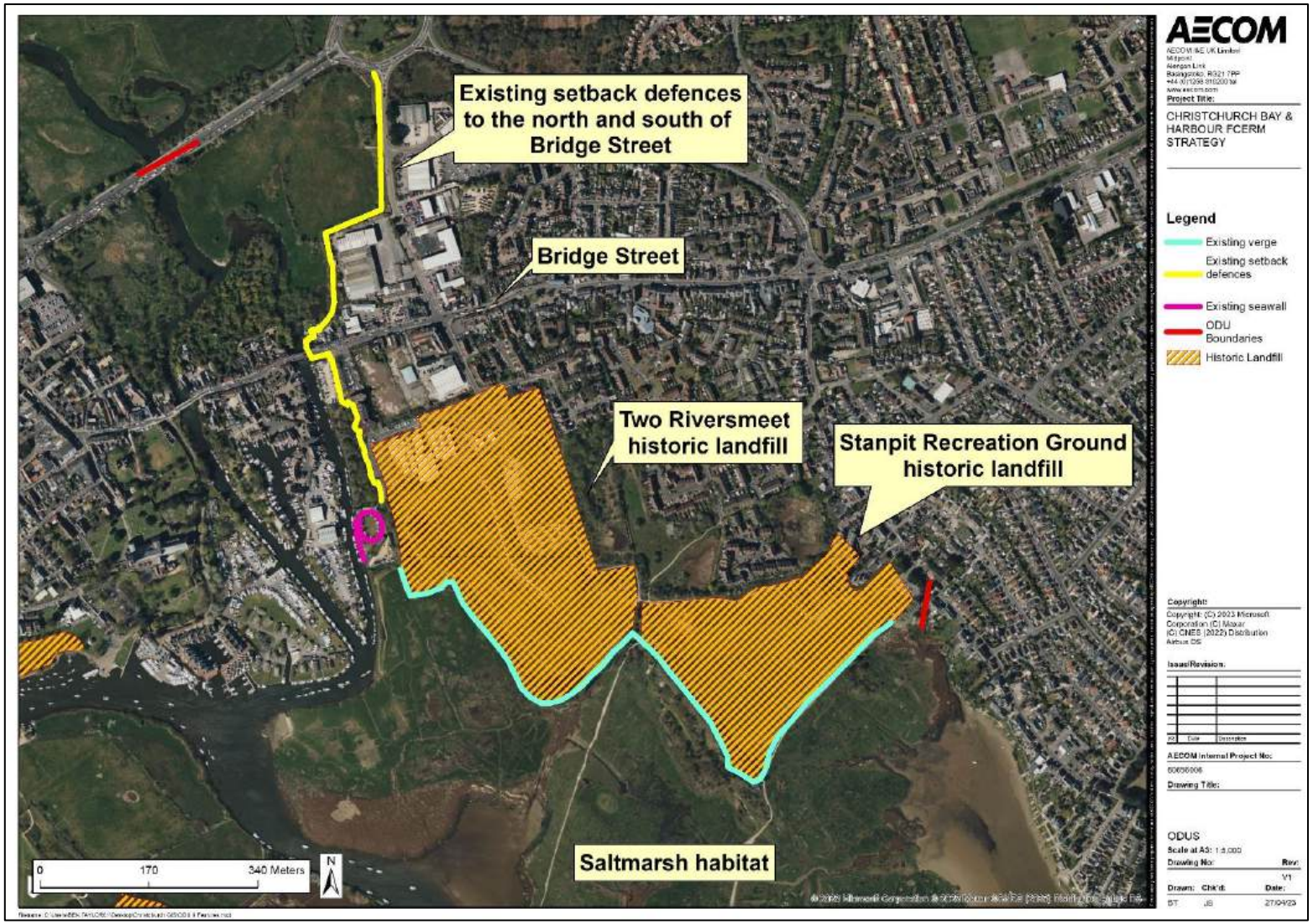

Figure 4-13: Key features in ODU 9

4.8.1 Short List of Options

The Short List of Strategic Options for ODU 9 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 4-14 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 9 erosion would be expected to occur initially in the undefended areas, albeit at a low rate due to the sheltered harbour environment. In the areas with existing frontline defences the erosion would be delayed until the defences reached the end of their service life and failed. As part of this scenario erosion could occur to the historic landfill sites at Two Riversmeet and Stanpit Recreation Ground which could have significant negative impacts on the environment if the contaminated materials are present in this location.

Over time the flood risk to the ODU would also be expected to increase due to sea level rise. Whilst the flood risk is initially low in this unit due to the presence of defences, by 2124 there are 867 properties expected to be at risk from a 1 in 200 year return period tidal flood event.

Due to the risks to properties, infrastructure (e.g. roads) and the historic landfill in ODU 9, doing nothing is not an acceptable solution in this location and would not be in line with the SMP policy for the area. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum Strategic option would involve undertaking reactive small scale maintenance to the existing defences in this unit. This would typically take the form of patch and repair maintenance whereby localised damage to the defence is repaired on an ad-hoc basis.

This option is likely to extend the service life of the existing raised defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reaches the end of their service lives the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis. Extending the service life of the defences by a several years would help delay the onset increased flood risk associated with failure of existing defences.

Maintain

In ODU 9 the focus for the Maintain option is to extend the service life of the existing defences through to the end of the Strategy period. This would be achieved through a series of capital refurbishments to the existing defences over time, as required based on the condition and deterioration of the defences. For the purposes of costing it has been assumed that the first capital refurbishment would be required in the second half of epoch 1 based on the estimated residual life of the defences.

The Maintain option would provide some economic benefit as it would ensure the existing defences would continue to provide a flood risk benefit to the area through the appraisal period. However, over time the standard of protection would reduce and the defences would be outflanked, leading to an increase in flood risk over time.

The intent of the Maintain option would reduce erosion risk to the historic landfill sites at Two Riversmeet and Stanpit Recreation Ground. This option may therefore require strengthening of the verge / embankment around the historic landfill site over time. However, this option would not involve raising of defence levels and therefore there is an uncertain impact of potential leaching risk from the historic landfill sites as the SoP of the defences falls over time due to sea level rise.

Sustain A

The Sustain A option would involve constructing new flood defences in epoch 2 and then lengthening / raising them over time to keep pace with sea level rise to provide a defined SoP over the next century. New defences are not required sooner than this because the existing defences currently provide a high standard of protection and through maintenance the service life could be extended through to epoch 2. For the costing / benefit calculations it has been assumed that the upgrade would occur at the start of epoch 2, but it could be undertaken

later on during the epoch, for example mid-way through epoch 2 subject to rates of climate change / condition of existing defences / funding availability.

The alignment of the defences will need to be determined during outline design / business case development but for the purposes of the Strategy appraisal it has been assumed that the new defences would follow the existing defence alignment in the north part of the unit adjacent to the River Avon. At Two Riversmeet and Stanpit Recreation Ground in the south, it has been assumed that the new defence will follow the existing shoreline position around the historic landfill sites. It would be the intention to build the new defence within the footprint of the existing bank / verge to minimise footprint encroachment into the harbour / saltmarsh habitat.

At the northern end of the defence there is uncertainty in the climate change flood risk mapping in this location due to the interactions with the River Avon. However, in epoch 3 there may be a need to lengthen the defence at the northern end of the alignment / potentially raise road levels to prevent outflanking adjacent to Christchurch Bypass. The requirement for this would need to be informed by more detailed modelling of the area.

Access is a key consideration along the frontage in this location and therefore it is likely that deployable flood defences such as flood gates will need to be incorporated into the defence alignment in some locations. The details / positioning of any gates should be determined during outline design / business case development.

Due to sea level rise the existing saltmarsh habitat in front of Two Riversmeet and Stanpit Recreation Ground historic landfill sites could be threatened in the future. Therefore, from epoch 1 work should be undertaken as part of this option to investigate opportunities to enhance / restore the saltmarsh habitat in the future. This could involve placing dredged material in the saltmarsh area to encourage accretion, allowing the saltmarsh to recolonise higher areas as sea levels rise. Other options for saltmarsh restoration such as seeding / planting / fencing could also be explored.

Improve A

Improve A follows the same approach as Sustain A, with the exception being that the new defences would be initially constructed to a 2124 SoP. This is a precautionary approach to managing the flood risk (as opposed to the managed adaptive approach followed in the Sustain options). It would result in a higher up-front investment but would mean that repeat interventions over time to raise and lengthen the defences would not be required.

Adaptation / Resilience

This option would follow the same approach as the Maintain Option with respect to defence maintenance. However this option would also involve property level protection to the properties at risk from flooding in this unit throughout the appraisal period. However the effectiveness of property level protection in the long term is uncertain in this unit given the potential for deep flooding in this location in the future. To be conservative the benefits of property level protection in this ODU have therefore not been included from epoch 3 in the economic appraisal.

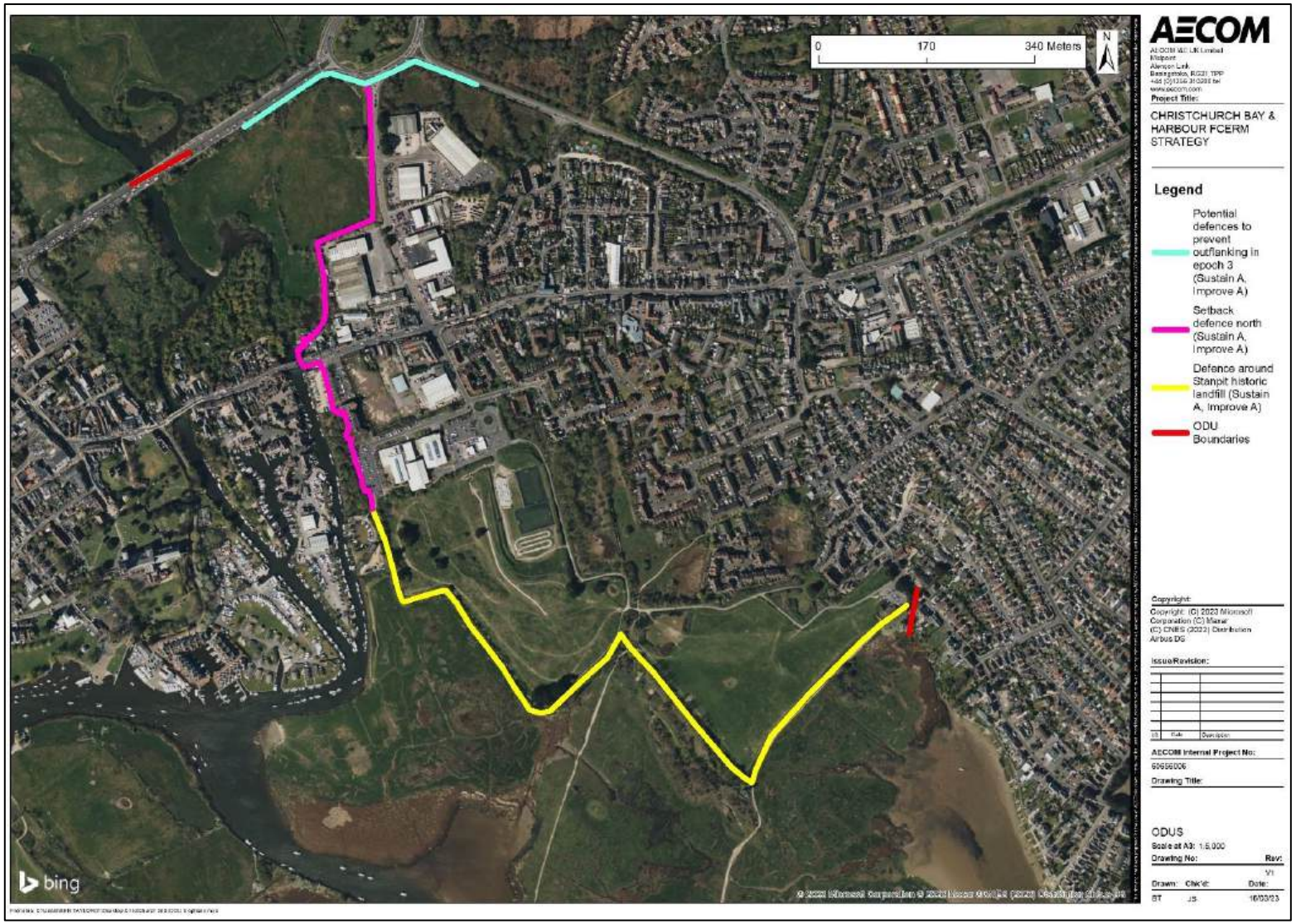

Figure 4-14: ODU 9 options

4.8.2 Economic Appraisal of Options

Cost benefit analysis

Table 4-31 presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. For ODU 9 it is possible to order the options by reducing probability of flooding because each option has the same benefit area. The options have therefore been ordered in this manner. As per FCERM-AG, when ordering by reducing probability of flooding, the initial National Economic Leading Option is selected as the option with the highest ABCR, in this case Sustain A (200yr SoP).

Table 4-31: ODU 9 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	39,803	0	-	-	
Do Minimum	510	38,510	1,293	2.54	783	
Maintain	7,087	33,103	6,700	0.95	-387	
Adaptation / Resilience	8,271	27,249	12,554	1.52	4,283	
Sustain A (75yr SoP)	10,859	5,519	34,284	3.16	23,425	
Sustain A (200yr SoP)	10,960	1,994	37,809	3.45	26,849	X
Improve A (75yr SoP – end of appraisal period)	11,760	2,171	37,632	3.20	25,872	
Improve A (200yr SoP – end of appraisal period)	12,082	796	39,007	3.23	26,925	

For the options presented in Table 4-31 the Sustain A (200yr SoP) option would provide an initial 200 year SoP when constructed in epoch 2 and this would be sustained through time through via a series of defence raises. However the equivalent Improve A option (200yr SoP) would be constructed to a 1 in 200 year SoP for the end of the appraisal period, which would mean that initially at the time of construction the SoP would far exceed the 1 in 200 year SoP and would be in excess of a 1 in 1000 year.

A comparison of the IBCR between Sustain A (75yr SoP and 200yr SoP) and Improve A (200yr SoP) is provided below in Table 4-32.

The table shows how the IBCR between the Sustain A (75yr SoP) and the Sustain A (200yr SoP) is 34.9, which is greater than the FCERM-AG IBCR threshold of 3 required to select the 200yr SoP as the leading standard.

The SoP for the Improve A (200yr SoP) would be in excess of 1 in 1000 year when initially constructed, and therefore as per FCERM-AG, an IBCR of >5 is required to move from the Sustain A (200yr SoP) to the Improve A (200yr SoP) option. As shown, the IBCR between Sustain A (200yr) and Improve A is 1.07, which results in Sustain A being retained as the provisional National Economic Leading Option.

Table 4-32: ODU 9 IBCR comparison

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Sustain A (75yr SoP)	10,859	5,519	34,284	3.16		
Sustain A (200yr SoP)	10,960	1,994	37,809	3.45	34.90	X
Improve A (200yr SoP – end of appraisal period)	12,082	796	39,007	3.23	1.07	

Sensitivity tests

The main uncertainties with the options in this location relate to option cost and the design water level of the defences to provide the desired SoP against flooding. The design water level of the option could be influenced by changes to sea level rise projections or updated understanding of the flood risk at the site.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include a cost uplift of 10% or 25% and also updated costs to account of for an additional 0.9m of sea level rise over the next century. This equates to the difference between the H++ sea level scenario and the sea level rise value used in the Strategy appraisal. Appendix A provides a summary of the results.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Sustain A (200yr SoP) option to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that the Sustain A (200yr SoP) option would retain an ABCR greater than unity with these level of cost increases but the choice of provisional National Economic Leading Option would change to the Improve A (200yr SoP). However, given that each of the Sustain and Improve options follows a very similar approach, any scenario leading to a cost increase for the Sustain A (200yr SoP) option would likely also lead to a similar scale of cost increase to the Improve A (200yr SoP). Therefore this sensitivity test does not indicate that a change of option choice is required.

In the sensitivity test focused on design crest level, the crest level increase of 0.9m has been applied to each of Sustain and Improve options to determine whether the cost of any of these options would be more or less sensitive to such design parameter changes and whether this would change the choice of option. As can be seen, similar to the cost increase sensitivity tests discussed above, the Improve A (200yr SoP) would be selected as the provisional National Economic Leading Option with this test. The test also indicates how the ABCR for the Sustain A (200yr Sop) option would remain above unity and this would remain a viable economic approach.

Whilst there appears to be a robust economic case with a large increase in crest height, the visual / landscape impact of such a crest level could lead to significant environmental / social impacts and therefore may not be a viable route forward. Further engagement would be required in the future if sea level rise progressed in line with the H++ scenario to determine the approach.

Considering the points above, there does not appear to be an overriding reason to change the choice of the provisional National Economic Leading Option in ODU 9 from the sensitivity tests undertaken. The sensitivity tests build a stronger case for selecting the Improve A (200yr SoP) as the leading option but given that this is more precautionary than the Sustain A (200yr SoP) and would lead to more significant landscape impacts initially, on balance the choice of provisional National Economic Leading Option is unchanged and is retained as Sustain A (75yr SoP).

4.8.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 9 frontage include:

- Indicates overall support for a number of the defence measures on the short list. Each of the following short list measures had more 'agree' than 'disagree' responses; Sheet pile wall, saltmarsh restoration, deployable defences, slope armour, setback embankment, setback floodwall, rock revetment.
- However, two short list measures had more 'disagree' than 'agree' responses; a seawall and maintenance / repairs.
- The short list measure with the most responses for being the most important measure was saltmarsh restoration.

In the northern part of the unit the land use is primarily industrial / commercial (to the north and south of Bridge Street) and access therefore a key consideration. To the south, the area of open space is widely used by the public for recreation and outdoor activities. New coastal defences will therefore need to be designed to be sympathetic to these land uses to minimise the social impacts. This could include access points / landscaping for example.

Table 4-33 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 4-33: ODU 9 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public feedback. Could result in failure of existing defences and increased flood risk to properties and other assets in this location.
Maintain	The maintain option would involve refurbishment and ongoing patch-repair to existing defences. In contrast to other units in SMZ 2, this measure did not appear to have overall support from the feedback received, with more respondents 'disagreeing' with this approach compared to 'agreeing'.
Sustain A, Improve A	These options involve upgraded raised defences along the alignment of the existing defences in this unit. This is likely to be a mixture of defence types including slope armouring and setback floodwalls / embankments, each of which appeared to have overall support (more respondents agreeing than disagreeing) during the last round of engagement. In addition, this option includes a recommendation to investigate potential saltmarsh restoration / improvement opportunities in this unit which was a supported measure from the feedback.
Adaptation / Resilience	Property level protection measures are deployable defences and the feedback from the previous round of engagement indicates support for these measures.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 4-34 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options could have negative impacts on most of the categories considered. This is due to the flood and erosion risk with these options, leading to negative impacts in the climate change, historic environment, population and communities and transport and movement categories. A potential negative impact on the land, soil and water resources category is also noted. This is due the potential erosion of the Stanpit historic landfill site without defences in place. However the contamination status of the historic landfill site is unknown (for the whole of the site) and therefore these impacts in the SEA are uncertain. Further site investigations are required to confirm the contamination status.

The Sustain A and Improve A options could have positive impacts across a range of categories as the flood and erosion risk would be reduced significantly in the defended areas. With respect to biodiversity / geodiversity, the

new defences as part of these options would be constructed in close proximity to a number of environmental designations, such as the River Avon SAC, Avon Valley SPA / Ramsar, Solent and Dorset coast marine SPA, River Avon SSSI and Avon Valley SSSI. Generally there is sufficient space to construct defences either setback or within the footprint of the existing defences and therefore opportunities to limit encroachment / habitat loss of designated areas could be available during the design. This would limit the impacts on these designated sites. These options also include seeking opportunities for saltmarsh restoration and if undertaken this has the potential to have a positive impact on biodiversity / biodiversity net gain in this location relative to the baseline. The SEA has not identified any major potential negative impacts for these options.

The Adaptation / Resilience Option could have minor negative impacts in a range of categories such as climate change, historic environment, population and communities, and transport and movement. Given that the area is widely developed / urbanised there could be flooding to transport links and public spaces in the areas of property level protection. However no major negative impacts have been identified.

Table 4-34: Summary of potential environmental impacts in ODU 9

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Could lead to major negative impacts across a variety of categories, including climate change / historic environment / land, soil and water resources / population and communities and transport and movement. Note that the impact on land, soil and water resources is uncertain and subject to contamination status of the historic landfill site which is not known (for the whole site).
Maintain	Option would reduce erosion risk but flood risk would not be improved in the long term therefore likely to have negative impacts across range of categories. Potential to have positive impact in land, soil and water category through defence of historic landfill site against erosion.
Sustain A, Improve A	Could lead to positive impacts across wide range of categories due to reduction in flood and erosion risk to properties, public spaces and historic landfill. Potential for saltmarsh restoration also could create biodiversity benefits. Potential for negative impacts in landscape category.
Adaptation / Resilience	This is an urban area that is widely used by members of the public therefore this option could have negative impacts in climate change, population and communities and transport and movement categories as property level protection would not defend public spaces.

4.8.4 Leading Option Selection

National Economic Leading Option

The economic appraisal identified the Sustain A option as the provisional National Economic Leading Option with a 1 in 200 year SoP. The IBCR comparison for this option indicates that there is not an economic justification to increase this standard further to deliver the Improve A option.

The SEA has not identified any major negative impacts with this option and it has the potential to create many environmental benefits relative to the baseline by reducing the flood and erosion risk. Further studies are required to confirm the contamination status of the historic landfill site, but if the contaminated status of the north-east corner is found to be representative of the full site, then a further benefit of the Sustain A option would be to prevent the erosion of this material and reduce the chance of leaching by providing a high SoP against flooding.

The Sustain A option recommends exploring options for restoring / enhancing the saltmarsh habitat in the future. This could commence from epoch 1 and would help the habitat adapt to sea level rise and provide a benefit in the biodiversity SEA category relative to the baseline. If nothing is done to help manage the saltmarsh there is a risk that it could be lost over time due to sea level rise and coastal squeeze. The speed of this baseline impact is uncertain as accretion in the harbour could help offset sea level rise.

The Sustain A option would involve defence measures that had overall support from the public and stakeholders during the previous round of engagement. In addition, it would defend the public open space which may be seen as a positive for the recreational benefits.

Based on the points above, the Sustain A option is confirmed as the National Economic Leading Option.

No viable alternative options with different overall approaches to managing the risks in this location have been considered and therefore a separate Local Aspirational Option for ODU 9 has not been identified.

4.8.5 Funding

An indicative Partnership Funding Assessment has been undertaken for the major capital scheme in epoch 2 for the Sustain A option.

For the calculations the major capital scheme has been assumed to be at the start of epoch 2, but as per the option description, the scheme could be undertaken later in the epoch subject to rates of climate change / funding availability / defence condition. The longer the scheme is delayed, typically the greater the amount of FCERM-GiA that will be available as the potential benefits of the scheme in discounted terms would increase. For the purpose of this calculation the cost associated with raising the defences in epoch 3 is included in the maintenance cost.

Table 4-35 presents the indicative Partnership Funding scores for the major capital interventions for the Sustain A option. As can be seen, the indicative Partnership Funding score is 16% and additional funding of approximately £15.9million would be required.

Table 4-35: Indicative Partnership Funding Scores for ODU 9 (first major capital scheme)

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention*
National Economic Leading Option: Sustain A	18,876	2,488	21,365	45,966	80 years	16%	2,985	15,892

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

Backup Option if funding cannot be secured

The size of the funding contribution required to deliver the Sustain A option is significant and this presents a risk to the delivery of this option. If the funding cannot be secured for the option, then it is recommended that funding opportunities for the Adaptation / Resilience option are sought instead. This option does not have a major capital scheme to improve the defences and instead focusses on frequent defence maintenance / refurbishments as well as property level protection. Overall the option has a lower present value cost than the National Economic and Local Aspirational options (option cost estimated to be approximately PV £8.3million) and smaller but more frequent funding would be required which may be more achievable to secure. Of this cost, approximately £2.3million is related to property level protection measures over the appraisal period and may be eligible for partial funding from flood resilience grants.

The Adaptation / Resilience option would not deliver the same level of benefits as the Sustain A option and there is uncertainty regarding the effectiveness of property level protection in the long term. However relative to the Do Nothing scenario, it would help to reduce flood risk in the short term and would provide time for an adaptation plan to be implemented.

4.8.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 4-31, the National Option is also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 4-31. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £15million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National Option could help avoid these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of this option.

4.8.7 Summary

Table 4-36 below summarises the leading options in ODU 9.

Table 4-36: Summary of ODU 9 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Sustain A: new defences from epoch 2, raised and lengthened over time to reduce risk of flooding and erosion of historic landfill sites.	10,960	2,985
Backup	Adaptation / Resilience: property level protection to properties at risk from flooding. Maintain existing defences.	8,271	To be determined during subsequent appraisal

Alignment with SMP

The area around Stanpit has a Hold the Line policy in the short term, followed by Managed Realignment in the medium and long term. However, the SMP refresh recommended that the policy for this area is revisited / potentially amended to Hold the Line for the medium and long term, to facilitate any management measures considered necessary to defend the historic landfill site. The National Economic Option for this location recommends defending Stanpit historic landfill sites and therefore it is recommended that the SMP policy is indeed reviewed as part of the SMP refresh.

4.9 ODU 10 – Mudeford

ODU 10 spans the north side of Christchurch Harbour between Two Riversmeet and Stanpit Recreation Ground and Chichester Way. The main land use in this ODU is residential property and gardens, many of which back-on to the shoreline. There is also key infrastructure including roads and commercial properties / hotels in this unit.

The frontage includes the River Mude and Bure Brook which both enter Christchurch Harbour at two locations at the eastern end of the unit. A frontline quay wall spans the majority of the length of the unit. This is of varying form / material / construction type but is generally concrete, with some localised differences such as rock. The quay wall is privately owned / maintained. Due to buildings being close to the water's edge and a range of private ownerships along the frontage, developing a scheme that includes frontline defences would need to encompass extensive engagement with landowners / stakeholders.

For the present day the flood risk is most prominent in the eastern part of the unit, but with sea level rise over time the flood risk becomes relatively uniform across the full frontage. The flood risk extends inland along the River Mude and Bure Brook and in order to mitigate this new defences along these channels may be required. For a present day 1 in 200 year tidal flood event an estimated 25 properties would be at risk within this unit, increasing to 370 properties in 100 years' time. Over the next 100 years the total PV damages for this ODU are estimated to be just over £12.7million.

The SMP policy for this unit is Hold the Line in the short term, followed by Managed Realignment in the medium term and then reverting to Hold the Line in the long term. The SMP intent for this policy is to manage flood risk initially through local protection and flood warning, recognising a potential need for a combination of setback defences to complement existing foreshore structures. The SMP Refresh (2020) recommended that the policy is revisited / potentially amended pending outcomes of contaminated land assessments (if it is indicated potentially contaminated substances could be released with Managed Realignment).

The eastern boundary for ODU 10 is different to the SMP policy unit boundary and it is noted that the main area discussed in the SMP for potential realignment as part of the SMP policy is the area of open space immediately to the north of Mudeford Quay. This area of open space is actually included in ODU 11 rather than ODU 10 and therefore potential realignment of this area is discussed in the appraisal for ODU 11.

Figure 4-15 shows the key features in ODU 10.

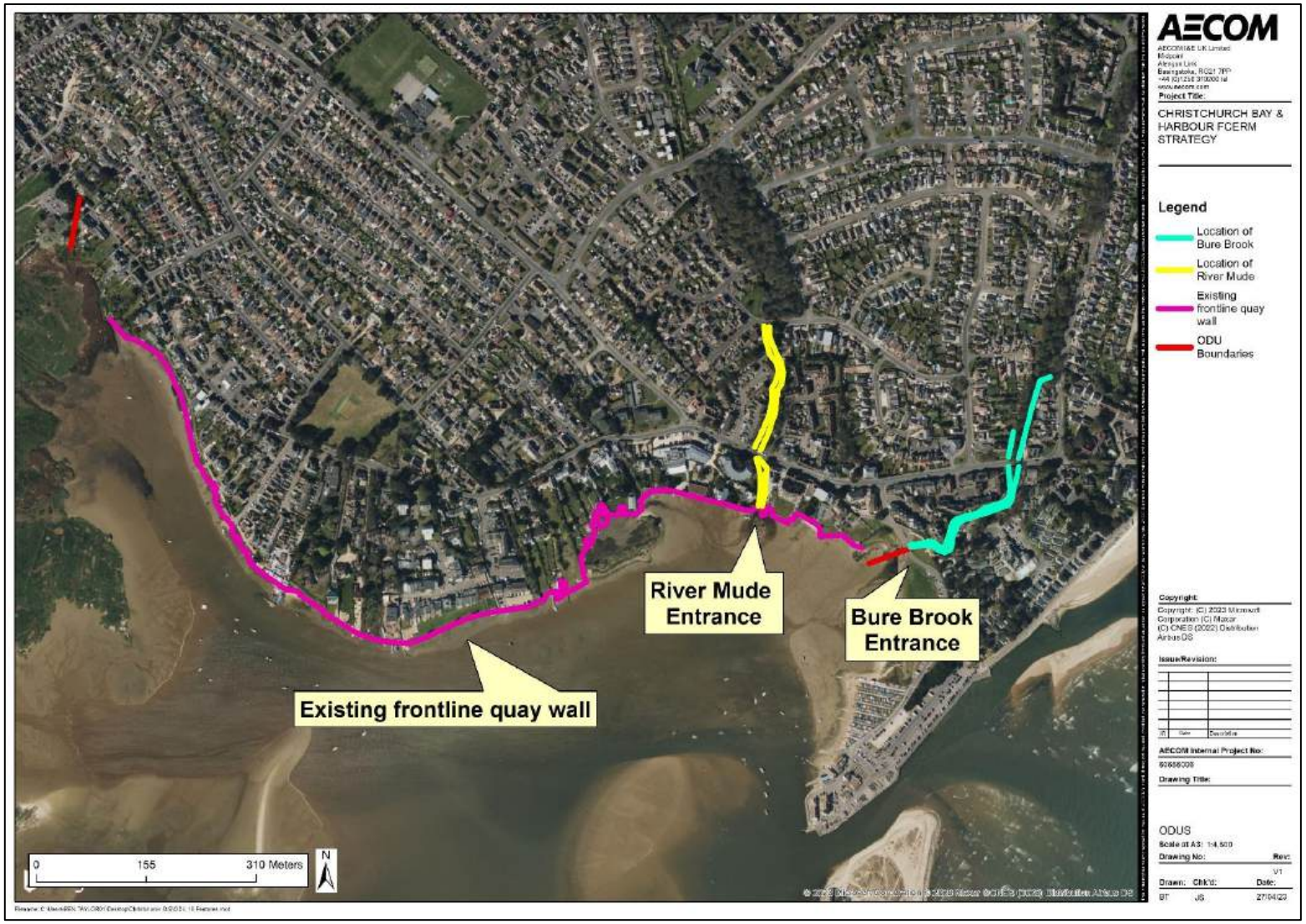

Figure 4-15: Key features in ODU 10

4.9.1 Short List of Options

The Short List of Strategic Options for ODU 10 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 4-16 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 10 this would result in failure of the existing quay wall once it reaches the end of its service life. This could lead to some localised erosion once the defence fails. In general the amount of erosion would be expected to be low due the sheltered harbour environment, but ODU 10 is more exposed than other parts of SMZ 2 and therefore the erosion could be higher than other locations around the harbour. Erosion zones are not available for the Strategy and typically properties are located at least 10-15m landwards of the existing frontline quay wall so therefore no damages / benefits have been assigned to the erosion risk. However this could be explored in more detail during subsequent business cases / outline design projects.

Without new higher defences being constructed with the Do Nothing scenario, over time the flood risk to the ODU would also be expected to increase due to sea level rise. By 2124 approximately 370 properties are expected to be at risk from a 1 in 200 year return period tidal flood event. Due to the risks to properties and infrastructure (e.g. roads), doing nothing is not an acceptable solution in this location and would not be in line with the SMP policy for the area. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum Strategic option would involve undertaking reactive small scale maintenance to the existing quay walls in this unit. This would typically take the form of patch and repair maintenance whereby localised damage to the defence is repaired on an ad-hoc basis.

This option is likely to extend the service life of the existing quay walls but only by a relatively small period of time (i.e. 5-10 years). Over time, as the quay walls reach the end of their service lives the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the walls on an ad-hoc basis. In ODU 10 there is no economic benefit for the Do Minimum option relative to the Do Nothing scenario given that there are no raised defences in this location above the quay walls to reduce flood risk.

Maintain

In ODU 10 the focus for the Maintain option is to extend the service life of the existing defences through to the end of the Strategy period. This would be achieved through a series of capital refurbishments to the existing defences over time, as required based on the condition and deterioration of the defences. For the purposes of costing it has been assumed that the first capital refurbishment would be required in the second half of epoch 1 based on the estimated residual life of the defences. Similar to the Do Nothing and Do Minimum scenarios, there is minimal economic benefit of the Maintain Option in the Strategy as it would not involve raising the crest level of the defences and therefore there would be no flood risk benefit.

Improve A

Improve A would involve constructing new flood defences (likely in the form of a quay wall with a raised floodwall) at the start of epoch 3. The defence would be constructed to a 2124 SoP.

For the purposes of costing / Strategy development the defence alignment has been assumed to be along the same alignment of the existing frontline quay wall along the length of the unit. This would ensure minimal encroachment into the harbour to minimise impact on biodiversity / ecology. Further work would be required during outline design to confirm this approach.

At either end of the frontage the new defences would be extended to tie-in with adjacent areas. New defences may also be required along the lower sections of the River Mude and Bure Brook and costs have been included for this.

Access is a key consideration along the frontage in this location and therefore it is likely that deployable flood defences such as flood gates will need to be incorporated into the defence alignment in some locations. The details / positioning of any gates should be determined during outline design / business case development.

The economic case for constructing new defences prior to epoch 3 has been investigated but due to the comparatively low number of properties at risk in epochs 1 and 2 (compared to epoch 3), the costs of a new defence prior to epoch 3 outweigh the economic benefits and therefore this would not be viable from an economic perspective.

To help manage the risk of flooding during epoch 1 and 2 property level protection measures would be used for the properties at risk. In addition, the existing quay wall would require a capital refurbishment towards the end of epoch 1 as it reaches the end of its service life. The capital refurbishment would help ensure the quay wall remains in place until it is replaced at the start of epoch 3.

Due to sea level rise the existing saltmarsh habitat in the harbour could be threatened in the future. Therefore, from epoch 1 work should be undertaken as part of this option to investigate opportunities to enhance / restore the saltmarsh habitat in ODU 10. This could involve placing dredged material in the saltmarsh area to encourage accretion, allowing the saltmarsh to recolonise higher areas as sea levels rise. Other options for saltmarsh restoration such as seeding / planting / fencing could also be explored.

Improve B

Improve B is largely the same as Improve A, except in the west part of the unit where the new defence in epoch 3 would be a setback wall along Fisherman's Bank rather than a new frontline quay wall. As part of this approach the frontline quay wall in-front of the new setback wall would need to be maintained and refurbished over time so that the structural integrity was retained.

Adaptation / Resilience

This option would involve providing property level protection to the properties at risk in ODU 10 throughout the next century. Over time the number of properties requiring property level protection would increase significantly as sea level rise leads to an increase in flood risk. The area of property level protection shown on Figure 4-16 is for epoch 3, and smaller areas would be required in epochs 1 and 2.

During epoch 3 the effectiveness of property level protection is uncertain as deeper flooding is anticipated (e.g. >1m flood depths) for most of the return periods considered as part of the appraisal. The benefits of property level protection in epoch 3 have therefore not been included in the economic appraisal during epoch 3.

In addition to the property level protection, ongoing maintenance and repeat refurbishments of the frontline quay wall is included in this option. This would be required to preserve the structural integrity of these defences as well as to ensure safe continued access to the shoreline.

Figure 4-16: ODU 10 options

4.9.2 Economic Appraisal of Options

Cost benefit analysis

Table 4-37 presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. For ODU 10 it is possible to order the options by reducing probability of flooding because each option has the same benefit area. The options have therefore been ordered in this manner. As per FCERM-AG, when ordering by reducing probability of flooding, the initial leading economic option is selected as the option with the highest ABCR, in this case Improve A (200yr SoP).

Table 4-37: ODU 10 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	12,747	0	-	-	
Do Minimum	340	12,747	0	-	-340	
Maintain	3,526	12,747	0	-	-3,526	
Adaptation / Resilience	5,473	9,970	2,777	0.51	-2,696	
Improve A (75yr SoP from epoch 3)	8,319	2,254	10,493	1.26	2,174	
Improve B (75yr SoP from epoch 3)	9,003	2,254	10,493	1.17	1,490	
Improve A (200yr SoP from epoch 3)	8,373	1,623	11,124	1.33	2,751	X
Improve B (200yr SoP from epoch 3)	9,071	1,623	11,124	1.23	2,053	

A comparison of the IBCR between Improve A (75yr SoP) and Improve A (200yr SoP) is provided below in Table 4-38.

The table shows how the IBCR between the Sustain A (75yr SoP) and the Sustain A (200yr SoP) is 11.69, which is greater than the FCERM-AG IBCR threshold of 3 required to select the 200yr SoP as the leading standard. This ratifies the choice of the Improve A (200yr SoP) as the leading economic option.

An option with an even higher SoP has not been considered but it is recommended that this undertaken during outline design / business case development.

Table 4-38: ODU 10 IBCR comparison

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	IBCR	Leading Economic Option
Improve A (75yr SoP)	8,319	2,254	10,493	1.26	-	
Improve A (200yr SoP)	8,373	1,623	11,124	1.33	11.69	X

Sensitivity tests

The main uncertainties with the options in this location relate to option cost and the design water level of the defences to provide the desired SoP against flooding. The design water level of the option could be influenced by changes to sea level rise projections or updated understanding of the flood risk at the site.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include a cost uplift of 10% or 25% and also updated costs to account of for an additional 0.9m of sea level rise over the next century. This equates to the difference between the H++ sea level scenario and the sea level rise value used in the Strategy appraisal. Appendix A provides a summary of the results.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Improve A (200yr SoP) option to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that the choice of option would shift to Improve A (75yr Sop). However, given that this option is the same option but with just a lower SoP, any scenario leading to a cost increase for the Improve A (200yr SoP) option would likely also lead to a similar scale of cost increase to the Improve A (75yr SoP). Therefore this sensitivity test does not indicate that a change of option choice is required.

In the sensitivity test focused on design crest level, the crest level increase of 0.9m has been applied to each of the Improve options to determine whether the cost of any of these options would be more or less sensitive to such design parameter changes and whether this would change the choice of option. As can be seen Improve A (200yr SoP) would remain the provisional National Economic Leading Option with this test. The majority of cost build-up for the options in this unit is in below ground aspects of the defences (e.g. piling) and therefore increases in crest height have an underweighted influence on the option cost. Whilst there appears to be a robust economic case with a large increase in crest height, the visual / landscape impact of such a crest level could lead to significant environmental / social impacts and therefore may not be a viable route forward. Further engagement would be required in the future if sea level rise progressed in line with the H++ scenario to determine the approach.

From the sensitivity tests it is apparent that with a cost increase of 25% or greater the economic case of all the Improve options would be marginal with ABCRs being just above unity with this scale of cost increase. If costs were to increase further, for example, by 50%, each of the options would have an ABCR less than 1 and would not be economically viable. The choice of provisional National Economic Leading Option has not changed as a result of the sensitivity tests, but lower cost solutions could be required in the future if costs increase.

4.9.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 10 frontage include:

- Indicates overall support for each of the defence measures on the short list with each of the measures having more 'agree' than 'disagree' responses. Saltmarsh restoration, crest raising, maintenance / repairs and deployable defences had the greatest amount of 'agree' responses.
- The short list measure with most responses for being the most important measure was maintenance and repairs.

Many of the properties in this unit have gardens adjacent to the harbour / shoreline and therefore access to the water is a key consideration. The design of any flood risk schemes in this location would need to ensure access could be continued. Whilst deployable defences such as flood gates could be used, given the number of properties / private gardens along this frontage it may not be feasible to include gates at the base of most gardens due to residual risk of some gates being left open during flood events. Other design solutions such as passive ramps / landscaped defences may be more appropriate. Engagement with property owners and the wider community would be required to identify the most appropriate design solutions and minimise social impacts as part of any scheme design in the future.

In addition, the landscape / visual impact of any new defences is likely to be a key consideration among the community. Non-typical solutions such as glass floodwalls could be explored to reduce visual impacts and help develop social support from the local community for future schemes in this location.

Table 4-39 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 4-39: ODU 10 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public feedback. Could result in failure of existing defences and increased flood risk to properties and other assets in this location.
Maintain	The maintain option would involve refurbishment and ongoing patch-repair to existing defences. Maintenance appeared to have support during the last round of engagement with the 'agree' responses far outweighing the 'disagree' responses. However, maintenance in isolation would not improve the standard of the defences, and therefore this approach could have more support if undertaken as part of an Improve option.
Improve A, B	These options involve upgraded raised defences along the length of this unit. This is likely to be a mixture of defence types including crest raising, new sheet pile / quay walls and deployable defences. Each of these measures had significantly more 'agree' responses than 'disagree' responses during the last round of engagement suggesting overall support for this approach. However, as noted above, landscape and access considerations are likely to be key and would need to be considered during design to identify appropriate solutions that minimise social impacts.
Adaptation / Resilience	Property level protection measures are deployable defences and the feedback from the previous round of engagement indicates support for these measures. There is uncertainty as to the how effective property level protection measures may be in the long term in this location.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 4-40 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options could have negative impacts on most of the categories considered. This is due to the increased flood risk with these options, leading to potential negative impacts in the climate change, historic environment, population and communities and transport and movement categories. The Maintain

option would not reduce the flood risk over time and therefore similar impacts would be expected in the medium / long term.

The Improve A and Improve B options could have positive impacts across a range of categories as the flood and erosion risk would be reduced significantly in the defended areas. If undertaken saltmarsh restoration has the potential to have a positive impact on biodiversity in this location relative to the baseline.

For the Improve options the intention would be to upgrade defences within the footprint of the existing frontline quay walls as part of this option. This would help to reduce encroachment into designated sites. However, being in proximity to a number of environmental designations, mitigation would still be required during construction to reduce temporary impacts. The Improve options include to seek opportunities for saltmarsh restoration which could have positive benefits and provide biodiversity net gain. The SEA has not identified any major negative impacts for these options.

The Adaptation / Resilience Option could have minor negative impacts in a range of categories such as climate change, historic environment, population and communities, and transport and movement. Given that the area is widely developed / urbanised there could be flooding to transport links and public spaces in the areas around the property level protection. However no major potential negative impacts have been identified.

Table 4-40: Summary of potential environmental impacts in ODU 10

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Major negative impacts could occur across a variety of categories, including climate change / historic environment / population and communities and transport and movement.
Maintain	Option would lead to increase in flood risk over time potentially leading to negative impacts on a range of categories.
Improve A, B	Positive impacts could occur across wide range of categories due to reduction in flood and erosion risk to properties, public spaces and infrastructure. Potential for saltmarsh restoration to create biodiversity benefits. Generally sufficient space to construct within existing defence footprint to minimise any encroachment into harbour habitats. Potential negative impacts on landscape.
Adaptation / Resilience	This is an urban area that is widely used by members of the public. Therefore this option could have negative impacts in climate change, historic environment, population and communities and transport and movement categories as property level protection would not defend public spaces.

4.9.4 Leading Option Selection

National Economic Leading Option

The economic appraisal has identified the Improve A option as the provisional National Economic Leading Option with a 1 in 200 year SoP.

The SEA has not identified any major negative impacts with this option and it has potential to lead to many environmental benefits relative to the baseline by reducing the flood and erosion risk. Similar to the adjacent unit in ODU 9, the leading option in ODU 10 recommends exploring options for restoring / enhancing saltmarsh habitat in the future. This could commence from epoch 1 and would help the habitat adapt to sea level rise and provide a benefit in the biodiversity SEA category.

The Improve A option would involve defence measures that had overall support from the public and stakeholders during the previous round of engagement. However, design of the scheme would need to consider access and landscaping to minimise social impacts on the local community.

Based on the points above, Improve A is confirmed as the National Economic Leading Option.

No viable alternative options with different overall approaches to managing the risks in this location have been identified and therefore a separate Local Aspirational Option for ODU 10 has not been developed. One option considered was to bring forward the construction of new defences from epoch 3 to earlier in the appraisal period.

However, this would not be viable from an economic perspective with approaches such as this having ABCRs below unity.

4.9.5 Funding

An indicative Partnership Funding Assessment has been undertaken for the major capital scheme in epoch 3 for the Improve A option. Table 4-41 presents the indicative Partnership Funding score for this intervention. As can be seen, the indicative Partnership Funding score is 8% and additional funding over £23million would be required for the capital scheme in epoch 3. Prior to this, in epochs 1 and 2 funding for maintenance of the existing quay walls will be the responsibility of the quay wall owners / maintainers and partial funding for property level protection measures may be available from flood resilience grants. This could be sought from individual property owners, but BCP could provide oversight to help facilitate this process.

The relatively low funding score for the capital intervention in epoch 3 is largely due to the high cost of this scheme, driven by the long defence length required relative to the properties defended. With the intervention not planned until epoch 3, there is a long period of time over which to source potential funding. There is also a high probability that funding criteria may change over this period so the scheme could become more affordable in the future. However, with a large funding amount required (>£23million), it is recognised that delivery of this option in epoch 3 is particularly uncertain.

Table 4-41: Indicative Partnership Funding Scores for ODU 10 (first major capital scheme)

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention*
National Economic Leading Option: Improve A	25,487	112	25,598	28,074	50 years	8%	2,093	23,394

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

Backup Option if funding cannot be secured

The size of the funding contribution required to deliver the Improve A option is significant and this presents a risk to the delivery of this option from epoch 3 onwards.

The economic analysis suggests that over the full appraisal period there are no economically viable alternatives to the Improve options. Therefore it is not recommended that the choice of option in the first two epochs changes. However, if funding cannot be found to deliver a scheme in epoch 3 then a different approach may be required from this point forward.

In the economic appraisal the benefits of property level protection in the Adaptation / Resilience option during epoch 3 have not been included due to the uncertainty around how effective this approach may be with deeper flooding. This assumption is appropriate for a strategic level study such as this, where it has been assumed that typical property level protection approaches would be adopted across a wide area. However, when assessed on a property by property basis there could be opportunities for more novel / costly solutions such as raising entire floors or extending properties upwards / adding floors to create habitable space away from the ground floor. Consideration of approaches such as this could result in the Adaptation / Resilience option being a viable solution in this location during epoch 3.

A better understanding of the flood risk will be available in 50 years' time (sea levels may rise at different rates to projected) which may change the viability of a new flood defence scheme or the adaptation option in epoch 3. It is recommended that over the first two epochs a long term adaptation strategy for the area is developed and kept as a live document that is updated as funding rules change and the impacts of projected climate change are monitored / become clearer.

4.9.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 4-37, the National Option is also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 4-37. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £7million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National Option could help avoid a significant proportion of these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of this option.

4.9.7 Summary

Table 4-42 below summarises the leading options in ODU 10.

Table 4-42: Summary of ODU 10 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Improve A: new flood defences from epoch 3. Property level protection to properties at risk from flooding in the interim.	8,373	2,093
Backup	Adaptation / Resilience: property level protection to properties at risk from flooding. Maintenance of existing quay walls.	5,473	To be determined during subsequent appraisal

To support the implementation of the National and Backup options, it is recommended that BCP provide advice to property owners regarding property level resilience and protection measures. This could include details of the grants that may be available to homeowners as well as assisting in liaising / coordinating resilience measures.

Alignment with SMP

The SMP policy recommends holding the line in the area of the SMP policy unit that is within ODU 10. Both the National Economic and Backup options align with the SMP policy in this location and would result in holding the line of the existing defences.

4.10 ODU 11 – Mudeford Quay

ODU 11 spans the frontage around Mudeford Quay between Chichester Way in the harbour and Mudeford Quay car park entrance on the open coast. Mudeford Quay itself is at risk from flooding and regularly shallow flooding occurs during typical winter storm conditions, usually driven by wave overtopping. Over the next 100 years the depth of flooding to the quay is expected to increase significantly due to sea level rise. There are only a small number of commercial and residential properties in this unit and therefore over the next 100 years the total PV damages for this ODU are estimated to be just over £1.3million.

There is currently a small flood defence scheme at the south end of the Quay which provides defences to an isolated group of properties in this location.

The quay is a strategically important feature for the overall morphology of the harbour and there is considerable uncertainty as to what the impact on the harbour would be if the quay were to not be there. For example, the quay wall acts as a training wall to the Run navigation channel in and out of the harbour and removal of the quay could lead to significant impacts on channel direction, flow velocities and sediment transport within the harbour and also at adjacent areas in ODU 2, ODU 12 and ODU 13. Changes to the morphology could be accompanied by increases in flood risk within the harbour itself, which would be more exposed to southerly wave conditions potentially leading to increased wave overtopping risk.

In addition to the morphological risks, there is also key infrastructure within the quay that passes across the Run to service the properties and huts on Mudeford Sandbank. If the quay were to erode there would be a risk of the services at the quay being damaged which would then have a knock-on impact to the Sandbank.

A wide variety of options that improve the flooding SoP to the properties on the quay have been considered and both a National Economic and a Local Aspirational Leading Option have been selected for this location.

The Quay falls within SMP policy unit D2 and the policy is to Hold the Line in the short, medium and long term, with the overall intent to maintain the alignment of Mudeford Quay, to maintain the use of this area and to continue to act as a navigation training wall at the entrance to Christchurch Harbour. The SMP Refresh (2020) recommended that the policy here is revisited / potentially amended to Hold the Line with localised opportunities for Managed Realignment.

The area of open space to the north of the quay in this unit falls within a different SMP policy unit (unit F1). In SMP policy unit F1 the policy recommends exploring managed realignment opportunities in the second epoch. However, the area identified for potential managed realignment is a historic landfill site and therefore the SMP Refresh (2020) recommended that the policy is revisited / potentially amended pending outcomes of contaminated land assessments (if it is indicated potentially contaminated substances could be released with Managed Realignment). At the time of writing the Strategy no further information is known on the contamination status of the historic landfill site.

The key features in ODU 11 are shown in Figure 4-17 overleaf.

Figure 4-17: Key features in ODU 11

4.10.1 Short List of Options

The Short List of Strategic Options for ODU 11 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 4-18 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 11 this would result in failure of the existing quay wall once it reaches the end of its service life. This would likely lead to erosion of the quay itself and therefore is considerable uncertainty as to what impact this would have on the wider morphology of the area, with potential for significant changes flow velocities and directions in the run, as well as broader sediment transport changes to adjacent areas such as Mudeford Sandbank and Christchurch beaches. This would also increase the flood risk within the harbour itself due to an increased exposure and greater wave overtopping risk.

On the quay itself the Do Nothing scenario would result in an increase in flood risk over time with the properties at the end of the quay being subject to more frequent and deeper flooding. Due to the risks to properties, infrastructure (e.g. roads, car parking, utilities connections etc.) and the potential for broader morphological impacts, doing nothing is not an acceptable solution in this location and would not be in line with the SMP policy for the area. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

There is potential for erosion of the historic landfill site to the north of the quay with the Do Nothing scenario. The area is currently sheltered by the quay and therefore erosion rates would be low, but there is uncertainty as to how the coastline would evolve under the Do Nothing scenario and therefore erosion of the historic landfill could be a risk.

Do Minimum

The Do Minimum Strategic option would involve undertaking reactive small scale maintenance to the existing quay wall and setback defences in this unit. This would typically take the form of patch and repair maintenance whereby localised damage to the defence is repaired on an ad-hoc basis.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reach the end of their service lives the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis. In ODU 11 there is minimal economic benefit for the Do Minimum option relative to the Do Nothing scenario given that it would not involve constructing new higher defences to reduce the flood risk and the frontline quay wall would also fail (albeit later on than Do Nothing), leading to potentially large impacts on the wider morphology and flood risk in adjacent areas.

Maintain

In ODU 11 the focus for the Maintain option is to extend the service life of the existing quay wall and setback defences through to the end of the Strategy period. This would be achieved through a series of capital refurbishments to the existing defences over time, as required based on the condition and deterioration of the defences. For the purposes of costing it has been assumed that the first capital refurbishment would be required in the second half of epoch 1 based on the estimated residual life of the defences. The Maintain option is the minimum option that could feasibly be undertaken to sustain the service of the existing quay walls to prevent the quay from eroding / significantly changing in the future.

Maintenance would also be provided to the quay wall in the north part of the unit adjacent to the historic landfill site. Until further information is available on the potential contamination status of this land it has been assumed that it should be defended.

Sustain A

Sustain A would involve maintaining the existing quay walls in ODU 11, as per the maintain option. However, it would also include constructing a new setback flood scheme around the properties on the quay in epoch 1. For

the purposes of the Strategy appraisal the costs and benefits have been developed using a setback floodwall spanning a larger area than the existing scheme alignment at the end of the quay, aiming to defend more of the properties on the quay that are currently undefended. If this option were to be taken forward in the future, then further engagement with the local businesses on the quay would be required to determine the exact scheme alignment and defence type for this option. The setback defences would be constructed to an initial standard and then raised over time to keep pace with sea level rise.

Sustain B

As per Sustain A, except an additional setback floodwall / embankment would also be constructed in the north part of the unit to defend the roadway (Chichester Way) from flooding. The setback defence would be raised over time to keep pace with sea level rise.

Improve A

Improve A follows the same approach as Sustain A, with the exception being that the new defences would be initially constructed to a 2124 SoP. This is a precautionary approach to managing the flood risk (as opposed to the managed adaptive approach followed in the Sustain options). It would result in a higher up-front investment but would mean that repeat interventions over time to raise and lengthen the defences would not be required.

Improve B

Improve B follows the same approach as Sustain B, with the exception being that the new defences would be initially constructed to a 2124 SoP. This is a precautionary approach to managing the flood risk (as opposed to the managed adaptive approach followed in the Sustain options). It would result in a higher up-front investment but would mean that repeat interventions over time to raise and lengthen the defences would not be required.

Adaptation / Resilience

Adaptation / Resilience would involve maintaining the existing quay walls in ODU 11, as per the maintain option. However, it would also involve providing property level protection to the properties at risk of flooding in the unit throughout the appraisal period. This is likely to be an effective defence against lower return period events during epochs 1 and 2, however, with sea level rise the effectiveness of the property level protection may be reduced as deep flooding is expected on the quay during most return periods considered in epoch 3 (e.g. >1m deep).

The property level protection may not be required immediately in all locations in the unit – for example, some of the buildings on the quay already have local flood defences that are likely to remain effective for some time. The requirement for property level protection would need to be assessed on a property by property basis, with requirements changing through time based on sea level rise.

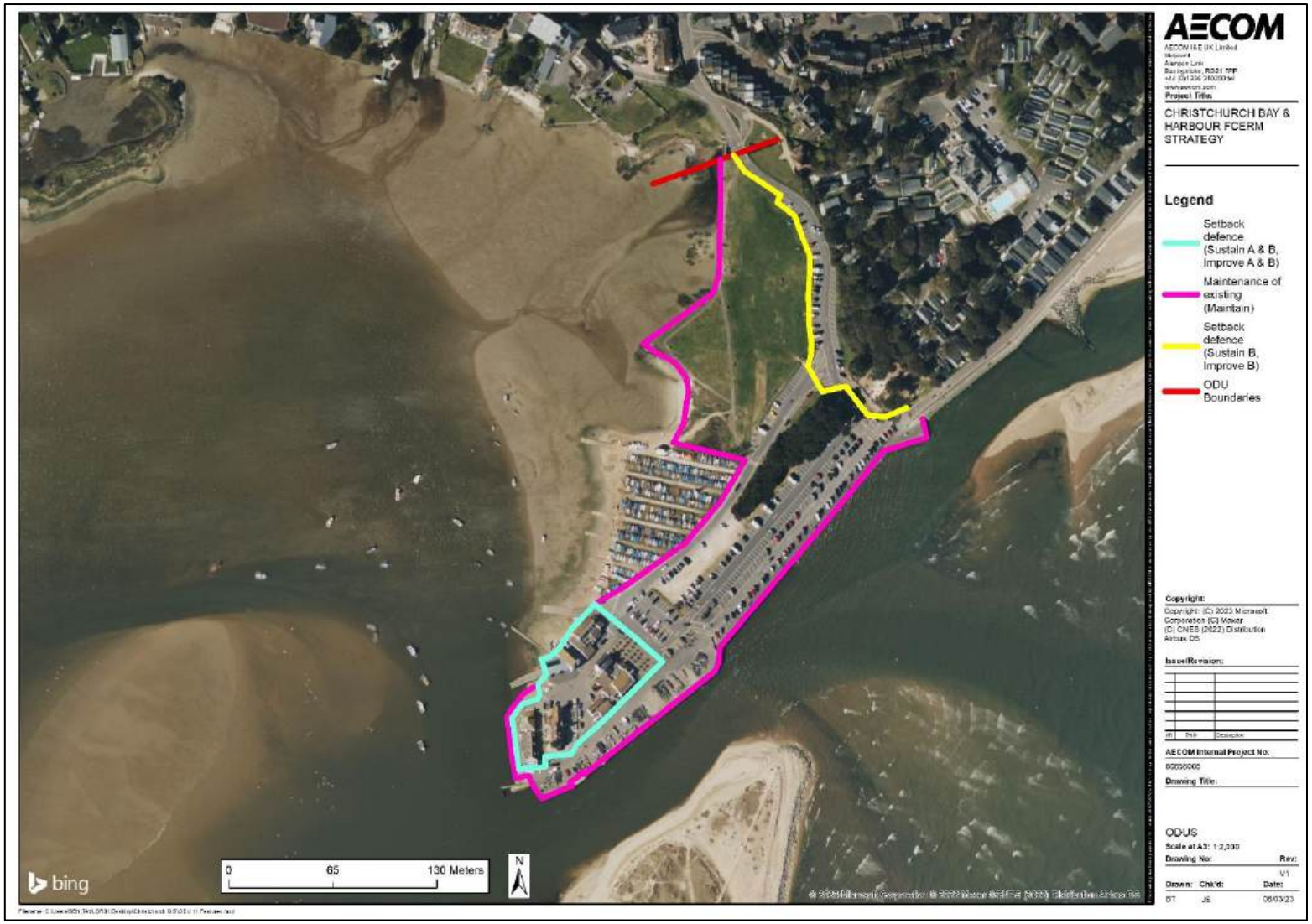

Figure 4-18: ODU 11 options

4.10.2Economic Appraisal of Options

Cost benefit analysis

Table 4-43 below presents the economic costs, damages and benefits for each option. As can be seen, the option costs outweigh the option benefits for each of the Do Something options. This is due to the lack of economic damages / benefits that can be counted for Mudeford Quay on a national basis. Other local economic benefits are likely to be associated with the Do Something options but are not eligible to be counted in this comparison. Each of the Do Something options has a negative NPV and therefore the Do Nothing option has been selected as the provisional National Economic Leading Option.

Table 4-43: ODU 11 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Do Nothing	-	1,362	-	-	-	X
Do Minimum	340	1,362	0	0	-340	
Adaptation / Resilience	9,530	682	680	0.07	-8,850	
Maintain	9,350	1,352	10	0.00	-9,340	
Improve A (75yr SoP – end of appraisal period)	10,765	36	1,326	0.12	-9,439	
Sustain A (75yr SoP)	10,688	174	1,188	0.11	-9,500	
Sustain B (75yr SoP)	11,615	174	1,188	0.10	-10,427	
Improve B (75yr SoP – end of appraisal period)	11,801	36	1,326	0.11	-10,475	

Sensitivity tests

The main uncertainty with the options in this location relate to option cost. However, given that the leading economic option is the Do Nothing option (which does not have a cost), there is little merit in sensitivity testing the option costs of the other options as it would not impact the choice of the provisional National Economic Leading Option (as no option will cost less than Do Nothing).

4.10.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 11 frontage include:

- Indicates overall support for each of the defence measures on the short list with each of the measures having more 'agree' than 'disagree' responses. Deployable defences, crest raising and maintenance /repairs had the greatest amount of 'agree' responses.
- The short list measure with most responses for being the most important was maintenance and repairs.

In addition to the feedback from the public and stakeholders, through discussions with BCP FCERM team there is understood to be an aspiration to reduce the flood risk to the properties and other infrastructure (e.g. roads) on or adjacent to the quay if additional funding for these works can be secured. The properties on the quay are primarily of commercial use and access is likely to be a key consideration. During the design of any schemes in this location appropriate access would need to be provided.

Table 4-44 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 4-44: ODU 11 social appraisal

Option(s)	Comments
Do Nothing	Option does not appear to align with stakeholder / public feedback. Could result in failure of existing defences and increased flood risk to properties and other assets in this location. Unknown morphological impact on harbour which could pose risks to navigation / fishing / leisure activities. Walking away from existing defences unlikely to be supported.
Do Minimum	Do Minimum would involve small scale maintenance / repairs. Compared to the Do Nothing scenario this better aligns with the feedback from stakeholders (for example, support for Maintenance / Repairs). However over the long term evolution the defences will fail leading to similar impacts to Do Nothing. In the long term unlikely to be supportive of this option.
Maintain	The maintain option would involve refurbishment and ongoing patch-repair to existing defences. Maintenance appeared to have support during the last round of engagement with the 'agree' responses far outweighing the 'disagree' responses.
Sustain A, Improve A	These options involve upgraded raised defences around the properties on the quay. This is likely to be a mixture of defence types including crest raising and deployable defences which had significantly more 'agree' responses than 'disagree' responses during the last round of engagement suggesting overall support for this approach. However, as noted above, access considerations are likely to be key and would need to be considered during design to identify appropriate solutions that minimise impacts.
Sustain B, Improve B	Same approach as Sustain / Improve A except a new setback embankment to defend the road onto the quay to the north. A setback embankment had significantly more 'agree' responses than 'disagree' during the last round of engagement suggesting overall support for this approach. The defence would also make the transport links more resilient which could bring wider benefits to the local community and users of the area.
Adaptation / Resilience	Property level protection measures such as deployable flood gates / defences to individual properties appeared to be a widely supported defence measure and had significantly more 'agree' responses than 'disagree' during the last round of engagement.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 4-45 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options could have negative impacts on most of the categories considered. This is due to the increased flood and erosion risk with these options, leading to negative impacts in the climate change, historic environment, population and communities and transport and movement categories. A potential negative impact on the land, soil and water resources category is also noted. This is due the potential erosion of the historic landfill site to the north of the quay without defences in place. However the contamination status of the historic landfill site is unknown (for the whole of the site) and therefore these impacts in the SEA are uncertain. Further site investigations are required to confirm the contamination status.

The Maintain option would reduce erosion risk but would not improve the flood risk relative to the baseline. Therefore this option could have both minor positive and negative impacts across range of categories. Potential to have a positive impact in land, soil and water resources category through erosion defence of historic landfill site.

The Sustain and Improve options could have positive impacts across a range of categories as the flood risk would be reduced significantly in the defended areas. The flood risk to the car park area would not be reduced and therefore potential negative impacts in the transport and movement category. These options involve setback defences and maintenance / refurbishment of existing quay walls and therefore expected to have a neutral impact on the biodiversity / geodiversity category. Mitigation would still be required during construction to reduce temporary impacts.

The Adaptation / Resilience Option has minor negative impacts in a range of categories such as climate change, population and communities, and transport and movement.

No major potential negative impacts have been identified for the Sustain / Improve / Adaptation options.

Table 4-45: Summary of potential environmental impacts in ODU 11

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Potential for major negative impacts across a variety of categories, including climate change / historic environment / land, soil and water resources, population and communities and transport and movement.
Maintain	Maintain would prevent erosion but risk of flooding would increase over time due to sea level rise. Potential for both minor negative impact and minor positive impact across categories.
Sustain A & B, Improve A & B	Could lead to positive impacts across wide range of categories due to reduction in flood risk to properties on the quay. However, both approaches would lead to flooding to the car park on the quay as this area would not be defended. This could lead to minor negative impact for Sustain / Improve A in the transport and movement category. Neutral impact in this category for Sustain / Improve B as this option does involve defending the road to the north.
Adaptation / Resilience	Property level protection to the buildings on the quay would provide less robust defence and therefore potential for minor negative impacts in climate change, population and communities and transport and movement.

4.10.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified the Do Nothing option as being the National Economic Leading Option.

The Do Nothing option is likely to have a range of negative impacts, including to the environment, flood risk, navigation and buried services. The morphological changes to the harbour that could arise with this option is very uncertain. Due to the risks to properties and infrastructure (e.g. utilities connections and car parks), doing nothing is not an acceptable solution in this location and would not be in line with the SMP policy for the area.

There are existing defences and quay walls on and around the quay that currently provide an FCERM function and therefore it is not considered acceptable to recommend walking away and identifying the Do Nothing option as the National Economic Leading Option in this location. Instead the next lowest cost option is the Do Minimum option and this has therefore been identified as the National Economic Leading Option in ODU 11.

The Do Minimum option would aim to use small scale maintenance (e.g. patch-repair) to extend the service life of the existing defences for as long as possible. However, in the medium and long term, this will not be sustainable and as the existing defences fail the risks associated with the Do Nothing scenario would be expected to occur with Do Minimum. Despite this the Do Minimum option appears to be a better solution that the Do Nothing option as it involves only a relatively small investment and may have better support by the local community and stakeholders in the short term. It is not appropriate to select a higher cost option (i.e. Maintain, Adaptation, Sustain, Improve) as the National Economic Leading Option due to the significant additional investments required for these options which are not justified on economic grounds.

There is a large amount of uncertainty as to what would happen if Mudeford Quay were to erode in the future. In the long term the Do Minimum option would do little to manage the risks of this happening and the morphological evolution of the harbour entrance could occur in a similar way to the Do Nothing scenario. This could have a potential impact on flood risk in the harbour, navigation, recreation and amenity and utilities, and therefore there is a local aspiration to do more to manage the risks in ODU 11. Therefore a Local Aspirational Leading Option has also been identified.

Local Aspirational Leading Option

Each of the Maintain, Adaptation / Resilience, Sustain and Improve options would help to reduce uncertainty around the morphological evolution of the harbour entrance by retaining the position of Mudeford Quay in the long term. The Adaptation / Resilience, Sustain and Improve options go a step further than the Maintain option as these options also reduce the flood risk to the properties on the quay itself. The Adaptation / Resilience option has the strongest economic case of these approaches. Relative to the Maintain option, it only requires an additional £180k investment to deliver an additional £670k in benefits, whereas the Sustain / Improve options involve additional investments in excess of £1million relative to Maintain. The Adaptation / Resilience option has therefore been identified as the Local Aspirational Leading Option.

The Adaptation / Resilience option does not have any major negative impacts in the SEA or the social appraisal.

The Adaptation / Resilience option would make use of property level protection, but the effectiveness of this during epoch 3 is uncertain due to potentially deep flooding that could occur. The Sustain A / Improve A option would provide a more robust defence during epoch 3 and it has a viable economic case. Therefore whilst not selected as the Local Aspirational Leading Option at this stage, it could remain as a potential adaptive pathway subject to rates of sea level rise / potential funding availability in the future.

4.10.5Funding

No indicative Partnership Funding calculations have been undertaken for this location because:

- The National Economic Leading Option is Do Minimum which would not be eligible for FCERM GiA.
- The Local Aspirational Leading Option is higher cost than the National Economic Leading Option and therefore GiA would not be available for the difference in cost. The initial major scheme cost as part of the Adaptation / Resilience option is in the order of £7.5million.

Non-GiA sources of funding will therefore be required to deliver the Leading Options in this location.

4.10.6Local Benefits

Whilst the Local Aspirational Option will not generate any nationally eligible economic benefits, it is likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 4-43. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £14.5million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the Local Aspirational Option could help to partially avoid these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of this option.

4.10.7 Summary

Table 4-46 below summarises the leading options in ODU 11.

Table 4-46: Summary of ODU 11 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Do Minimum: small scale repairs to existing defences (i.e. patch-repairs)	340	0
Local Aspirational	Adaptation / Resilience: property level protection to properties at risk. Maintain existing quay walls.	9,530	0

Alignment with SMP

The SMP policy for Mudeford Quay is to Hold the Line. The SMP policy for the area of open space to the north of the quay is to explore managed realignment opportunities, but the SMP refresh recommended that this policy is revisited subject to contaminated land assessments. The Local Aspirational option would Hold the Line in both areas. The National Economic option would not align with the SMP policies of the area. It is recommended that the SMP policy is reviewed as part of the SMP refresh process once the contaminated land status of the area to the north of the quay is known. At this point it will also be possible to also consider the Strategy leading options and how this may influence the SMP policy moving forward.

4.11 Tidal Flood Barrier

The construction of a tidal flood barrier across the entrance to Christchurch Harbour was included in the short list of defence measures for SMZ 2 and has therefore been appraised in further detail at this stage of the appraisal. The sections below outline the advantages and disadvantages of the tidal flood barrier solution with respect to the economic, environmental, social and technical factors.

4.11.1 Technical

A tidal flood barrier solution is likely to be very technically complex to deliver. The entrance to Christchurch Harbour, the Run, is a dynamic channel with frequent changes in morphology, strong currents and variable sediment transport deposition patterns. This could lead to complex challenges to overcome during construction and operation of the barrier.

During operation the barrier would be closed during periods of storm surge / high sea levels to reduce tidal water levels within the harbour. However, this would lead to a gradual increase in water levels within the harbour itself as the fluvial flows from the River Avon and River Stour would fill-up the storage capacity within the harbour. New linear flood defences around the key low-lying areas around the harbour would therefore also be required to reduce the fluvial flood risk, adding to overall cost. It is likely that defences of similar scale / cost to the leading options in each of the SMZ 2 ODUs would be required as part of a barrier solution.

The operation of the barrier would also be challenging owing to the complex tri-probability flood risk between the sea level and the fluvial flows from the River Avon and River Stour. There would be a significant number of different scenarios to consider and in some situations, uncertainty may persist as to the whether the barrier should be closed or remain open. A more detailed and thorough understanding of the tri-probability flood risk and the role of climate change on changing this risk would be required to inform the operation procedures of the barrier.

4.11.2 Cost

Tidal barriers are not commonly used for flood defence in the UK and one of the key reasons for this is the high cost.

The cost of a barrier across the entrance to Christchurch Harbour has been estimated using publicised cost information of similar schemes from elsewhere in the UK. The width of the Run entrance channel at Christchurch Harbour is approximately 50m.

- The Boston Barrier in Boston, Lincolnshire, is a recent barrier project with construction completed in 2020. The barrier gate is 28m wide and 11m deep and can be raised / lowered prior to a tidal surge to prevent inundation of the town with flood water. The estimated cost of the barrier was in the region of £100-120million based on published information.
- The Bridgwater Tidal Barrier was approved by the Government in early 2022 and once constructed will feature two moveable gates on the River Parrett near Bridgewater. A barrier at the entrance to Christchurch Harbour would be of similar scale to the Bridgwater Barrier which has an estimated cost of approximately £100million

Based on the examples above it is likely that the cost of a barrier at Christchurch Harbour would be in the region of £100million. However, in addition there would also be costs associated with tie in structures (across the low-lying key and at Mudeford Sandbank), fluvial defences around the low-lying areas of Christchurch Harbour and then maintenance and ongoing operational costs of the barrier itself. Therefore it is likely that costs would increase to be significantly more than the £100million value. Assuming the cost of fluvial defences around the harbour would be similar to the cost of the National Economic Leading Options in each ODU, the total cost of the barrier solution and fluvial defences would be expected to be in the region of £130-140million. This value does not include tie-in defence costs or maintenance / operation.

The total PV damage value for all the ODUs in SMZ 2 is approximately £106million over the next 100 years. This would be the theoretical maximum benefit value a tidal barrier scheme could achieve. However, it is significantly below the approximate cost that would likely be upwards of £130-140million. A barrier scheme at Christchurch Harbour is therefore unlikely to be viable from an economic standpoint at this stage.

4.11.3 Environmental

There are national and international designated habitat areas within Christchurch Harbour, such as SSSI and SPA designations. A tidal barrier would be in / within close proximity to these designations and is likely to have an impact on coastal habitats and ecology, coastal processes and sediment dynamics. However the scale of impacts is uncertain and further detailed environmental monitoring and studies would be required to ascertain whether a barrier is likely to be viable from an environmental consenting standpoint.

4.11.4 Social

Christchurch Harbour is an area that is used extensively for outdoor recreation and amenity, fishing and water sports. Navigation in and out of the harbour would likely to be impacted by both the construction and operation of a tidal barrier. During construction navigation may be restricted for prolong periods of time, and after construction restrictions to navigation would occur during times when the barrier was in operation / closed. This could have an impact on a variety of related activities it is likely that a range of stakeholders would oppose the barrier.

4.11.5 Outcome

Based on the points discussed in the sections above, the tidal barrier solution has not been identified as a leading option for SMZ 2. The leading options identified in each ODU within SMZ 2 are considered to be more appropriate and robust solutions to managing the flood and erosion risks in this location at this stage.

In the future if sea levels rise faster / more than anticipated the economic case of a solution such as a tidal barrier may become more feasible. It should therefore not be ruled out in future studies and reappraised as required.

5. Strategy Management Zone 3

5.1 Overview

SMZ 3 (Christchurch Beaches and Cliffs) includes ODU 12 and ODU 13 and covers the Avon Beach and Highcliffe parts of the frontage. Figure 5-1 below shows the location of the ODUs within SMZ 3.

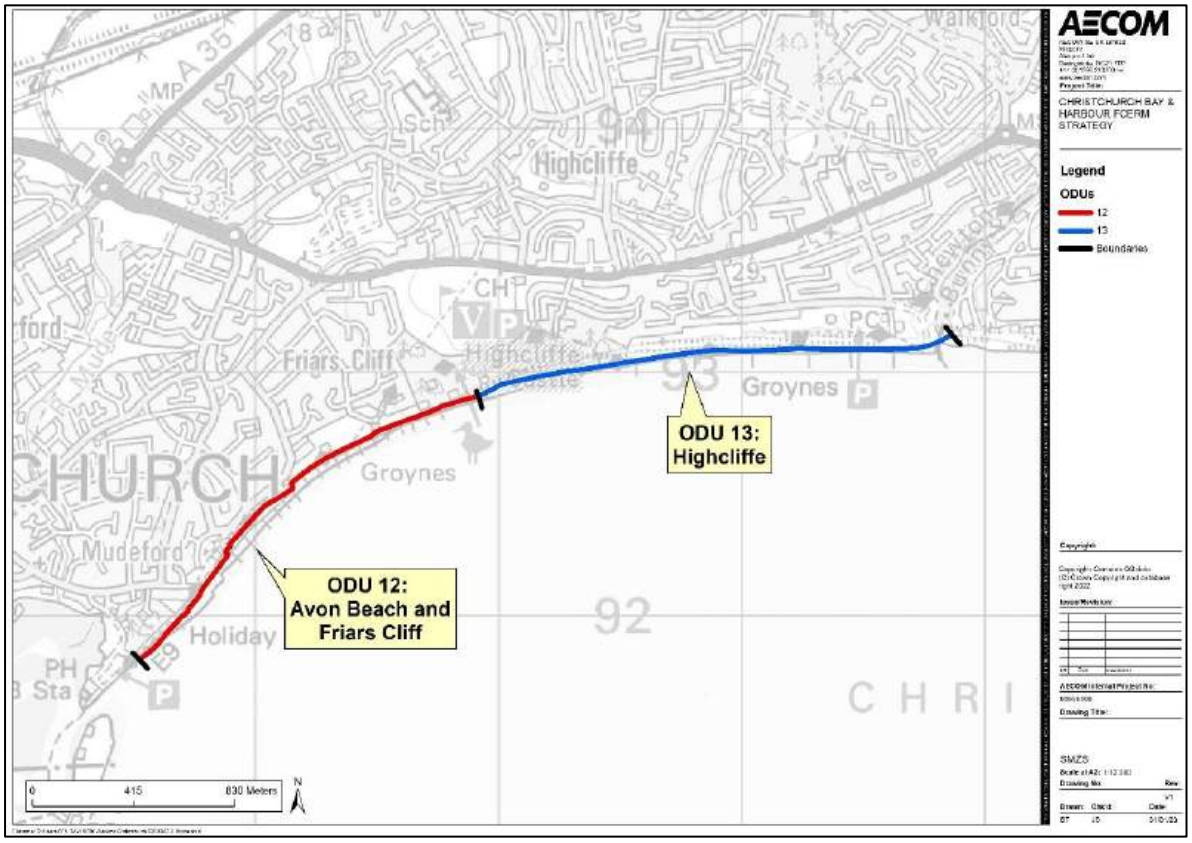

Figure 5-1: Location of ODUs within SMZ 3

SMZ 3 is an open coast environment. The land in the west part of the SMZ (ODU 12) at the interface with SMZ 2 is lower lying with localised flood risk in some areas. Here the risk of flooding comes from both the west direction (from Christchurch Harbour) and also wave overtopping along the open coast. Moving to the east, between Friars Cliff and Highcliffe the land gets higher and the main coastal risk in the future is from erosion of the cliff rather than from coastal flooding. A beach is present along the length of SMZ 3, held in place by groynes in ODU 12 and at the eastern part of ODU 13 at Highcliffe. The beach is important for amenity and recreational purposes but also provides protection to the toe of the cliff which has been stable in recent times but threatens to erode in the future in response to sea level rise.

There are numerous environmental designations in this unit, notably the SAC and Local Nature Reserve. The cliff line from the eastern part of ODU 12 is designated as a SSSI due its geological importance.

The SMP policy for both ODU 12 and ODU 13 is to Hold the Line in the short, medium and long term. ODU 12 is in SMP policy unit D1. Here the ebb tide delta from the entrance to Christchurch Harbour provides protection to Avon Beach and the aim of the SMP policy is to take advantage of this in sustaining a wide amenity beach as protection to extensive areas of housing to the rear. The SMP recognised potential challenges in attracting public funding for defence improvements in ODU 12 but framed the policy recommendation in terms of the wider benefits a wide amenity beach in this location provides to Christchurch Harbour as a whole.

ODU 13 is in SMP policy unit C1. In this area the SMP outlines the importance of maintaining the strong point at Chewton Bunny (east end of the unit); in part to maintain a degree of control on the coast to the east at Naish Cliff, but primarily as a means of stopping outflanking of the defences at Highcliffe. The SMP also recognised that in the future there is significant benefit in terms of property at risk along the cliff line at Highcliffe and this coupled to the fact that the cliff line is currently stable would indicate that maintaining a wide beach at Highcliffe is

preferable to concentrating efforts on maintaining defences at the back of the beach. For the undefended section of cliff in the west part of ODU 13 between Steamer Point and Highcliffe Castle, the SMP recommendations included provision for constructing a new defence in this location in the future as required.

There are a range of opportunities to enhance the local environment in SMZ 3 and therefore environmental enhancements will be considered alongside each of the Strategic options. Environmental enhancements may include ecological improvements to defences (such as Vertipools / rock pools) as well as landscaping. The de-culverting of Walkford Brook at Chewton Bunny has also been discussed as a potential area for improvement along with the wider benefits that this may generate. As the option appraisal develops the environmental enhancements will be considered further and incorporated into the options as appropriate.

5.2 ODU 12 – Avon Beach and Friars Cliff

ODU 12 spans the open coast frontage between Mudeford Quay and Steamer Point. There are a variety of existing coastal defences in this ODU including rock groynes, timber groynes, hybrid groynes (rock and timber), rock revetment and seawalls, with the condition of the defences varying between good and poor. The area is a popular site for recreation and is used by people visiting the beach and beach huts. There are a number of environmental designations in the vicinity (including an SAC and Local Nature Reserve), with the cliffs at the eastern end of the unit being designated as a SSSI.

The main risk in this unit is from coastal erosion although there is some localised flood risk, primarily from the west direction (via ODU 10 and 11). Over the next 100 years the total PV damages for this ODU are estimated to be over £8.9million. The majority of the damage would be expected to occur later on in the appraisal period as initially in epoch 1 relatively few properties are at risk. Over the next 20 years 9 properties are expected to be at risk from erosion under the Do Nothing scenario, increasing to 172 properties (cumulative) over the next 100 years.

The SMP policy for this area is Hold the Line from the present day, with the intent to maintain the integrity of the amenity beach through control structures and recharge. A Strategic option for Managed Realignment has not been included in the appraisal given the proximity of properties to the coastline in this location.

Figure 5-2 shows the key features of this unit.

Figure 5-2: Key features in ODU 12

5.2.1 Short List of Options

The Short List of Strategic Options for ODU 12 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 5-3 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences and / or beach management is not undertaken. In ODU 12 this would result in failure of the existing beach control structures and linear defences once they reach the end of their service life (most likely during epoch 1 based on the condition of the defences). Whilst the land behind the beach and cliff in the east part of the unit are currently stable, with projected sea level rise the land and cliff would be expected to erode over time if nothing is done to protect the toe. This is likely to lead to erosion of the properties and infrastructure located in this unit.

From an amenity and recreation perspective, Doing Nothing could lead to a smaller beach as sea levels rise. This is likely to negatively impact the value of the area to locals and visitors and would not be in line with local aspirations or the SMP policy. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

The Do Nothing scenario is not a viable way forward, but it is important to include in the short list as it forms the baseline for the appraisal, against which all other options are compared.

Do Minimum

The Do Minimum option would involve undertaking reactive small scale maintenance to the existing defences. This would typically take the form of patch and repair maintenance whereby localised damage to the defences is repaired on an ad-hoc basis. Beach management would not be undertaken as part of this option.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reach the end of their service life the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis. The Do Minimum also permits undertaking works to ensure health and safety compliance of defences that fail as part of this option. For example, clearance of failed defences and or removing access to unsafe areas.

The Do Minimum option only has small economic benefits relative to the Do Nothing option, arising from delaying the onset of erosion by a few years.

Maintain

In ODU 12 the focus for the Maintain option is to extend the service life of the existing defences to the end of the appraisal period. This would be achieved through a series of capital refurbishments to the existing defences over time, as required based on the condition and deterioration of the defences. For the purposes of costing it has been assumed that the first capital refurbishment would be required approximately mid-way through epoch 1 based on the estimated residual life of the defences. Beach management in the form of beach recycling from adjacent areas would also be undertaken as part of this option. This is unlikely to lead to significant increases in beach levels over time and would be focussed on locally topping up vulnerable / erosion prone areas of beach as required. Further thought will be required during design / further appraisal to determine source locations for the beach recycling. This should consider the potential impact in adjacent areas to the source sites and the role in the implementation of the overall strategic options.

The Maintain option does not include any raising or lengthening of the existing defences. Therefore, due to sea level rise, the SoP provided by the defences would reduce over time. Without raising and upgrading the beach / defences there is a possibility that erosion of the land and cliffs behind the defences may occur in the future. It is difficult to establish the probability of this happening or the magnitude of erosion that could occur under this scenario as the evolution of the beach in response to sea level rise would also play a role. However, for the purposes of the benefits assessment it has been conservatively assumed that the Do Nothing erosion damages

would be delayed until a later point in time in the appraisal period, creating a substantial economic benefit for this option.

Improve A

This option is focussed on increasing the beach levels and providing upgraded linear defences and beach control structures. This would provide a higher SoP over time and minimise the probability of any land / cliff erosion from occurring in the future.

This option would be achieved by initially refurbishing the existing linear defences (seawall and rock revetment) in epoch 1 once they reach the end of their service life and undertaking patch-repairs on the existing groynes. In epoch 2 a large scale beach nourishment scheme would then be undertaken alongside the construction of new rock groynes to help retain the beach material. At the same time the seawall at Avon Beach would be raised so that it could accommodate the additional beach volume in front of the wall (currently the beach crest is level with the majority of the wall crest).

For the purposes of costing it has been assumed that the beach nourishment would need to be repeated in the future, but with a lower volume of material relative to the initial scheme. The dominant longshore drift direction is from west to east and therefore the beach nourishment scheme here would also provide a strategic benefit to the adjacent unit (ODU 13) over time.

Through ongoing beach management this option would provide protection to minimise the chance of erosion to the land / cliffs behind the beach and would also provide an amenity benefit to the area by retaining / increasing beach volumes in the future.

As part of this option localised property level protection defences at Mudeford Road are included in epoch 3 to manage this localised risk to a small number of properties.

Improve B

This option would upgrade the linear defences along the length of the frontage to provide a higher crest level and minimise the probability of any land / cliff erosion from occurring in the future. This approach would involve constructing new linear defences with extensive toe protection and would not be reliant on the beach to provide this protection. Beach nourishment is therefore not included in this approach. The ethos of this option is to use linear hard defences as the primary defence rather than a softer solution such as Improve A that uses beach nourishment.

One of the advantages of this approach is that it would not require ongoing beach management and would provide a more permanent defence for the long term. However, it would likely result in a smaller beach in the future, negatively impacting the amenity value of the beach and the character of the area.

Improve C

This option is similar to Improve A but would involve additional investment into raising the seawall and promenade area at the back of the beach along its full length. This would provide broader public realm improvements and improve connectivity / access to the beach for visitors.

The initial scheme (beach nourishment, rock groynes and seawall / promenade improvements) would also be undertaken sooner with this option relative to Improve A. In Improve A the initial upgrade scheme is in epoch 2 but in Improve C it has been assumed to occur mid-way through epoch 1. This reflects the local aspiration to upgrade the defences sooner given the condition of some of the groynes in this location.

The FCERM benefits of this option would be the same as Improve A and therefore due to a higher cost cannot be selected as the National Economic Leading option. However it could be selected as the Local Aspirational Leading Option and would require non-GiA sources of funding to be delivered.

Figure 5-3: ODU 12 Options

5.2.2 Economic Appraisal of Options

Cost benefit analysis

Table 5-1 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 12 cannot be ordered based on AEP because they are primarily focussed on managing the erosion risk and have therefore been ordered according to the NPV. The Improve A option has the highest NPV and is therefore selected as the provisional National Economic Leading option.

All the other options considered in this unit have ABCRs below unity and negative NPVs. This reflects the low benefits available in this unit relative to the costs of maintaining the existing defences or constructing new linear defences in this location.

The Improve C option which involves broader public realm improvements and promenade raising has an ACBR below unity (0.64). However costs with this option are uncertain as there is wide scope for what public realm improvements may be and therefore how much they may cost.

Table 5-1: ODU 12 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve A	8,443	11	8,978	1.06	535	X
Do Nothing	-	8,989	-	-	-	
Do Minimum	510	8,827	162	0.32	-348	
Improve B	11,398	11	8,978	0.79	-2,420	
Improve C	14,030	11	8,978	0.64	-5,052	
Maintain	9,412	5,535	3,454	0.37	-5,958	

Sensitivity tests

The main uncertainties with the options in this location relate to the option cost and changes to the estimated costs could influence the choice and viability of different options. Given the large role of beach nourishment in the Improve A and Improve C options, the specific cost of this intervention is likely to have an overweighted influence on the viability of these options as a whole and the selection process.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include generic cost uplift of 10% or 25% and also amended costs for the beach nourishment element of the options (see Appendix A).

The original beach nourishment cost applied in the cost estimates was £33.30 per m^3 of material which is considered to be a reasonable, mid-level estimate of nourishment costs at the Strategy level. However there could be potential to reduce this cost if local sources of material were to be used or with optimisations to the dredging / placement approach (e.g. combining operations with beach nourishment works in adjacent parts of Poole Bay). In addition, smaller quantities of material or material with different characteristics (e.g. coarser material) could also be used to achieve a similar FCERM function. The sensitivity test on beach nourishment costs undertaken assumes a 50% cost reduction in the beach nourishment interventions.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Improve A option to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that with a 10% or 25% cost increase the ABCR of the Improve A option falls below unit and therefore it may not be a viable economic option in this scenario. With a 10% or 25% cost increase there are no alternative viable options and therefore it is not recommended to change the choice of National Economic Leading option from Improve A based on this test result.

In the sensitivity test focused on beach nourishment, the 50% reduction in beach nourishment costs has been applied to all options that include beach nourishment. As can be seen in Appendix A, the choice of the provisional National Economic Leading Option in this scenario would remain unchanged, however, the economic case of the C option is improved with the ABCR still below but approaching unity. Further cost reductions in beach nourishment may make it more viable to pursue this option as a Local Aspirational Option.

5.2.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 12 frontage include:

- Indicates overall support for each of the defence measures on the short list with each of the measures having more 'agree' than 'disagree' responses. Maintenance / repairs, groynes, beach management (recycling and nourishment) and seawall were among the defence measures had the greatest amount of 'agree' responses.
- The short list measure with the most responses indicating it was most important was maintenance and repairs followed by beach management (recycling).

To deliver the Improve Options on the shortlist the beach level / defence crest level will need to be raised over time. This could have an impact on the public realm in this location, which is widely used for recreation / amenity / tourism. Therefore there is an aspiration from the BCP FCERM team to provide public realm enhancements in the future to reduce the impact of raised defences on the landscape and functioning of the area.

Table 5-2 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 5-2: ODU 12 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public feedback. Could result in failure of existing defences and increased erosion risk to properties and other assets in this location.
Maintain	The maintain option would involve refurbishment and ongoing patch-repair to existing defences as well as beach recycling. Maintenance and beach recycling appeared to have support during the last round of engagement with the 'agree' responses far outweighing the 'disagree' responses for these measures.
Improve A	This approach would be based on beach nourishment, new groynes and raising of the seawall at Avon Beach to accommodate larger beach volumes. Each of these defence measures appeared to be supported during the previous round of engagement. Other measures such as beach management / groynes had more 'agree' responses.
Improve B	This approach would be based on constructing upgraded linear defences along the length of the frontage, such as seawall. The seawall defence measure appeared to be supported during the previous round of engagement.
Improve C	This approach would be similar to Improve A but could have more support due to the enhancements to the public realm that would aim to improve recreation / amenity / tourism opportunities in the area.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 5-3 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options could have negative impacts on most of the categories considered. This is due to the increased erosion risk with these options, leading to negative impacts across all the categories except biodiversity / geodiversity. For this category the lack of defence interventions in the future would enable natural coastal processes to resume, leading to erosion of the cliff face in the eastern part of the unit and a potential improvement to the condition of the SSSI (which is currently in an unfavourable condition here).

The Maintain option could also have minor negative impacts on a range of categories such as population and communities and transport and movement, but impacts are uncertain given the more uncertain coastal evolution as part of this option.

The Improve options could provide a major positive benefit to the vast majority of categories by reducing the erosion risk. For example, these options could lead to major positive impacts in climate change, landscape, historic environment, and land, soil and water resources, population and communities and transport and movement. A neutral impact in the biodiversity / geodiversity category is expected with the Improve options as it would be unlikely that they would contribute to improving the SSSI condition but would not be expected to make it worse (it is currently in an unfavourable condition). Opportunities for biodiversity net gain could also be explored with the Improve options. No major negative impacts have been identified for the Improve options.

Table 5-3: Summary of potential environmental impacts in ODU 12

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Major negative impacts across all categories except biodiversity / geodiversity where a positive impact would be anticipated.
Maintain	Uncertain impacts particularly with respect to timings in the long term as coastal evolution is less clear. Potential for minor negative impacts in categories such as climate change, population and communities, and transport and movement.
Improve A-C	Major positive impacts across vast majority of categories due to reduction in erosion risk. Neutral impact biodiversity / geodiversity.

5.2.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified the Improve A option as being the National Economic Leading Option. The SEA and social appraisal have not identified any major negative impacts associated with this option and therefore it is confirmed as the National Economic Leading Option.

The Improve A option would provide defence against erosion whilst also ensuring the recreational and amenity value of the beach is sustained, as per the SMP policy for the area. It would also provide a strategic benefit to adjacent areas, such as ODU 13 which are downdrift of ODU 12 and would be fed by the beach nourishment material over time.

There is an aspiration to improve the public realm in this location in the future and these works could be incorporated into an FCERM scheme. In addition, there is an aspiration to intervene with an upgrade scheme sooner given the condition of some of the groynes in this location. Therefore a Local Aspirational Leading Option has also been identified (see next section).

Local Aspirational Leading Option

With higher beach levels and defence crest elevations in the future as part of Improve A, there is an aspiration to also improve the public realm in this location to support recreation, tourism and amenity opportunities. If funding can be found, there is also an aspiration to intervene sooner given the poor condition of some of the groynes in this location.

Improve Option C would deliver on these aspirations as it includes broader public realm improvements and the initial scheme of beach nourishment / rock groynes would be sooner (mid point of epoch 1) and was therefore included in the appraisal for this purpose. Unfortunately the economic analysis indicates that the ABCR for this option is below unity and is therefore unviable purely from an economic standpoint. However, this is based solely on the National FCERM benefits that this option would deliver. If locally specific benefits were included there is case to improve the economic case of this option.

For example, by improving the public realm with promenade raising, additional tourism and recreation opportunities could be created that could bring in additional investment, GVA benefits, as well as health and

wellbeing benefits. These additional local benefits are not eligible to be counted as part of an application for GiA, but if included in a broader economic appraisal could increase the overall ABCR of the option to above unity.

Furthermore, the sensitivity tests indicated that with a reduction in cost for beach nourishment, the Improve Option C could be closer to being viable from an economic standpoint. Options for reducing the beach nourishment cost should be explored as part of the delivery of this option.

5.2.5 Funding

Partnership Funding

An indicative Partnership Funding calculation has been undertaken for the major capital intervention for the Improve A option (National Economic Leading option). The major capital intervention is considered to be the beach nourishment scheme and associated defence improvements / rock groynes at the same time within the option. This is scheduled to occur in epoch 2 in the option and for the purpose of the funding calculation this has been assumed to be at the start of epoch 2 for illustrative purposes.

For the Local Aspirational Leading Option, the funding from GiA is capped at the level of the National Economic Leading Option and therefore any additional investment required to deliver Improve Option C would need to come from non-GiA sources. A funding calculation has therefore not been undertaken for the Improve C option.

The indicative funding score is shown in Table 5-4. As can be seen the Improve A option has an indicative Partnership Funding score of 15% and an additional funding of over £8.2million would be required.

Table 5-4: Indicative Partnership Funding Scores for ODU 12

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention*
National Economic Leading Option: Improve A	9,689	1,747	11,436	15,332	80 years	15%	1,454	8,235

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

Backup Option if funding cannot be secured

The size of the funding contribution required to deliver Improve A is significant and this presents a risk to the delivery of this option. If funding cannot be secured for this option a lower cost option could be considered. The Maintain option is a lower cost alternative but this does not have a positive ABCR due the lower benefits that this delivers. Therefore it is recommended that modifications are made to the Improve A option aiming to reduce the cost. Costs could be reduced by:

- Reducing the quantity of new beach material as part of the beach nourishment scheme and undertaking more frequent / smaller nourishment schemes instead. This is unlikely to reduce overall option cost but it may be more feasible to source non-GiA funding if the requirement is on more frequent / smaller basis per intervention.
- Modifications to rock groyne design / spacing to retain less material on the beach but at a lower cost. This would place greater emphasis on beach recycling activities that could be funded by annual maintenance budgets.

5.2.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 5-1, the National and Local Aspirational Options are also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 5-1. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £80million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National or Local Aspirational Options could help avoid these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of these options considerably. Additional benefits not included in this value could also be associated with the Local Aspirational Option, if public realm improvements increase coastal recreation and tourism above the baseline level.

5.2.7 Summary

Table 5-5 below summarises the leading options in ODU 12. The beach nourishment as part of the National Economic and Local Aspirational options form part of a wider beach nourishment approach within the bay whereby material is placed at strategic locations. Material is expected to drift from west to east over time to benefit areas to the east, such as Highcliffe, Barton on Sea and ultimately Milford on Sea.

Table 5-5: Summary of ODU 12 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Improve A: refurbish existing defences from epoch 1 and undertake beach nourishment from epoch 2 with new groynes.	8,443	1,454
Local Aspirational	Improve C: as Improve A, except also provide broader public realm enhancements, such as promenade raising.	14,030	1,454
Backup	Lower cost Improve A: refurbish / maintain existing defences and smaller scale beach nourishment	To be developed during OBC if required	To be confirmed during OBC if required

Alignment with SMP

The SMP policy for this area is to Hold the Line. Each of the leading options aligns with this policy and will deliver a Hold the Line policy if funding can be secured.

5.3 ODU 13 – Highcliffe

ODU 13 covers the frontage between Steamer Point and Chewton Bunny. The western part of the unit does not currently have any hard coastal defences, with the beach providing the only protection to the cliff toe. To the east of Highcliffe Castle, a coastal defence scheme consisting of slope stabilisation (Highcliffe counterforte drains), a rock revetment and rock groynes that retain beach levels is present (rock defences in a good condition). The defence system and drainage is working well and has stabilised the cliff in the period since construction (in the 1970s). Similar to ODU 12, the area is a popular site for recreation and is used by people visiting the beach. There are a number of environmental designations in the vicinity (including an SAC) and the cliffs are designated as a SSSI due to their geological importance.

The main risk in this unit is from coastal erosion and over the next 100 years the total PV damages for this ODU are estimated to be over £6.9million. Similar to ODU 12, the majority of the damage would be expected to occur later on in the appraisal period as initially in epochs 1 and 2 relatively few properties are at risk; 18 properties are expected to be at risk by 2074 and 191 properties at risk by 2124 (cumulative) under a Do Nothing scenario.

A key part of the option appraisal in this location has been considering how to effectively manage the transition from the currently defended coastline in ODU 13 to the undefended coastline in ODU 14 to the east. The options developed in the appraisal consider a range of approaches such as outflanking defences or potential managed realignment of the eastern end of the unit. The SMP policy for this area is to Hold the Line in the short, medium and long term, with a note to consider the need for defences at Highcliffe Castle in the long term.

Figure 5-4 shows the location of the key features in ODU 13.

Figure 5-4: Key features in ODU 13

5.3.1 Short List of Options

The Short List of Strategic Options for ODU 13 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 5-5 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences and / or beach management is not undertaken. In ODU 13 this would result in failure of the existing beach control structures, linear defences and cliff drainage system once they reach the end of their service life. Whilst the land behind the cliff is currently stable, with projected sea level rise and the failure of the existing defences, the cliff would be expected to erode over time if with this approach. This is likely to lead to erosion of the properties and infrastructure located in this unit.

The Do Nothing scenario is not a viable way forward, but it is important to include in the short list as it forms the baseline for the appraisal, against which all other options are compared. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum option would involve undertaking reactive small scale maintenance to the existing defences. This would typically take the form of patch and repair maintenance whereby localised damage to the defences is repaired on an ad-hoc basis. Beach management would not be undertaken as part of this option.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reach the end of their service life the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis. The Do Minimum also permits undertaking works to ensure health and safety compliance of defences that fail as part of this option. For example, clearance of failed defences and or removing access to unsafe areas.

The Do Minimum option does not have any economic benefit relative to the Do Nothing scenario in this unit given that there is no erosion risk to properties during epoch 1. Over the longer term Do Minimum would not be able to extend the length of the existing defences for long enough to have an economic impact.

Maintain

The focus for the Maintain option is to extend the service life of the existing defences to the end of the appraisal period. This would be achieved through a series of capital refurbishments to the existing defences over time, as required based on the condition and deterioration of the defences. For the purposes of costing it has been assumed that the first capital refurbishment would be required approximately at the end of epoch 1 based on the estimated residual life of the defences. Beach management in the form of beach recycling from adjacent areas would also be undertaken as part of this option. This is unlikely to lead to significant increases in beach levels over time and would be focussed on locally topping up vulnerable / erosion prone areas of beach as required.

The Maintain option does not include any raising or lengthening of the existing defences. Therefore, due to sea level rise, the SoP provided by the defences would reduce over time. Without raising and upgrading the beach / defences there is a possibility that erosion of the land and cliffs behind the defences may occur in the future. It is difficult to establish the probability of this happening or the magnitude of erosion that could occur under this scenario as the evolution of the beach in response to sea level rise would also play a role. In addition, the existing defences could be outflanked from the currently undefended frontage at Naish Cliff to the east which is subject to episodic erosion events (substantial sections fall in singular events making it more difficult to predict the impacts). This could speed up the onset of erosion and/or the erosion rate at Highcliffe and also make it more challenging to maintain the defences at the eastern part of the unit.

For the purposes of the benefits assessment it has been conservatively assumed that the Do Nothing erosion damages would be delayed until a later point in time in the appraisal period, creating a substantial economic benefit for this option.

Improve A

The objective of the Improve A option is to minimise the amount of cliff erosion in the future by refurbishing the existing defences and using soft engineering solutions such as Beach Nourishment to defend the toe of the cliff. In addition, new defences would be constructed at the eastern end of the unit to prevent the risk of outflanking from Naish Cliff.

In epoch 1 this option would involve constructing a new rock armour defence at the eastern end of the unit to prevent outflanking of the existing defences. The exact design of this scheme would need to be determined during outline design but for the purposes of costing options in the Strategy a localised area of rock armour just to the north of the existing terminal groyne at the intersection with Naish Cliff has been included. In the costing it has been assumed that this would in approximately year 10 of the appraisal period. Elsewhere in the unit, epoch 1 would largely be a continuation of the existing management approach, with small scale patch-repair of the existing defences as well as beach recycling to top-up any areas prone to erosion.

In epochs 2 and 3 beach nourishment would be undertaken to help mitigate the potential impacts of sea level rise. This would be undertaken as required based on beach monitoring trends. For the purposes of costing the initial intervention has been conservatively assumed to occur at the start of epoch 2 but in practice this could occur at a different time depending on beach levels and monitoring data.

At the same time as the initial nourishment the existing rock groynes and rock would be refurbished to extend the service life. There is an opportunity to alter the design of the groynes when being refurbished, depending on the design requirements and any intent to improve beach transport between this area and ODU 14 to the east.

After the initial beach nourishment intervention it has been assumed that beach recycling would be undertaken approximately every 5 years and a smaller scale beach nourishment every 25 years. At the start of epoch 3 a cost has been included to construct new rock groynes. At this point in time new groynes (potentially a new design / different layout) may be required to help retain beach material due to sea level rise.

The design of the beach nourishment scheme in this location would need to consider the beach nourishment scheme in ODU 12 (as part of the National Economic Leading Option) and the potential feed of material from this location. Similar to ODU 12, a beach nourishment scheme at ODU 13 may provide benefit to the areas downdrift such as ODU 14 at Barton on Sea.

By defending the toe of the cliff throughout the next century, it has been assumed that the existing cliff drainage system that is working well would continue to operate and would not require large scale replacement / refurbishment as part of this option.

Improve B

The Improve B option has the same objective as Improve A; to minimise the amount of cliff erosion. However, rather than using soft engineering solutions such as beach nourishment, the Improve B option would upgrade and extend the rock revetment and use this as the primary defence to the cliff toe. There would be a reduced reliance on the beach to provide toe protection to the cliff.

In epoch 1 the Improve B option is the same as Improve A. It would include constructing a new rock armour defence at the eastern end of the unit to prevent outflanking (assumed to be in year 10 in the option costing). Elsewhere patch-repair maintenance and ongoing beach recycling would be undertaken.

In epoch 2 or 3 a new larger rock revetment would be constructed along the full length of the unit to defend the cliff toe against rising sea levels. This would include a new section of defence at the western end of the unit beneath Highcliffe Castle. For the purposes of costing it has been conservatively assumed that this would be required towards the start of epoch 2. This hard defence structure would be the primary toe protection to the cliff and would not rely on ongoing beach management to provide the defence.

As per Improve A, by defending the toe of the cliff throughout the next century, it has been assumed that the existing cliff drainage system that is working well would continue to operate and would not require large scale replacement / refurbishment as part of this option.

Improve C

Improve C is the same approach as Improve A with the only difference being in the timing of the major beach nourishment intervention. Instead of undertaking beach nourishment in epoch 2, it would instead be undertaken

from epoch 3. This improves the economic case for the scheme given that the majority of benefits are expected to occur in epoch 3. The remainder of the option would be the same, with outflanking defences constructed in epoch 1 and the existing defences refurbished in epoch 2.

Managed Realignment A

The aim of this option is to increase the amount of beach material bypassing Highcliffe from the west direction, helping to increase the feed of material to Naish Cliff to the east. This could help to increase the size of the beach at Naish and slow the rate of erosion in this location by providing stability at the toe of the cliffs (however it would not stop erosion at Naish due to the complex geology of the cliffs and other drivers of erosion such as groundwater induced instability). This would be achieved by reducing the length of the groynes at the eastern end of the unit during epoch 1.

Elsewhere in the unit the option is the same as Improve A; in epoch 1 outflanking defences would be constructed and then in epoch 2 and 3 beach nourishment would be used to provide the primary defence to the cliff toe. The upgraded rock groynes in epoch 2 would be designed to allow more movement / bypassing of material.

It has been assumed that more frequent beach management / recycling would be required with this option (relative to Improve A) given that less material would be retained by the shorter rock groynes.

Managed Realignment B

The intent of this option is similar to Managed Realignment A but would use a different approach to manage the beach levels and feed of material to Naish cliff to the east.

In epoch 1 the groynes at the eastern end of Highcliffe would be either be removed or significantly reduced in length to allow more material to bypass this area and feed Naish Cliff to the east. At the same point in time, a series of nearshore breakwaters would be constructed at the eastern end of Highcliffe to provide shelter to this location and to control the beach levels. The intent of the breakwaters would be to retain a beach at the toe of the cliff to provide the required protection to Highcliffe, but at the same time to create a more continuous sediment transport pathways from Highcliffe to Naish.

The design details for the breakwaters would need to be determined during concept / outline design if this option were to be taken forward. The design would need to consider the preferred beach response to achieve the objective of this option – whether that is to create a limited beach response, to create salients or to create tombolos. Tombolos would be more disruptive to longshore sediment transport than salients and therefore the design may favour the creation of salients as long as the beach profile can provide the required defence standard to the Highcliffe section.

To the west of the breakwaters, undertake beach nourishment in epoch 2 and 3 to provide the primary defence to the cliff toe and also refurbish the existing rock revetment as per Improve A.

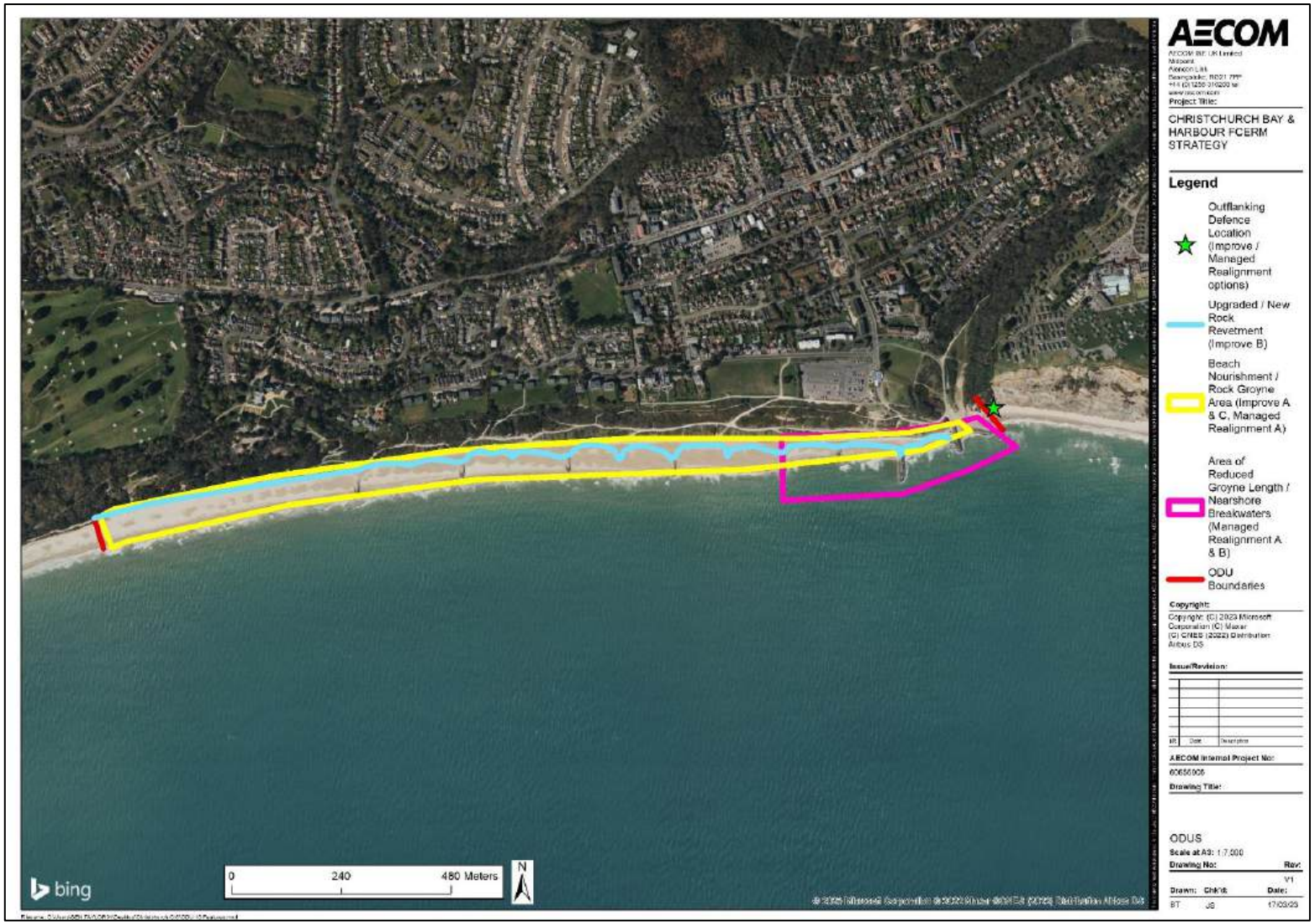

Figure 5-5: ODU 13 Options

5.3.2 Economic Appraisal of Options

Cost benefit analysis

Table 5-6 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 13 cannot be ordered based on AEP because they are primarily focussed on managing the erosion risk and have therefore been ordered according to the NPV. The Improve C option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

Table 5-6: ODU 13 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve C	5,431	0	6,946	1.28	1,515	X
Improve A	6,689	0	6,946	1.04	257	
Do Nothing	-	6,946	0			
Do Minimum	177	6,946	0	-	-177	
Improve B	7,918	0	6,946	0.88	-972	
Managed Realignment A	7,562	369	6,577	0.87	-985	
Maintain	5,310	4,401	2,545	0.48	-2,765	
Managed Realignment B	11,474	369	6,577	0.57	-4,897	

Sensitivity tests

The main uncertainties with the options in this location relate to option cost and changes to the estimated costs could influence the choice and viability of different options. Given the large role of beach nourishment in the Improve A, Improve C and Managed Realignment options, the specific cost of this intervention is likely to have an overweighted influence on the viability of these options as a whole and the selection process.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include generic cost uplift of 10% or 25% and also amended costs for the beach nourishment element of the options (see Appendix A).

The original beach nourishment cost applied in the cost estimates was £33.30 per m^3 of material which is considered to be a reasonable, mid-level estimate of nourishment costs at the Strategy level. However there could be potential to reduce this cost if local sources of material were to be used or with optimisations to the dredging / placement approach. In addition, smaller quantities of material or material with different characteristics (e.g. coarser material) could also be used to achieve a similar FCERM function. The sensitivity test on beach nourishment costs undertaken assumes a 50% cost reduction in the beach nourishment interventions.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Improve C option to determine how the cost increase would alter the choice of leading options. The sensitivity tests indicate that the Improve C option remains the provisional National Economic Leading Option with a 10% cost increase. With a 25% cost increase for Improve C, the NPV is very similar to Improve A and the benefit cost ratio is just above unity (1.02).

In the sensitivity test focused on beach nourishment, the 50% reduction in beach nourishment costs has been applied to all options that include beach nourishment. As can be seen in Appendix A, the choice of the provisional National Economic Leading Option in this scenario would remain unchanged, however, the economic case of the each of the options would improve and the cost required to deliver options with an intervention sooner (e.g. Improve A) would reduce.

5.3.3 Social and Environmental Appraisal

Social Appraisal

The key feedback from stakeholders and the public obtained during engagement round 4 for the ODU 13 frontage include:

- Indicates overall support for each of the defence measures on the short list with each of the measures having more 'agree' than 'disagree' responses. Cliff slope stabilisation / drainage, rock groynes, beach management (recycling and nourishment) and maintenance / repairs were among the defence measures had the greatest amount of 'agree' responses.
- The short list measure voted most important was maintenance and repairs.

Table 5-7 presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key feedback from key stakeholders / public and the FCERM team.

Table 5-7: ODU 13 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public feedback. Could result in failure of existing defences and increased erosion risk to properties and other assets in this location.
Maintain	The maintain option would involve refurbishment and ongoing patch-repair to existing defences as well as beach recycling. These measures appeared to have support during the last round of engagement with the 'agree' responses far outweighing the 'disagree' responses for these measures.
Improve A	This approach would be based on beach nourishment, rock groynes and a continuation of the cliff drainage / stabilisation. Each of these defence measures appeared to be supported during the previous round of engagement.
Improve B	This approach would be based on constructing an upgraded rock revetment along the length of the frontage. Whilst this defence measure appeared to be supported during the previous round of engagement, it was not among the options with the most 'agree' responses. In addition, with no beach nourishment as part of this option the relative beach levels could be lower in the future with sea level rise, potentially impacting amenity and recreation opportunities which may have impacts.
Improve C	This approach would be the same as Improve A but with the major beach nourishment beginning in epoch 3 later on in the appraisal period. Likely to have similar social impacts as Improve A.
Managed Realignment A	This approach uses similar defences measures to Improve A and therefore this aspect of the option could be supported. However, it would result in a greater amount of recession to the cliff top in the eastern part of the unit and there is uncertainty as to whether this would be supported by the local community. Further engagement is required to understand levels of support for this approach.
Managed Realignment B	This option involves using nearshore breakwaters at the eastern end of the unit. This defence measure had more 'agree' than 'disagree' responses during the previous round of engagement, but overall it appeared to be among the least supported measures with fewer 'agree' responses than other defence measures.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 5-8 below provides a summary of the appraisal results.

The Do Nothing and Do Minimum options could have negative impacts on most of the categories considered. This is due to the increased erosion risk with these options, potentially leading to negative impacts across all the categories except biodiversity / geodiversity. For this category the lack of defence interventions in the future would enable natural coastal processes to resume, leading to erosion of the cliff face and a potential improvement to the condition of the SSSI (which is currently in an unfavourable condition here).

The Maintain option could also have minor negative impacts on a range of categories such as climate change, population and communities and transport and movement, but impacts are uncertain given the more uncertain coastal evolution as part of this option.

The Improve options could provide a major positive benefit to the vast majority of categories by reducing the erosion risk. For example, these options could lead to major positive impacts in climate change, historic environment, and land, soil and water resources, population and communities and transport and movement. A neutral impact in the biodiversity / geodiversity category is expected with the Improve options as it would be unlikely that they would contribute to improving the SSSI condition but would not be expected to make it worse (it is currently in an unfavourable condition). Opportunities for biodiversity net gain could also be explored with the Improve options. No major negative impacts have been identified for the Improve options.

The Managed Realignment options could have overall impacts that are similar to the Improve Option and no major negative impacts have been identified. Managed Realignment A has the potential to create a minor positive impact on biodiversity / geodiversity as erosion of the cliff at the eastern end of the unit would occur, potentially leading to an improvement in the SSSI condition. Managed Realignment options may have a minor negative impact to the landscape category associated with changes to shoreline position.

Table 5-8: Summary of potential environmental impacts in ODU 13

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Major negative impacts could occur across all categories except biodiversity / geodiversity where a positive impact would be anticipated.
Maintain	Uncertain impacts particularly with respect to timings in the long term as coastal evolution is less clear. Potential for minor negative impacts in categories such as climate change, historic environment, population and communities, and transport and movement.
Improve A-C	Major positive impacts could occur across vast majority of categories due to reduction in erosion risk. Neutral impact for biodiversity / geodiversity.
Managed Realignment A	Could lead to positive impacts across majority of categories, including on biodiversity / geodiversity relating to erosion of the cliff at the eastern end and potential for SSSI condition to improve. However, potential or negative impact in landscape category.
Managed Realignment B	Could lead to positive impacts across majority of categories. However, potential or negative impact in landscape category.

5.3.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified the Improve C option as being the National Economic Leading Option. The social appraisal or SEA has not identified any major negative impacts for this option and therefore it is confirmed as the National Economic Leading Option.

The Improve C option would provide defence against erosion whilst also ensuring the recreational and amenity value of the beach is sustained in the long term.

Local Aspirational Leading Option

The Improve A option is similar to the Improve C option but would involve undertaking the major beach nourishment scheme in epoch 2 rather than in epoch 3. If undertaken sooner, the beach nourishment would provide greater confidence in epoch 2 that the defence system is resilient to the impacts of climate change. In addition, it would ensure that the area could continue to be used for recreation / amenity during epoch 2 by helping to sustain / increase beach levels. Therefore the Improve A option has been selected as the Local Aspirational Leading Option.

Interaction with ODU 14

Implementing the National and Local Aspirational Options (Improve C and Improve A) will retain the existing defence system at Highcliffe. This system currently performs well in terms of stabilising the cliff and retaining beach material. Both options include beach nourishment in the future but this intervention is not outlined until epoch 3 for the National Option (Improve C) and epoch 2 for the Local Option (Improve A). Therefore over the short and medium term, prior to the beach nourishment schemes starting, the Improve Options will not promote an increase in the natural bypassing of beach material downdrift into ODU 14 to the east. This is because the rock groynes at Highcliffe will remain in place and are expected to continue to retain material in this location, whilst input of beach material to the system will not increase significantly prior to the nourishment schemes.

However, once beach nourishment begins in epochs 2 or 3, the increased input of material to the beach system could lead to increased bypassing and supply of beach material to downdrift locations such as Naish Cliff. This would however be subject to the design of the nourishment scheme and any refurbishments / groyne upgrades as part of the Improve options. There may be opportunities for the combined groyne / beach nourishment scheme design to sustain the level of protection to Highcliffe, whilst improving the feed of material to the east.

In the short and medium term, in order to better support beach volumes in the eastern part of the Bay (ODU 14-18) it is recommended that recycling of beach material from Highcliffe to Naish Cliff is considered / appraised. This would be an interim measure until epochs 2/3 when large scale beach nourishment in ODU 13 would be undertaken. There may be merit in this beach management approach as it would allow more material to move from west to east throughout the bay and provides a more holistic bay wide approach to beach management that could benefit Barton on Sea and Milford on Sea. This would be subject to there being sufficient beach volumes at Highcliffe to support this approach. To consider the relative merits of this it is recommended that a bay-wide Beach Management Plan is developed after the Strategy.

Managed Realignment A and Managed Realignment B were considered as Local Aspirational Options in ODU 13 as these options would improve the transition to Naish Cliff in ODU 14 by creating a more consistent sediment transport pathway (relative to Improve A and C). However the key concerns with identifying the Manged Realignment Options as a Local Aspirational Option are outlined below:

- Economic viability: both Managed Realignment A and B have an ABCR less than unity and therefore do not have a strong economic case relative to the Improve options.
- Uncertainty: both options involve removal or shortening of the existing groynes. It is uncertain how the beach would respond to this change. Currently the defences at Highcliffe are working effectively to defend this location but changes to the groynes could change this and further unforeseen investment may be needed at Highcliffe if a loss of beach material here threatened the stability of the existing revetment at the top of the beach. This option is therefore unlikely to be supported by local decision makers.

5.3.5 Funding

Partnership Funding

Indicative Partnership Funding calculations have been undertaken for the major capital intervention for the Improve C option (National Economic Leading Option) and Improve A option (Local Aspirational Leading Option). The major capital intervention is considered to be the beach nourishment scheme and associated defence improvements that would occur at the same time. Depending on the option, the beach nourishment occurs at the same time as either the groyne upgrades (Improve C) or the capital refurbishment of the existing defences (Improve A).

The intervention in epoch 1 (local outflanking defences) is important for the overall implementation of both options but it would not be appropriate to assign the majority of the units benefits to this intervention. This would reduce the amount of GiA available and affordability of the major capital intervention later on in the option implementation.

As can be seen in Table 5-9, the indicative Partnership Funding score for the capital scheme in Improve C is 30% and for Improve A is 17%. Both options would require significant funding contributions to be deliverable; approximately £5.3million for Improve C and £7.4million for Improve A.

Table 5-9: Indicative Partnership Funding Scores for ODU 13

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention*
National Economic Leading Option: Improve C	7,578	957	8,535	25,596	50 years	30%	2,268	5,309
Local Aspirational Leading Option: Improve A	8,972	1,315	10,287	11,785	80 years	17%	1,537	7,435

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

Backup Option if funding cannot be secured

The size of the funding contribution required to deliver either Improve C or Improve A is significant and this presents a risk to the delivery of these options. If the funding cannot be secured neither option could be delivered. If this were to be the case then it is recommended that funding opportunities for lower cost options were sought instead.

Similar to the adjacent unit at ODU 12, the Maintain option is a lower cost alternative but this does not have a positive ABCR due the lower benefits that this delivers. Therefore it is recommended that modifications are made to the Improve options aiming to reduce the cost. Costs could be brought down by reducing the quantity of new beach material as part of the beach nourishment scheme and undertaking more frequent / smaller nourishment schemes instead. This is unlikely to reduce overall option cost but it may be more feasible to source non-GiA funding if the requirement is on more frequent / smaller basis per intervention.

5.3.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 5-6, the National and Local Aspirational Options are also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 5-6. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £35million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National or Local Aspirational Options could help avoid these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of these options considerably.

5.3.7 Summary

Table 5-10 below summarises the leading options in ODU 13. The beach nourishment as part of the National Economic and Local Aspirational options form part of a wider beach nourishment approach within the bay whereby material is placed at strategic locations. Material is expected to drift from west to east over time to benefit areas to the east, such as Barton on Sea and Milford on Sea.

Table 5-10: Summary of ODU 13 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Improve C: construct outflanking defence in epoch 1. Beach nourishment from epoch 3.	5,431	2,268
Local Aspirational	Improve A: construct outflanking defence in epoch 1. Beach nourishment from epoch 2.	6,689	1,537
Backup	Lower cost Improve: outflanking defence. Smaller scale beach nourishment	To be developed during OBC if required	To be confirmed during OBC if required

Alignment with SMP

The SMP policy in this location is to Hold the Line. Each of the leading options aligns with this policy and will deliver a Hold the Line policy if funding can be secured.

6. Strategy Management Zone 4

6.1 Overview

SMZ 4 (Naish Cliff and Barton on Sea) includes ODU 14 and covers the area between Chewton Bunny to the eastern end of the Barton on Sea coastal defences. Figure 6-1 below shows the location of ODU 14 and SMZ 4.

Figure 6-1: Location of ODUs within SMZ 4

SMZ 4 is an open coast environment between Naish Cliff and Barton on Sea, characterised by steep topography and an active cliff face. ODU 14 is the sole ODU in SMZ 4.

The cliff in this area is a complex cliff and instability is caused by both the erosion of the toe as well as increased groundwater levels which can then result in landslides occurring. Areas of the cliff are currently undefended (such as at Naish Cliff) and in these location toe erosion can occur. The influence of groundwater instability is closely linked to antecedent precipitation levels. A combination of cliff toe protection and cliff slope drainage and stability measures are required to effectively manage the rate of cliff top recession.

The SMP policy in SMZ 4 / ODU 14 is Managed Realignment in the short, medium and long term. There are three SMP policy units within SMZ 4 / ODU 14 (B2, B3 and B4) and the SMP Managed Realignment policy intent is slightly different for each area. In B2 (the east part of the unit), the SMP policy intent is to maintain and improve the drainage system but acknowledge that the cliff top will continue to erode over time. In B3 (the central part of unit), the intent is to initially maintain the areas with defences and drainage, allowing this to adapt to provide a transitional defence to Naish Cliff. At B4 (the west part of unit), a potential way forward mentioned in the SMP was a limited intervention with recharge to allow adaptation of use. In the SMP refresh it was noted that more clarification is needed in B4 on what cliff works are acceptable.

There are a variety of coastal defences in SMZ 4 / ODU 14. In the west part of the ODU at Naish Cliffs the coastline is currently undefended and actively eroding. At Barton on Sea there is a rock revetment at the toe of the cliffs and rock groynes. In addition, various cliff drainage schemes have been undertaken in the past at Barton on Sea. In SMP policy units B2 and B3 there is an extensive drainage system (approximately 2km long) consisting of a sheet pile cut off wall and perforated drainage pipes. The system requires regular maintenance

and the majority of it is still intact, although failures have occurred at the western end of the system and opposite Marine Drive, west of Barton Court.

The full length of the unit is fronted by a marine SPA designation and the cliffs are designated as a SSSI due to their geological importance. The condition of the SSSI in the west part of the unit at Naish Cliff is favourable given the actively eroding nature of this cliff. To the east where the cliff is defended and eroding at a much slower rate the condition of the SSSI is unfavourable.

In the west part of the SMZ / ODU at Naish Cliff, there is a beach in front of the cliff line and a privately owned caravan park at the top of the cliff. There is generally a lack of beach material in front of the Barton on Sea defences and there are properties along the cliff top, beach huts and a cliff path located landward of the coastal defences. The area is an important recreation site.

6.2 ODU 14 – Naish Cliff and Barton on Sea

The main risk in this area is from coastal erosion caused by cliff toe erosion and groundwater induced cliff slope instability. Over the next 100 years the total PV damages for this location are estimated to be £28.3million. Similar to other areas such as ODU 12 and ODU 13, in ODU 14 the majority of damage would be expected to occur later on in the appraisal period. Initially in epoch 1 relatively few properties are at risk from erosion but this increases significantly in the future; 10 properties are at risk by 2044, 130 by 2074 (cumulative) and then 607 by 2124 (cumulative) under the Do Nothing scenario. Whilst not considered as permanent dwellings in the economic appraisal, the risk to the caravan park at Naish Cliff is more immediate with loss of land in this area occurring as the cliff line retreats. The properties in the caravan park can sell for several hundreds of thousands of pounds and therefore whilst ineligible to be counted as a national economic loss, they do provide significant local benefit to the economy.

The short list of defence measures for this unit included beach management, rock groynes, rock revetment / armour and cliff stabilisation. Many difference combinations of these defence measures have been considered as part of the option development. The short list of options presented below are the approaches that are technically viable with the strongest economic cases for the duration of the appraisal period.

The appraisal of options in this location is sensitive to the option appraisal results in the adjacent units, particularly ODU 13 at Highcliffe. As described in Section 5.3, the National Economic Leading Option in ODU 13 is Improve A, which would involve keeping the existing defences in place at Highcliffe and supplementing this with beach nourishment in the future. It also involves constructing an outflanking defence at the eastern end of the Highcliffe defences. Beach nourishment at Highcliffe is likely to increase the feed of material to ODU 14 at Naish, however, it is unclear at the Strategy stage how much material is likely to pass into ODU 14, particularly with the retention of groynes at Highcliffe. This can be investigated in more detail when designing and developing the beach nourishment and groyne scheme for Highcliffe and there will be a variety of approaches that can be followed for groyne design and beach nourishment volumes.

In the appraisal for ODU 14, it has conservatively been assumed that there will be minimal feed of material from Highcliffe so that the options developed and selected in ODU 14 are not reliant on material from ODU 13. Whilst this may not be the case in reality (there is likely to be a feed of material from ODU 13 to 14), it ensures that the option appraisal in ODU 14 is robust and that the options developed are appropriate even in a scenario where there is no beach material coming from Highcliffe.

The key features in ODU 14 are shown in Figure 6-2.

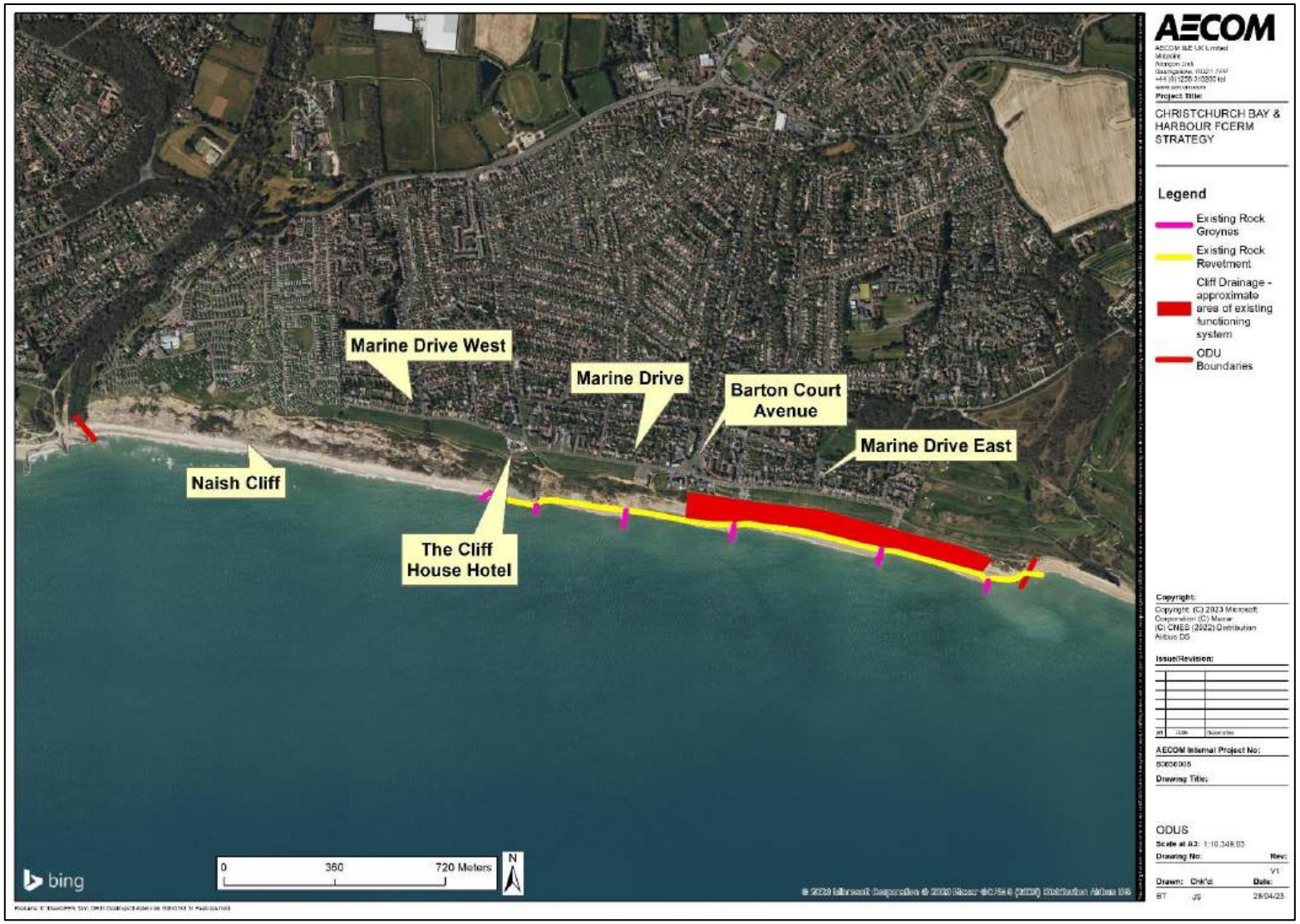

Figure 6-2: ODU 14 key features

6.2.1 Short List of Options

The Short List of Strategic Options for ODU 14 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 6-3 and Figure 6-6 show maps of the key interventions mentioned in each option description (for the Improve and Managed Realignment Options respectively). Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 14 this would result in failure of the existing toe defences at the base of the cliff, as well as the cliff drainage installations along the length of the unit. With this scenario the cliff line would be expected to erode leading to a considerable loss of property in the future, particularly later in the appraisal period (epoch 2 and 3).

The Do Nothing scenario is not a viable way forward, but it is important to include in the short list as it forms the baseline for the appraisal, against which all other options are compared. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail but this may prove challenging given the dynamic nature of the cliff and access constraints.

Do Minimum

The Do Minimum option would involve undertaking reactive small scale maintenance to the existing toe defences. This would typically take the form of patch and repair maintenance whereby localised damage to the defences / is repaired on an ad-hoc basis. Beach management would not be undertaken as part of this option and it is unlikely that patch-repair would be possible on the drainage system.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reach the end of their service life the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis. Cliff recession is still likely to occur with this option and whilst it would initially be slower than the Do Nothing scenario, the economic benefits of this approach would only be small. The Do Minimum also permits undertaking works to ensure health and safety compliance of defences that fail as part of this option. For example, clearance of failed defences and or removing access to unsafe areas.

Maintain

The Maintain Strategic option would involve undertaking proactive maintenance to the existing defences at the cliff toe. The maintenance to the toe defences would typically be in the form of capital refurbishments replacing larger areas of the defence to ensure the structures can perform as intended with respect to erosion risk.

Small scale annual maintenance to the drainage system would also be undertaken as required, but large scale improvements / reinstallation of already failed sections of drainage would not be undertaken.

This option is likely to extend the service life of the existing defences by a longer duration than the Do Minimum option. The option would not include replacing the drainage system or defences where they have already failed.

Given the complex nature of the cliffs and the fact that parts of the cliff drainage system have already failed, this approach would not prevent further erosion of the cliff top from occurring. The rate of erosion would initially be slowed but would not be stopped. In the economic appraisal, for the currently defended areas, it has been assumed that the Do Nothing erosion damages during epochs 1, 2 and 3 would be delayed to a later point in time in the appraisal period. For the currently undefended areas, erosion would continue as per the Do Nothing scenario.

Improve A

The Improve A option would aim to minimise further erosion along the length of the ODU 14 frontage, including at Naish Cliff. This would be achieved through a combination of a beach nourishment scheme to provide improved toe protection along the full length of the unit, refurbishment of the existing rock revetment, upgraded rock groynes as well as new cliff drainage / stabilisation.

In epoch 1 the existing rock revetment would be refurbished when it comes to the end of its service life. This is likely to involve replacing damaged rock with new rock, rebuilding any parts of the structure that have failed and restoring the original design geometry of the structure (rock structures can slump over time). The rock groynes would also be upgraded during this intervention to help retain new beach material along this part of the frontage. This could involve constructing larger groynes, refurbishing the existing groynes or changing the groyne layout (approach to be decided during outline design).

Alongside the works to the rock structures, a large scale beach nourishment scheme would be used to build a wide beach along the length of the frontage. For costing purposes the initial volume of material included is in excess of 300,000m^3 (note that this would need to be recalculated / revisited during outline design as part of a formal beach design process). Cliff drainage would also be installed along the full length of the unit (except where it is still functional in the east part of the unit). This would include at Naish Cliff.

The wider beach with this option would help to reduce wave action at the cliff toe and revetment structure. Therefore this option does not include for raising or increasing the size of the existing rock revetment along the base of the cliff.

In the option costing it has been assumed that the initial capital interventions (rock revetment refurb, rock groyne upgrades, beach nourishment and cliff drainage) would occur between years 5-10 in the appraisal period. After the initial intervention, subsequent beach nourishment interventions would be required as well as ongoing beach management and further refurbishments of existing defences through time.

Despite the large investment in new toe protection and cliff drainage, it is recognised that even with this approach the retreat of the cliff line would not be stopped entirely. In the economic appraisal it has been assumed that properties landward of the Marine Drive roadway (Marine Drive East and Marine Drive West) would be defended as part of this option, but the open space and properties seaward of this road would still be lost in time, albeit with delayed timing compared to the Do Nothing scenario. This is due to the complex geology of the cliffs in this location, where erosion is driven by both erosion of the toe and groundwater / rainfall induced slope instability as well as the current angle of cliff repose being greater than the stable angle. It is unlikely that the erosion of the cliff top could be stopped entirely and therefore some erosion would be expected to occur even with the Improve Options.

Improve B

The intent of the Improve B option is the same as in Improve A in aiming to reduce the rate of erosion of the cliff top as much as possible along the majority of the unit. However, this would be achieved via the construction of a new rock revetment between the eastern end of Marine Drive East and the Highcliffe defences (including Naish) in epoch 1, as well as new cliff drainage / stabilisation along this length. There would be no beach renourishment as part of this option and new groynes would not be required (however, refurbishing the existing groynes could be undertaken).

The rock revetment would provide the protection to the cliff toe in this approach and it would not be reliant on beach material and ongoing beach management to provide this function. The new rock revetment would be larger than the existing revetment structure to ensure that it provides adequate defence to the cliff toe in the future with sea level rise (there would be minimal beach in front the revetment to reduce wave action before reaching the revetment).

In the option costing it has been assumed that the initial capital interventions (new rock revetment, refurb rock groynes and cliff drainage) would occur between years 5-10 in the appraisal period.

The economic benefits of this option are the same as Improve A and even with the new toe defence the retreat of the cliff line would not be stopped entirely due to the complex geology of the cliffs.

Managed Realignment A

The Managed Realignment A option would aim to significantly slow the rate of cliff top erosion between the western end of Marine Drive West and the eastern end of Barton on Sea. The option involves providing new toe defences and cliff drainage / stabilisation for this part of the frontage.

The initial capital interventions as part of this option would be during the first part of epoch 1. In the costing it has been assumed that this will occur between years 5-10 of the appraisal period. This would involve the following initial interventions:

- Construction of a rock revetment at the toe of the cliff beneath Marine Drive West (but not at Naish Cliff, the revetment would stop at approximately the west end of Marine Drive West). This section of the frontage is currently undefended.
- Refurbishment / upgrade of the existing rock revetment at the toe of the cliff between the Cliff House Hotel and the eastern end of Marine Drive East. Over time transition the defences to the east of Marine Drive East into outflanking defences (there is not an economic justification to defend the full length of the currently defended frontage to the east of Marine Drive East where there are no properties at risk).
- Installation of new cliff stabilisation / drainage between the western end of Marine Drive West and Barton Court Avenue (the existing cliff stabilisation / drainage to the east of Barton Court Avenue is still functioning). This would likely involve a horizontal drilled drainage solution but this will be subject to the results of a drainage trail currently being planned by NFDC.

During outline design / business case development, beach nourishment at Naish Cliff should be considered as part of this option as there may be merit in placing material here. However, for the purposes of the Strategy, beach nourishment has not been included as part of the Managed Realignment A option as it is not likely to be essential to achieve the objectives of this option. The early intervention of improved toe defences is anticipated to be sufficient in controlling rates of toe erosion between Marine Drive West and Marine Drive East but this should be revisited / appraised at outline design stage.

It is not anticipated that new groynes with a different design / geometry to the existing would be required as part of this option and therefore costs for new groynes have not been included. However a cost has been included in the option cost build-up for refurbishing the existing groynes if this is deemed to be required during scheme design.

The option includes costs for ongoing maintenance of the new toe defences. It also includes for refurbishment of the cliff stabilisation / drainage in the future as this will be required due to the continued erosion of the cliff.

There is uncertainty as to how effective the new toe defences and drainage at Marine Drive West may be in the future. The SMP identified that this area is within the slump zone of Naish Cliffs and therefore even with new toe defences at the base of the cliff and new cliff drainage, the area could still be at risk of land sliding / erosion due to cliff slope processes. It is the intention of this option to reduce the rate of erosion in this location, but further work will need to be undertaken during outline design / business case development to test the viability of this approach in more detail.

Whilst this option would slow the rate of erosion for the main Barton on Sea frontage between Marine Drive West and Marine Drive East, due to ongoing cliff slope processes the erosion would not be stopped entirely in this location and would be ongoing (but at a slower rate). In the economic appraisal it has been assumed that properties landward of the Marine Drive roadway to the east of the Cliff House Hotel would be defended as part of this option, but the open space and properties seaward of this road would still be lost in time, albeit with delayed timing compared to the Do Nothing scenario.

Due to the uncertainty around the technical success of defences at Marine Drive West (to the west of the Cliff House Hotel), 20% of the Do Nothing erosion damages have been assumed to occur in this location (but delayed compared to Do Nothing) despite the new defences here.

Managed Realignment B

Managed Realignment B is a similar option as Managed Realignment A and involves providing the same toe defences and cliff drainage / stabilisation improvements between the western end of Marine Drive West and the eastern end of Barton on Sea.

However, the main difference is that the initial capital interventions would not be undertaken until epoch 2 (rather than in years 5-10 with Managed Realignment A). In the option costing it has been assumed that the interventions would occur between years 20-25 in the appraisal period.

In addition to the measures outlined in the Managed Realignment A option, a localised beach nourishment scheme has been included in the Managed Realignment B option at Naish Cliff. This would be undertaken at the same time in epoch 2 as improvements to the toe defences and cliff drainage. The larger beach would provide localised protection to the toe of Naish Cliff but would also feed the wider Barton on Sea area and the area further to the east over time with new beach material. This beach nourishment has been assumed to be required because relative to Managed Realignment A, this option would experience greater amounts of erosion during epoch 1 and therefore more robust toe defences / higher beach levels may be required to slow the rate of erosion

further. For costing purposes it has been assumed that approximately 70,000m^3 of material would be placed here initially then subsequent top-ups at half this volume would be needed. However this would need to be recalculated / revisited during outline design as part of a formal beach design process.

Prior to the interventions in epoch 2, during epoch 1 small scale maintenance would be undertaken on the existing defences with the aim of extending the life of the assets until the new scheme is delivered in epoch 2. There is uncertainty as to whether this approach will be sufficient to extend the life of the assets until epoch 2 and it will therefore be important to undertake regular defence condition assessments to develop an understanding of how the condition of the defences is changing over time. This will inform decisions on when interventions can reasonably be delayed until and which adaptive pathway to take through the options when delivering the Strategy.

It is acknowledged that the risk of the defences failing in epoch 1 is increased with this option (relative to Managed Realignment A) but the main advantage of this approach is that it provides more time to seek and secure contributions for the initial scheme.

Managed Realignment C

The Managed Realignment C option would aim to significantly slow the rate of cliff top erosion between the Cliff House Hotel (western end of Marine Drive) and the eastern end of Barton on Sea. The option involves providing upgraded toe defences and cliff drainage / stabilisation for this part of the frontage.

The main difference with this option compared to Managed Realignment A is that the length of the frontage defended with new hard defences / cliff drainage would be shorter, with no new defences provided to the cliff at Marine Drive West.

The initial capital interventions as part of this option would be during the first part of epoch 1. In the costing it has been assumed that this will occur between years 5-10 of the appraisal period. This would involve the following initial interventions:

- Refurbishment / upgrade of the existing rock revetment at the toe of the cliff between the Cliff House Hotel and the eastern end of Marine Drive East. Over time transition the defences to the east of Marine Drive East into outflanking defences (there is not an economic justification to defend the full length of the currently defended frontage to the east of Marine Drive East where there are no properties at risk).
- Installation of new cliff stabilisation / drainage between the Cliff House Hotel and Barton Court Avenue (the existing cliff stabilisation / drainage to the east of Barton Court Avenue is still functioning).

Similar to Managed Realignment A, costs for beach nourishment at Naish Cliff and for new groynes have not been included in this option as due to the early intervention they are not considered essential for the objectives of this option. However, these aspects should be reappraised during outline design and business case development. A cost has been included for refurbishing the existing groynes along the frontage.

The option includes costs for ongoing maintenance of the upgraded toe defences. It also includes for refurbishment of the cliff stabilisation / drainage in the future as this will be required due to the continued erosion of the cliff.

Whilst this option would slow the rate of erosion at Marine Drive and Marine Drive East relative to the Do Nothing baseline, erosion would still be expected to occur here and would not be stopped entirely due to ongoing cliff slope processes. In the economic appraisal it has been assumed that the properties landward of the roadway would not be eroded during the appraisal period. However, the open space and properties seaward of this road would still be lost in time, albeit with delayed timing compared to the Do Nothing scenario.

Marine Drive West would remain undefended with this option and therefore in the economic appraisal, 100% of the Do Nothing erosion damages have been assumed to occur in this location.

Managed Realignment D

Managed Realignment D is a similar option as Managed Realignment C and involves providing the same toe defences and cliff drainage / stabilisation improvements between the Cliff House Hotel (western end of Marine Drive) and the eastern end of Barton on Sea.

However, the main difference is that the initial capital interventions would not be undertaken until epoch 2 (rather than in years 5-10 with Managed Realignment C). In the option costing it has been assumed that the interventions would occur between years 20-25 in the appraisal period.

In addition to the measures outlined in the Managed Realignment C option, a localised beach nourishment scheme has been included in the Managed Realignment D option at Naish Cliff. This would be undertaken at the same time in epoch 2 as improvements to the toe defences and cliff drainage. The larger beach would provide localised protection to the toe of Naish Cliff but would also feed the wider Barton on Sea area and the area further to the east over time with new beach material. This beach nourishment has been assumed to be required because relative to Managed Realignment C, this option would experience greater amounts of erosion during epoch 1 and therefore more robust toe defences / higher beach levels may be required to slow the rate of erosion further. For costing purposes it has been assumed that approximately 70,000m^3 of material would be placed here initially then subsequent top-ups at half this volume would be needed. However this would need to be recalculated / revisited during outline design as part of a formal beach design process.

Prior to the interventions in epoch 2, during epoch 1 small scale maintenance would be undertaken on the existing defences with the aim of extending the life of the assets until the new scheme is delivered in epoch 2. There is uncertainty as to whether this approach will be sufficient to extend the life of the assets until epoch 2 and it will therefore be important to undertake regular defence condition assessments to develop an understanding of how the condition of the defences is changing over time. This will inform decisions on when interventions can reasonably be delayed until and which adaptive pathway to take through the options when delivering the Strategy.

It is acknowledged that the risk of the defences failing in epoch 1 is increased with this option (relative to Managed Realignment C) but the main advantage of this approach is that it provides more time to seek and secure contributions for the initial scheme.

Managed Realignment E

The Managed Realignment E option would aim to significantly slow the rate of cliff top erosion in the future between Barton Court Avenue (eastern end of Marine Drive) and the eastern end of Barton on Sea. The option involves providing upgraded toe defences and cliff drainage / stabilisation for this part of the frontage.

The main difference with this option compared to Managed Realignment A and C is that the length of the frontage defended with new hard defences / cliff drainage would be even shorter.

No new defences would be constructed at the cliff at Marine Drive West and this area would remain undefended. At Marine Drive, between the Cliff House Hotel and Barton Court Avenue, the existing toe defences would be repaired over time with small scale patch-repair maintenance but would not be replaced at the end of the service life. Once failed the rock would still provide a form of defence to the cliff toe but it would not be as effective. This area would form a transition area between the defended area at Marine Drive East and the undefended area at Marine Drive West. This option is the most similar option to the Shoreline Management Plan Managed Realignment policy for the area.

The initial capital interventions as part of this option would be during the first part of epoch 1. In the costing it has been assumed that this will occur between years 5-10 of the appraisal period. This would involve the following initial interventions:

- Refurbishment / upgrade of the existing rock revetment at the toe of the cliff beneath Marine Drive East, to the east of Barton Court Avenue. Over time transition the defences to the east of Marine Drive East into outflanking defences (there is not an economic justification to defend the full length of the currently defended frontage to the east of Marine Drive East where there are no properties at risk).
- Installation of new cliff stabilisation / drainage between the Cliff House Hotel and Barton Court Avenue (the existing cliff stabilisation / drainage to the east of Barton Court Avenue is still functioning).

Similar to Managed Realignment A and C, costs for beach nourishment at Naish Cliff and for new groynes have not been included in this option as due to the early intervention they are not considered essential for the objectives of this option. However, these aspects should be reappraised during outline design and business case development. A cost has been included for refurbishing the existing groynes along the frontage.

The option includes costs for ongoing maintenance of the upgraded toe defences at Marine Drive East. It also includes for refurbishment of the cliff stabilisation / drainage here in the future as this will be required due to the continued erosion of the cliff.

This option would slow the rate of erosion at Marine Drive East relative to the Do Nothing baseline but erosion would still be expected to occur and would not be stopped entirely due to ongoing cliff slope processes. In the economic appraisal it has been assumed that the properties landward of the Marine Drive East roadway would not be eroded during the appraisal period. However, the open space and properties seaward of this road would still be lost in time, albeit with delayed timing compared to the Do Nothing scenario.

To the west of the defended section at Marine Drive East, between the Cliff House Hotel and Barton Court Road erosion would continue in the future, particularly after existing toe defences fail and become less effective. Further to the west, at Marine Drive West, the cliff would remain undefended with this option and therefore in the economic appraisal, 100% of the Do Nothing erosion damages have been assumed to occur in this location.

Managed Realignment F

Managed Realignment F is a similar option as Managed Realignment E and involves providing the same toe defences and cliff drainage / stabilisation improvements at Marine Drive East.

However, the main difference is that the initial capital interventions would not be undertaken until epoch 2 (rather than in years 5-10 with Managed Realignment E). In the option costing it has been assumed that the interventions would occur between years 20-25 in the appraisal period.

In addition to the measures outlined in the Managed Realignment E option, a localised beach nourishment scheme has been included in the Managed Realignment F option at Naish Cliff. This would be undertaken at the same time in epoch 2 as improvements to the toe defences and cliff drainage. The larger beach would provide localised protection to the toe of Naish Cliff but would also feed the wider Barton on Sea area and the area further to the east over time with new beach material. This beach nourishment has been assumed to be required because relative to Managed Realignment E, this option would experience greater amounts of erosion during epoch 1 and therefore higher beach levels may be required to help manage rates of erosion. For costing purposes it has been assumed that approximately 70,000m^3 of material would be placed here initially then subsequent top-ups at half this volume would be needed. However this would need to be recalculated / revisited during outline design as part of a formal beach design process.

Prior to the interventions in epoch 2, during epoch 1 small scale maintenance would be undertaken on the existing defences with the aim of extending the life of the assets until the new scheme is delivered in epoch 2. There is uncertainty as to whether this approach will be sufficient to extend the life of the assets until epoch 2 and it will therefore be important to undertake regular defence condition assessments to develop an understanding of how the condition of the defences is changing over time. This will inform decisions on when interventions can reasonably be delayed until and which adaptive pathway to take through the options when delivering the Strategy.

It is acknowledged that the risk of the defences failing in epoch 1 is increased with this option (relative to Managed Realignment E) but the main advantage of this approach is that it provides more time to seek and secure contributions for the initial scheme.

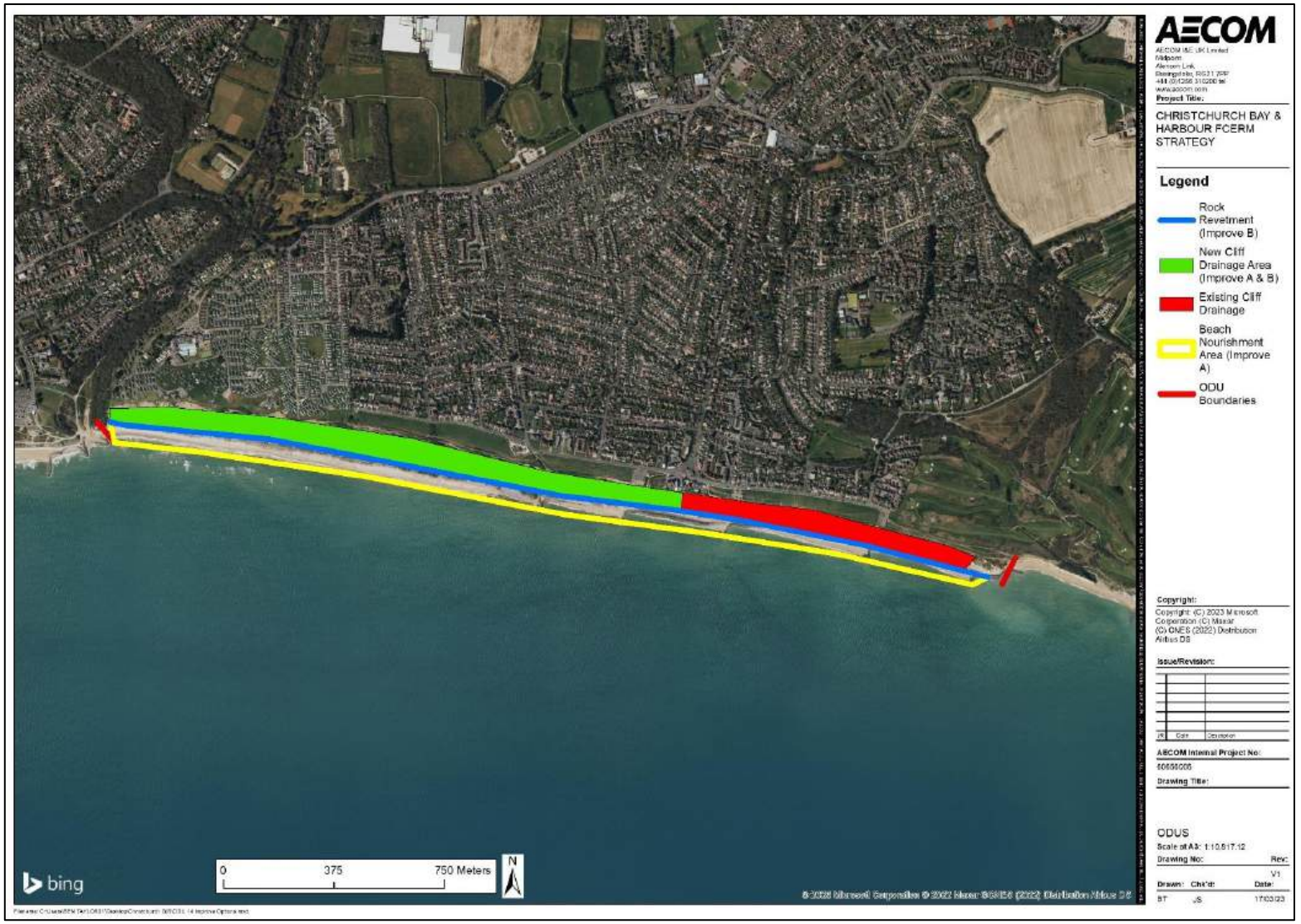

Figure 6-3: ODU 14 Improve Options

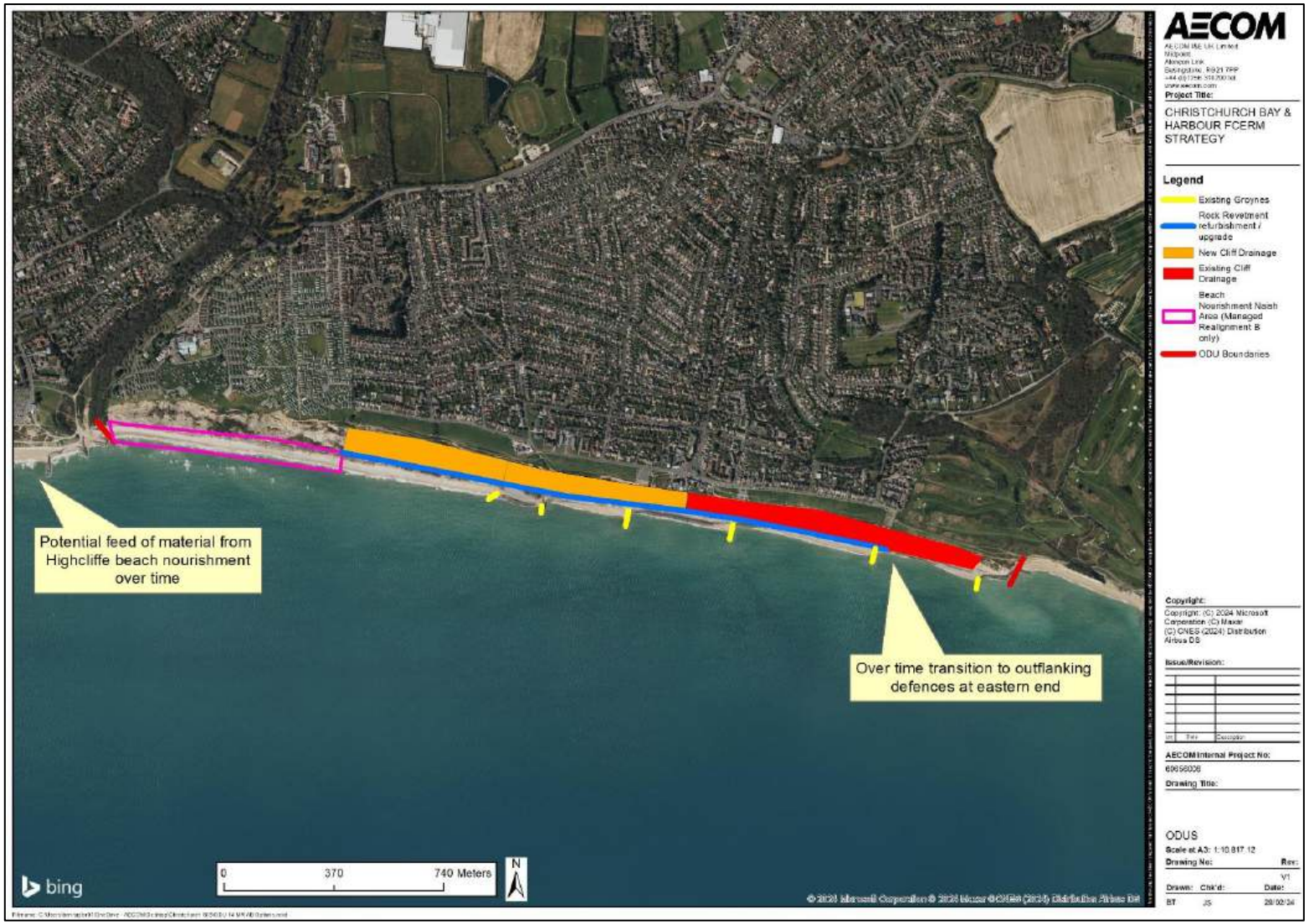

Figure 6-4: ODU 14 Managed Realignment Options A and B

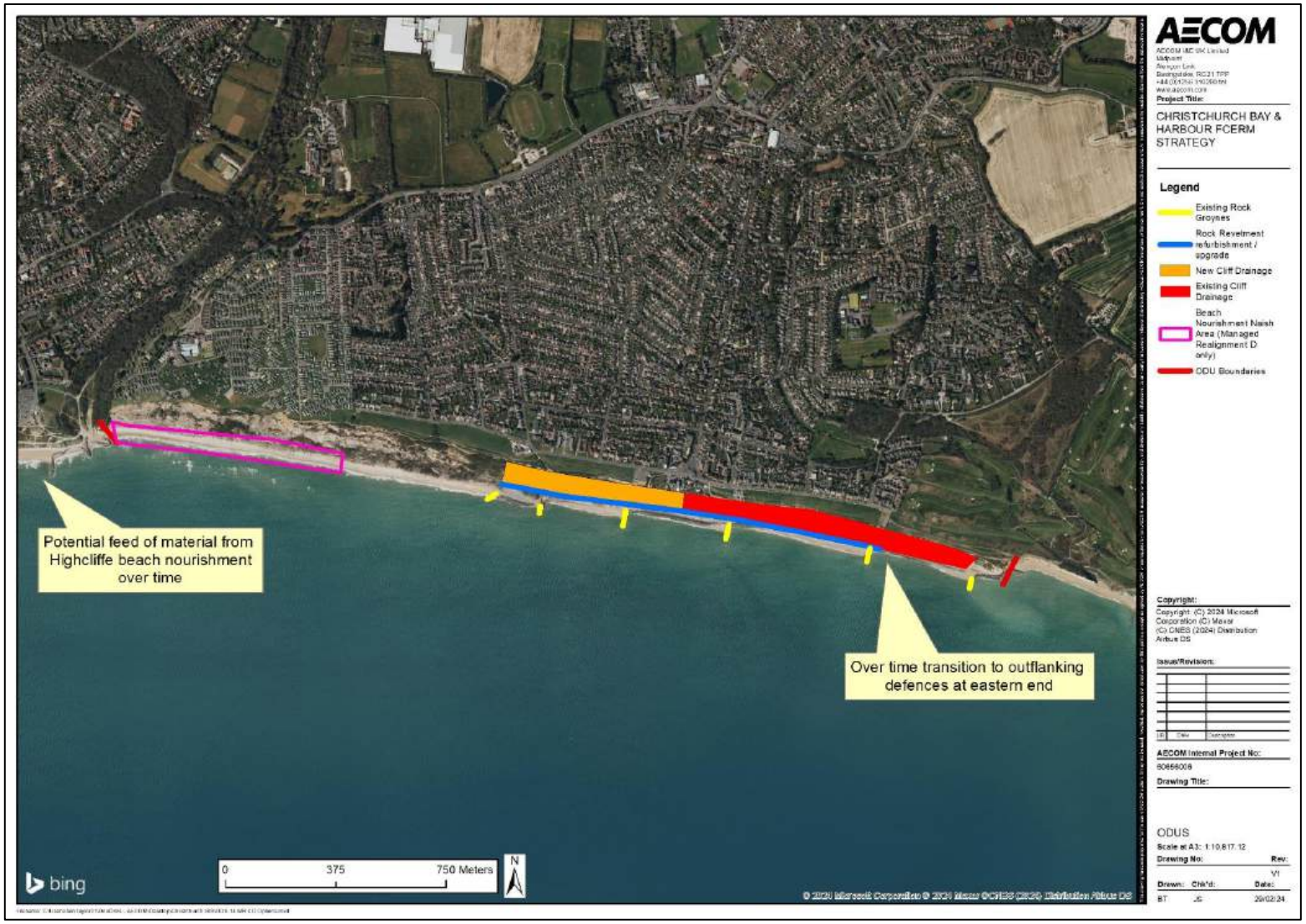

Figure 6-5: ODU 14 Managed Realignment Options C and D

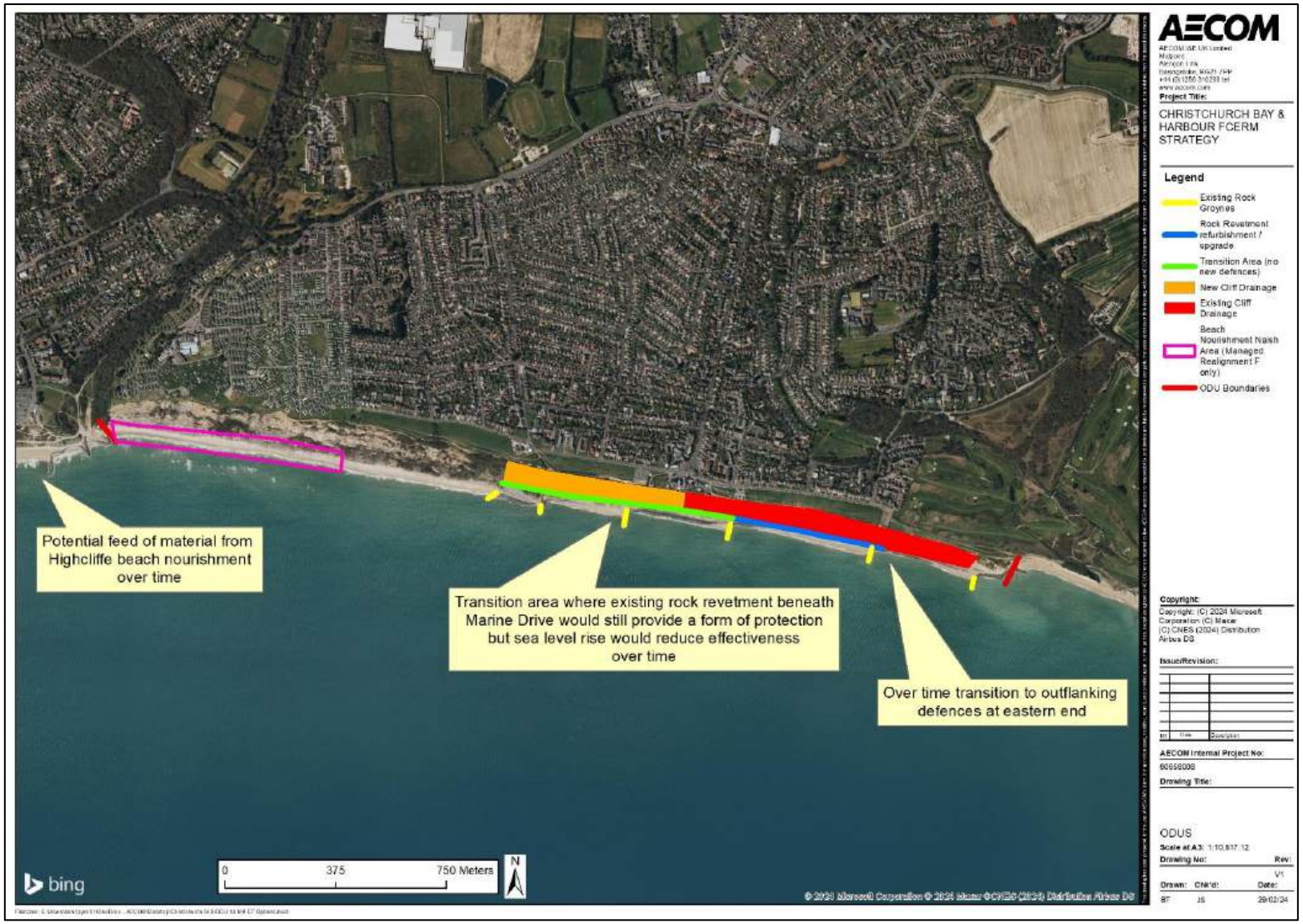

Figure 6-6: ODU 14 Managed Realignment Options E and F

6.2.2 Economic Appraisal of Options

Cost benefit analysis

Table 6-1 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 14 cannot be ordered based on AEP because they are focussed on managing the erosion risk and have therefore been ordered according to the NPV. The Managed Realignment A option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

Managed Realignment B, Managed Realignment D and Maintain also have ABCRs greater than unity and are the only other Do Something options that are viable from an economic standpoint. Neither of the Improve A or Improve B options have an ABCR greater than unity which indicates that providing cliff slope stabilisation / robust toe defences to the full length of the frontage is unviable.

Table 6-1: ODU 14 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Managed Realignment A	22,211	4,875	23,489	1.06	1,278	X
Managed Realignment B	19,718	8,287	20,077	1.02	359	
Managed Realignment D	14,218	13,973	14,391	1.01	173	
Maintain	5,927	22,405	5,959	1.01	32	
Do Nothing	-	28,364	-	-	-	
Managed Realignment C	15,317	13,973	14,391	0.94	-926	
Do Minimum	1,228	28,078	286	0.23	-942	
Managed Realignment F	11,750	19,150	9,214	0.78	-2,536	
Managed Realignment E	11,836	19,150	9,214	0.78	-2,622	
Improve B	46,061	1,089	27,275	0.59	-18,786	
Improve A	55,527	1,089	27,275	0.49	-28,252	

Sensitivity tests

The main uncertainties with the options in this location relate to option cost and how changes to the estimated costs could influence the choice and viability of different options.

A sensitivity test has been undertaken to test the choice of options with a cost uplift of 10% and 25% for Managed Realignment A (the provisional National Economic Leading Option). Appendix A provides a summary of the results. A discussion around the alternative options and broader uncertainty in this unit is provided below.

The sensitivity tests show that with a 10% and 25% increase in costs, Managed Realignment A would not remain as the leading economic option and would be replaced by the Managed Realignment B option. However, as outlined in the Barton on Sea Option Review Technical Note (AECOM, 2024), on balance Managed Realignment A is a less risky option than Managed Realignment B. Managed Realignment A has greater buildability (owing to the earlier intervention and more space available at the top of the cliff) and in any scenario leading to cost increases, larger cost increases would be expected with Managed Realignment B so the choice of option would be unchanged.

It is recognised that there is a significant funding shortfall / uncertainty for capital schemes at Barton on Sea due to a lack of FCERM-GiA relative to option costs. Therefore an additional sensitivity test specific to the option funding

was undertaken and is shown in the Economic Appraisal Report (AECOM, 2024). This sensitivity test considered how the potential GiA funding availability may change if the capital scheme is delayed until year 50 or year 75 in the appraisal period. The test indicates that whilst the funding case would improve, there would still be a large funding shortfall at this time and therefore irrespective of when a capital scheme is delivered, significant amounts of non-GiA funding will be needed.

6.2.3 Social and Environmental Appraisal

Social Appraisal

Based on the feedback from stakeholders and the public during the Strategy development and engagement round 4, the key feedback for the Barton on Sea frontage includes:

- Indicates general support for beach nourishment, maintenance / repairs, cliff slope stabilisation / drainage and use of rock structures such as rock revetment / groynes.
- Cliff slope stabilisation / drainage was considered to be the most important intervention for this location.

Through discussions with the NFDC FCERM team there is recognition that central government funding from FCERM GiA for new / improved defences in the short-medium term is likely to be limited and significant non-GiA contributions will be required to deliver a scheme. However, if other sources of funding can be found then there is an aspiration to intervene with new defences over this time period if possible. The sooner the intervention the greater the amount of open space between the cliff top and the properties landward of Marine Drive (where the majority of damages occur) could be retained, keeping this area as ‘buffer zone’ in the future. If an early intervention does not occur, there is increased risk that the distance between the cliff top and the properties landward of Marine Drive would reduce over time, making it more challenging to prevent property loss with a future intervention.

Table 6-2 presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key aspirations of key stakeholders / public and the FCERM team.

Table 6-2: ODU 14 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public / FCERM aspirations. Would result in extensive loss of property in the future and likely to negatively impact local community.
Maintain	Previous engagement from stakeholders / public suggests support for maintenance and repairs. However, this option would still result in loss of property in the future and would only delay the onset of erosion.
Improve A, B	Choice of defence measures in line with those that appeared to be most supported during previous engagement phase. This would involve new drainage / stabilisation along the length of the frontage which was highlighted as the most important intervention from the last engagement feedback.
Managed Realignment A, B	Choice of defence measures in line with those that appeared to be most supported during previous engagement phase. The initial intervention of Managed Realignment A would be sooner than in B, and therefore this approach may have better support / align with local aspirations.
Managed Realignment C, D	Choice of defence measures in line with those that appeared to be most supported during previous engagement phase. Relative to Managed Realignment A and B this approach would result in a smaller part of the frontage being defended with new toe protection / cliff drainage and therefore may not be as well supported from the local community.
Managed Realignment E, F	Choice of defence measures in line with those that appeared to be most supported during previous engagement phase. However, relative to Managed Realignment A-D, this approach would result in the smallest length of the frontage being defended with new toe protection / cliff drainage and therefore could be the least supported of the Managed Realignment approaches on the short list.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 6-3 below provides a summary of the appraisal results and indicates if there are any major negative impacts associated with any of the options which may make them unviable from an environmental perspective.

The Do Nothing / Do Minimum / Maintain options could generally have negative impacts on most of the categories considered. This is due to the high erosion risk with these options, leading to potential negative impacts across all the categories except biodiversity / geodiversity. For this category the lack of upgraded defence interventions in the future would enable natural coastal processes to resume, leading to erosion of the cliff face and a potential benefit to the SSSI.

The Improve options could provide a positive benefit to the vast majority of categories by reducing the erosion risk. For example, these options could lead to major positive impacts in climate change, historic environment, and land, soil and water resources, population and communities and transport and movement. However, major negative impacts would be expected in the biodiversity / geodiversity category as options would aim to minimise cliff erosion and therefore SSSI condition at Naish Cliff could turn unfavourable (currently favourable).

No major negative impacts are expected with the Managed Realignment Options. However, the impacts vary between Managed Realignment A-B, Managed Realignment C-D and Managed Realignment E-F based on the lengths of defences provided.

Managed Realignment A-B could provide the greatest benefits to the majority of categories. Conversely Managed Realignment E-F could lead to negative impacts on the majority of categories but major positive impacts on biodiversity / geodiversity.

Table 6-3: Summary of potential environmental impacts in ODU 14

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Could lead to major negative impacts across all categories except biodiversity / geodiversity where a positive impact would be anticipated.
Maintain	Similar negative impacts as Do Nothing, except minor negative rather than major negative as erosion risk slowed.
Improve A-B	Could lead to positive impacts across vast majority of categories due to reduction in erosion risk. However, potential for major negative impact on biodiversity / geodiversity category as options would aim to minimise cliff erosion and therefore SSSI condition at Naish Cliff could turn unfavourable (currently favourable).
Managed Realignment A-B	Could have major positive impacts across vast majority of categories as erosion risk would be better controlled along the length of the frontage. Neutral impacts on biodiversity / geodiversity expected; in SSSI units 5 and 6 these options would not be expected to worsen the condition of the designation. In unit 6 there may be reduced potential for the SSSI condition to improve given there would be a control on the rate of erosion. Options not expected to impact Solent and Dorset Coast SPA.
Managed Realignment C-D	Could have minor positive impacts across each of the categories, including a positive impact to biodiversity / geodiversity. For geodiversity there is potential for an improvement to the condition of the west part of unit 6 of the SSSI as this area of cliff would remain undefended. Options not expected to impact Solent and Dorset Coast SPA.
Managed Realignment E-F	Minor negative impacts in majority of the categories could occur due to smallest length of frontage defended (of the Managed Realignment Options). However, the exception is for biodiversity / geodiversity where positive impacts could occur due to improvements to SSSI condition as erosion along much of the cliff frontage would not be controlled.

6.2.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified Managed Realignment A option as being the National Economic Leading Option.

The SEA has not identified any major negative impacts for this option and relative to the other Managed realignment Options it would be expected to have more positive impacts. The social appraisal indicated that the choice of defence measures are in line with those that were supported during the previous round of stakeholder engagement and relative to the other Managed Realignment Approaches (C-F) this option would include defences along the largest length of the frontage.

After considering uncertainties and the social / environmental appraisal, Managed Realignment A has been retained as the National Economic Leading Option.

Other options such as Managed Realignment B and Managed Realignment D have similar net present values and could have also been identified as the National Economic Leading Options. However:

- Managed Realignment B has not been selected because intervening sooner with Managed Realignment A has many advantages in terms of risk reduction and buildability. Managed Realignment A has more cost certainty.
- Managed Realignment D has not been selected because it is the aspiration to defend as many properties as possible at Barton on Sea within the confines of the economic case and therefore Managed Realignment A would be preferable.
- Uncertainties still remain around funding and technical viability (i.e. of defences at Marine Drive West) but these can be managed with adaptive pathways and use of Backup Options in this location.

Managed Realignment A would reduce the rate of erosion to the part of the ODU 14 frontage with properties located at the cliff top, from the western end of Marine Drive West to the eastern end of Marine Drive East. The rate of erosion would be reduced but not stopped entirely and some properties would still be expected to be lost over the appraisal period. The option is broadly in line with the SMP policy for the area but extends the defences further to the west to provide coastal defences at Marine Drive West.

As outlined in section 6.2.1, whilst not included in the option at the Strategy stage, beach nourishment at Naish Cliff should be considered as part of this option during scheme appraisal as there may be merit in placing material here.

No Local Aspirational Options have been identified in ODU 14 but a series of Backup Options have been identified to account for the key uncertainties in this location.

Requirement for Backup options

Given the relatively low ABCR of the Managed Realignment A option (just above 1), the sensitivity tests on option cost highlight how sensitive the viability of this option is to cost increases. With a 10% cost increase, the ABCR falls below unity and the economic viability of the option would be uncertain.

There is also uncertainty around funding for Managed Realignment A (see next section), with funding for the majority of the initial scheme cost needing to come from non-GiA sources. This is a significant amount (approximately £23million in cash terms) that would need to be secured in years 0-10 in order to undertake construction in the first part of epoch 1. Whilst it is the aspiration of NFDC to work with potential funding partners to secure this funding, it is recognised that this is uncertain and may not be achievable.

In addition to the cost and funding uncertainties, there is uncertainty around the effectiveness of drainage / toe defences at Marine Drive West that requires further investigation when developing a scheme design at Barton on Sea. These defences are included in Managed Realignment A and B, but not in Managed Realignment D.

Each of these factors indicate that it would be prudent to identify Backup options in case of funding risks, cost increases in the future or findings from further appraisal during scheme design.

Backup options

Three Backup options have been identified and allow a range of adaptive pathways to be implemented.

- The first Backup option is Managed Realignment B. This option is the same as Managed Realignment A, but the initial capital scheme (cliff drainage and toe protection) would be undertaken at the start of epoch 2 (rather than in the first part of epoch 1 with Managed Realignment A). This option has been identified as a Backup option in case of a scenario in which not enough non-GiA funding could be secured during the first part of epoch 1 to implement Managed Realignment A, and more time is needed to secure all the funding contributions.
- The second Backup option is Managed Realignment D. Both Managed Realignment A and B include cliff drainage and toe defences at Marine Drive West, but the effectiveness of cliff drainage and toe defences here is uncertain due to this area being within the slump zone of Naish Cliffs. Managed Realignment D does not include defences at Marine Drive West and could be implemented as a Backup Option if further appraisal work during scheme development determines that defences at Marine Drive West are not likely to be effective.
- The third Backup option is Maintain. This has been identified in case the scheme costs for either Managed Realignment A, B or D increase, leading to the benefit cost ratios of these options falling below unity.

Adaptation / transition plan

With the National Option and each of the Backup Options the erosion rate of the cliff in ODU 14 will be reduced to varying extents, but not stopped entirely. There is likely to be some loss of property in the future and also loss of amenity space at the top of the cliff with each of the options. It is therefore recommended that an adaptation / transition plan is developed by NFDC for this location. The plan should:

- Outline the residual risks to the location once the Strategy is being delivered;
- Raise awareness on the residual risks with the local community and stakeholders;

- Outline the actions required to cope with the consequences of the residual erosion risk and support the community;
- Determine roles and responsibility and timings for these actions;
- Promote the use of appropriate planning policy (i.e. Coastal Change Management Areas); and
- Be shared and consulted on with the local community and stakeholders.

6.2.5 Funding

Partnership Funding

Indicative Partnership Funding calculations have been undertaken for the first capital intervention and whole life maintenance for the Managed Realignment A option (National Economic Leading option).

In order to calculate the funding score the base date for the calculations has been shifted so that it starts at the time of the initial intervention. This provides a hypothetical Partnership Funding score for the year of the first intervention. By shifting the base date forward, it ensures that the option costs and benefits are discounted correctly. However the calculations assume that the funding rules between now and the time of the initial intervention would be unchanged which is considered unlikely and therefore the calculations should be used for illustration purposes only rather than to inform long term investment decisions. The indicative Partnership Funding scores are provided in Table 6-4 below.

As can be seen, the National Economic Leading Option (Managed Realignment A) requires significant funding contributions (in the order of £23million).

It is unlikely that GiA could be used to contribute towards cliff drainage / stabilisation measures which are included in the capital costs for the Managed Realignment B option. Of the PV capital cost value (£26.1m), approximately 50% is related to cliff drainage / stabilisation and the other 50% required for toe defences. Given that the maximum GiA amount of £3.4m is less than the £13m (50%) required for toe defences, the amount of overall GiA available for the scheme would not be impacted by this rule.

Table 6-4: Indicative Partnership Funding Scores for ODU 14

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention*
National Economic Leading Option: Managed Realignment B	26,100	4,424	30,525	30,710	90 years	12%	3,215	22,886

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

6.2.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 6-1, the National Option is also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 6-1. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £54million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National

Option could help avoid these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of this option considerably.

6.2.7 Summary

Table 6-5 below summarises the leading options in ODU 14.

Table 6-5: Summary of ODU 14 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Managed realignment A: control rate of cliff erosion with new toe defences and cliff drainage / stabilisation from Marine Drive West to the eastern end of Barton on Sea from epoch 1	22,211	3,215
Backup	Managed realignment B: control rate of cliff erosion with new toe defences and cliff drainage / stabilisation from Marine Drive West to the eastern end of Barton on Sea from epoch 2	19,718	To be determined during OBC
Backup	Managed realignment D: control rate of cliff erosion with new toe defences and cliff drainage / stabilisation from Marine Drive to the eastern end of Barton on Sea from epoch 2	14,218	To be determined during OBC
Backup	Maintain: refurbish / maintain existing defences (effectiveness will reduce over time as sea levels rise likely leading to loss of properties).	5,927	To be determined during subsequent appraisal

Alignment with SMP

The SMP policy in this location is Managed Realignment although the intent varies along the frontage. The National Economic option will deliver Managed Realignment, but the intent is different to the SMP policies in some locations. As outlined in section 6.2.4, the National Option will extend the defences further west than the SMP recommended and there is some uncertainty with this approach that will need to be considered further during outline design.

7. Strategy Management Zone 5

7.1 Overview

SMZ 5 (Taddiford) includes ODU 15 and covers the area between Barton on Sea and Hordle Cliff. The west boundary of the unit is at the eastern end of the Barton on Sea defences and the east boundary is at West Road (western end of the Hordle beach huts). Figure 7-1 below shows the location of ODU 15 and SMZ 5.

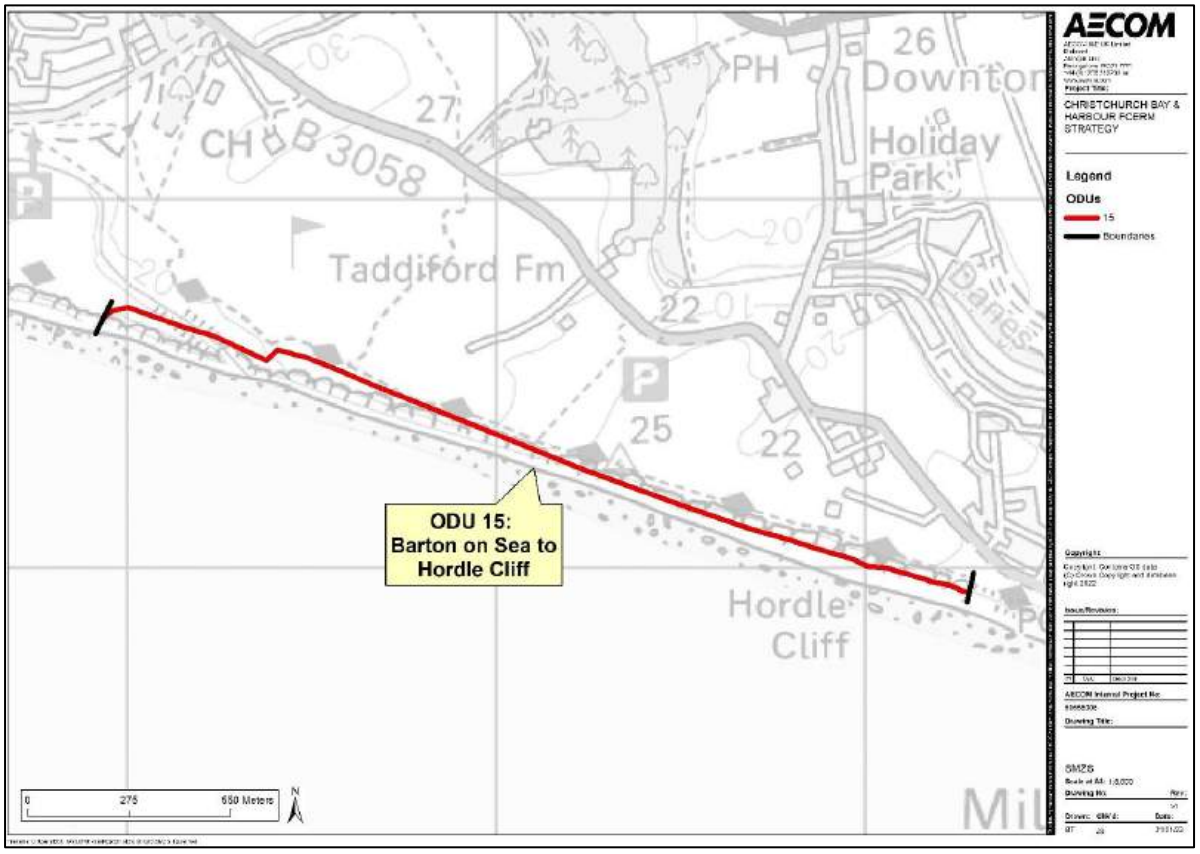

Figure 7-1: Location of ODUs within SMZ 5

SMZ 5 / ODU 15 spans over 2.5km along the open coast. The ODU is currently undefended with no linear coastal defences in place. The beach in front of the cliffs provides the only protection to the cliff toe. The exception is a single rock structure that is located in the west part of this unit, constructed to protect a decommissioned storm outfall but which now acts as a terminal groyne. The beach in this unit is used for recreation / amenity purposes. Landward of the cliff line the land is primarily open space, including a golf course and agricultural land. The full length of the ODU is fronted by a marine SPA designation and the cliffs are part of the SSSI designation due to their geological importance.

No properties are at risk from erosion in this ODU until epoch 3 (1 property at risk in epoch 3) and therefore damages are significantly discounted. Over the next 100 years the total PV damages for this ODU are estimated to be just under £0.1million. Given the low level of risk in this area the SMP policy is no active intervention for the short, medium and long term, allowing natural rollback of the cliff.

7.2 ODU 15 – Barton on Sea to Hordle Cliff

7.2.1 Short List of Options

The Short List of Strategic Options for ODU 15 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 7-2 shows a map of the key interventions mentioned in the Managed Realignment Option (this is the only option with a new defence measure). Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a 'walk away' scenario whereby any maintenance of FCERM assets or defences is not undertaken and beach management is not undertaken. With the Do Nothing scenario, the cliffs would continue to erode over time, likely increasing in pace in response to sea level rise. This option is in line with the SMP policy and is the current management approach for this location. As the cliffs erode this option may involve ensuring health and safety compliance – e.g. restricting access to unsafe zones / clearance of debris etc. It may also be necessary to make safe the rock structure that is currently protecting the decommissioned outfall if this were to fail.

Do Minimum

Given the lack of formal defences in this SMZ, the Do Minimum Strategic option would also be focussed on ensuring health and safety compliance following cliff recession events. This may involve clearance of debris / restricting access to unsafe zones. This option could also include small scale patch-repairs to the rock structure that is protecting the decommissioned outfall. However, this would not provide an FCERM economic benefit to the unit and it would not be the responsibility of NFDC.

Managed Realignment

The Managed Realignment Strategic option would involve maintaining the beach levels in this SMZ through beach management activities / beach recycling. It is not anticipated that this would require substantial interventions given that the actively eroding cliff would provide source material to the beach and beach nourishment schemes further to the west are likely to also provide a benefit to beach levels. However, if certain parts of the cliff are eroding faster than anticipated it may be feasible to periodically move beach material to top-up the beach in these areas. This option is unlikely to significantly slow the rate of erosion of the cliff significantly in the long term as the beach level would not be significantly increased but it would provide more control on the rates of erosion relative to Do Nothing and Do Minimum.

Figure 7-2: ODU 15 options

7.2.2 Economic Appraisal of Options

Cost benefit analysis

Table 7-1 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 15 cannot be ordered based on AEP because they are focussed on managing the erosion risk and have therefore been ordered according to the NPV. None of the Do Something options have an ABCR greater than unity therefore Do Nothing is identified as the provisional National Economic Leading option.

Table 7-1: ODU 15 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	73	-	-	-	X
Do Minimum	44	73	-	-	-44	
Managed Realignment	110	73	-	-	-110	

7.2.3 Social and Environmental Appraisal

Social Appraisal

Based on the feedback from stakeholders and the public to date during the Strategy development and engagement round 4, the key feedback for the ODU 15 frontage includes:

- Indicates general support for beach nourishment and beach recycling.

This is the defence measure that has been used to develop the Managed Realignment option and therefore the approach of this options is likely to be supported. However the economic case for this option is unviable and therefore it is unlikely that they would be taken forward.

Other key factors raised during the engagement related to sustaining access and ensuring health and safety measures. Although not an FCERM intervention, as part of the Do Nothing or Do Minimum approaches options for moving the coastal footpath inland over time as required could be explored.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. In summary:

- The Do Nothing, Do Minimum and Managed Realignment options could have a minor negative impact on a range of categories including landscape, population and communities and transport / movement due the cliffs eroding. However, a positive impact is expected in the biodiversity / geodiversity category relating to the continued erosion of the cliffs contributing to continuation of the favourable SSSI condition (unit 7 of the SSSI).

7.2.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified the Do Nothing option as being the National Economic Leading Option. The social appraisal and SEA have not identified any major negative impacts associated with this option and therefore it is confirmed as the National Economic Leading Option. This approach aligns with the SMP policy for the area.

There are no viable alternative options from an economic perspective given that there are no existing defences or properties at risk in this unit. Therefore a Local Aspirational Leading Option has not been selected. However, if opportunities arise to undertake beach nourishment as part of a wider scheme (for example in ODU 16), then this

would not be discouraged from a technical perspective as it would likely provide benefit to broader areas in the Strategy frontage.

7.2.5 Funding

The Do Nothing option does not involve any interventions to reduce flood or erosion risk to ODU 15 and therefore would not be eligible for FCERM-GiA. Any interventions to improve public health and safety, such as restricting access to eroding cliffs, would need to be sourced from non-GiA sources.

7.2.6 Local Impacts

There could be a range of local impacts in this location associated with reduced recreation and health and wellbeing in this location if the cliffs erode and access / coastal footpaths are lost. It is therefore recommended that non-FCERM interventions such as moving / reinstating footpaths are undertaken to prevent these impacts and ensure the area can continue to be used by the local community and visitors.

7.2.7 Summary

Table 7-2 below summarises the leading options in ODU 15.

Table 7-2: Summary of ODU 15 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Do Nothing	0	0

Alignment with SMP

The SMP policy in this area is for No Active Intervention and the National Economic Option fully aligns with this policy.

8. Strategy Management Zone 6

8.1 Overview

SMZ 6 (Milford on Sea) includes ODU 16, ODU 17 and ODU 18 and covers the 2.3km frontage between Hordle Cliff and the eastern end of Milford on Sea. Figure 8-1 below shows the location of the ODUs within SMZ 6.

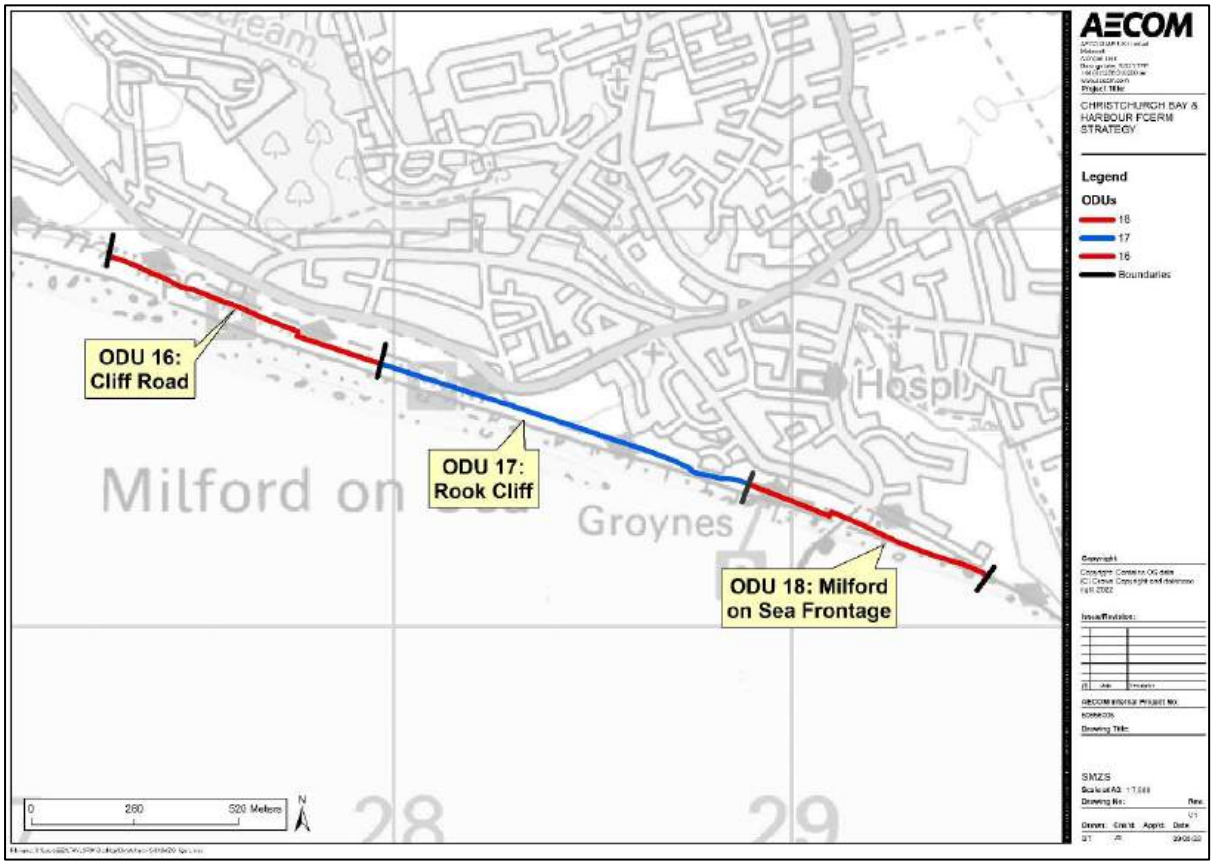

Figure 8-1: Location of ODUs within SMZ 6

SMZ 6 is an exposed, open coast environment. Hurst Spit is located immediately to the east of the zone. At the proximal end of Hurst Spit at its west end (immediately to the east of the ODU 18 boundary) there is a large rock revetment. This provides an anchor / strong point in the coastline for both the Milford on Sea frontage and also Hurst Spit.

The appraisal of options for managing Hurst Spit is being developed by an adjacent coastal Strategy, the Hurst Spit to Lymington Coastal Strategy (HS2L) which is currently in development and is being led by the Environment Agency. The interaction between SMZ 6 and Hurst Spit is a key consideration for the option appraisal in this location. Both project teams have collaborated on the development of options for the spit to ensure a joined up and cohesive approach is recommended. It has been agreed that the baseline stance for the appraisal in SMZ 6 is that the revetment at the root of Hurst Spit will be kept in place throughout the duration of the Strategy appraisal period.

In SMZ 6 the elevation reduces moving from the west to the east, with a high cliff line at Hordle Cliff in ODU 16, gradually transitioning to lower lying land at the eastern end of ODU 18. The main risk in this area is from coastal erosion, however, there are localised areas at risk from wave overtopping in the eastern part of the zone. There is also a risk of tidal inundation to the eastern part of Milford on Sea coming from behind Hurst Spit via Sturt Pond / the Keyhaven direction. Behind the cliff line / coastal defences there is extensive development with many residential and non-residential properties and key infrastructure such as roads. Much of this would be at risk from coastal erosion / flooding if nothing is done to manage the risks.

There are a variety of defences in SMZ 6 including concrete seawalls, rock revetments and groynes (rock and timber), primarily in ODUs 17 and 18. ODU 16 is largely undefended with beach huts located at the top of the beach / cliff toe. A significant failure of the seawall occurred recently at ODU 17 at Westover and emergency

works have since been undertaken to protect the coastline where the wall had failed and to stabilise the remaining sections of wall.

There is a beach in front of the defences for most of this unit with a dominant direction of sediment movement from west to east. The currently undefended and eroding section of cliffs to the west of SMZ 6 supplies beach material to the frontage. The SMP estimated the existing supply of sediment from the west to be in the order of 3,000m^3 per year. Despite the supply of material from the west, the beach in SMZ 6 has been eroding over time, reducing the capability of the beach to provide protection to the toe of the defences. The erosion of the beach is thought to be the main contributing factor for the seawall failure at Westover. Periodic beach replenishment is undertaken in ODU 18 to top up beach levels to help protect the toe of the defences, but overall there still remains a net erosion trend. Typically around 2,500m^3 of material is placed at Milford on Sea annually, funded through NFDC annual revenue budgets.

The SMP policy in SMZ 6 varies by location and more details are provided in the separate sections for each area below. In summary the SMP policy for ODU 16 is for Managed Realignment in the short, medium and long term. In ODU 17 the policy is for Hold the Line in the short, medium and long term, and in ODU 18 the policy is Hold the Line in the short term, but transitions to Managed Realignment in the medium and long term.

The full length of the unit is fronted by a marine SPA designation and in the west part of the unit the cliffs are designed as a SSSI due to their geological importance.

8.2 ODU 16 – Cliff Road

ODU 16 spans over 700m between the Hordle beach huts and the west end of the defences at Rook Cliff. The majority of ODU 16 does not currently have any coastal defences and the beach in-front of the cliffs provides the main defence to the cliff toe. At the eastern end of the unit there is a wall and groynes providing localised protection.

There are beach huts located at the top of the beach / along the lower section of the cliff in this unit. The cliffs and beach are used extensively for recreation and amenity. In the past a significant number of beach huts have been lost along this frontage due to erosion of the beach causing instability of the cliff and during storm events, such as the 2013/2014 winter storms. This process is ongoing with further beach huts currently at risk of imminent loss. Inland of the cliffs is the B3058 main road and properties. The main risk is from coastal erosion although the risk to property is mainly expected to occur between 2074-2124. Over the next 100 years the total number of properties at risk of erosion is estimated to be 238, leading to total PV damages for this ODU of just over £7.4million.

The SMP policy for this area is Managed Realignment in the short, medium and long term. The intent of this policy is to maintain the road (Cliff Road) and properties but with a possible future need for further refinement beyond the period of the SMP. The recommended approach to implement this policy was construction of a local strong point to help control rates of erosion. The SMP refresh (2020) recommended that a detailed study was undertaken to re-examine and test the SMP policy in this location.

The dominant longshore drift direction on the beach in this location is from west to east and therefore any beach management activities, such as beach nourishment, that are undertaken in this unit have the potential to also benefit ODUs 17 and 18, as well as potentially provide a feed of material onto Hurst Spit further to the east.

The key features in ODU 16 are shown in Figure 8-2.

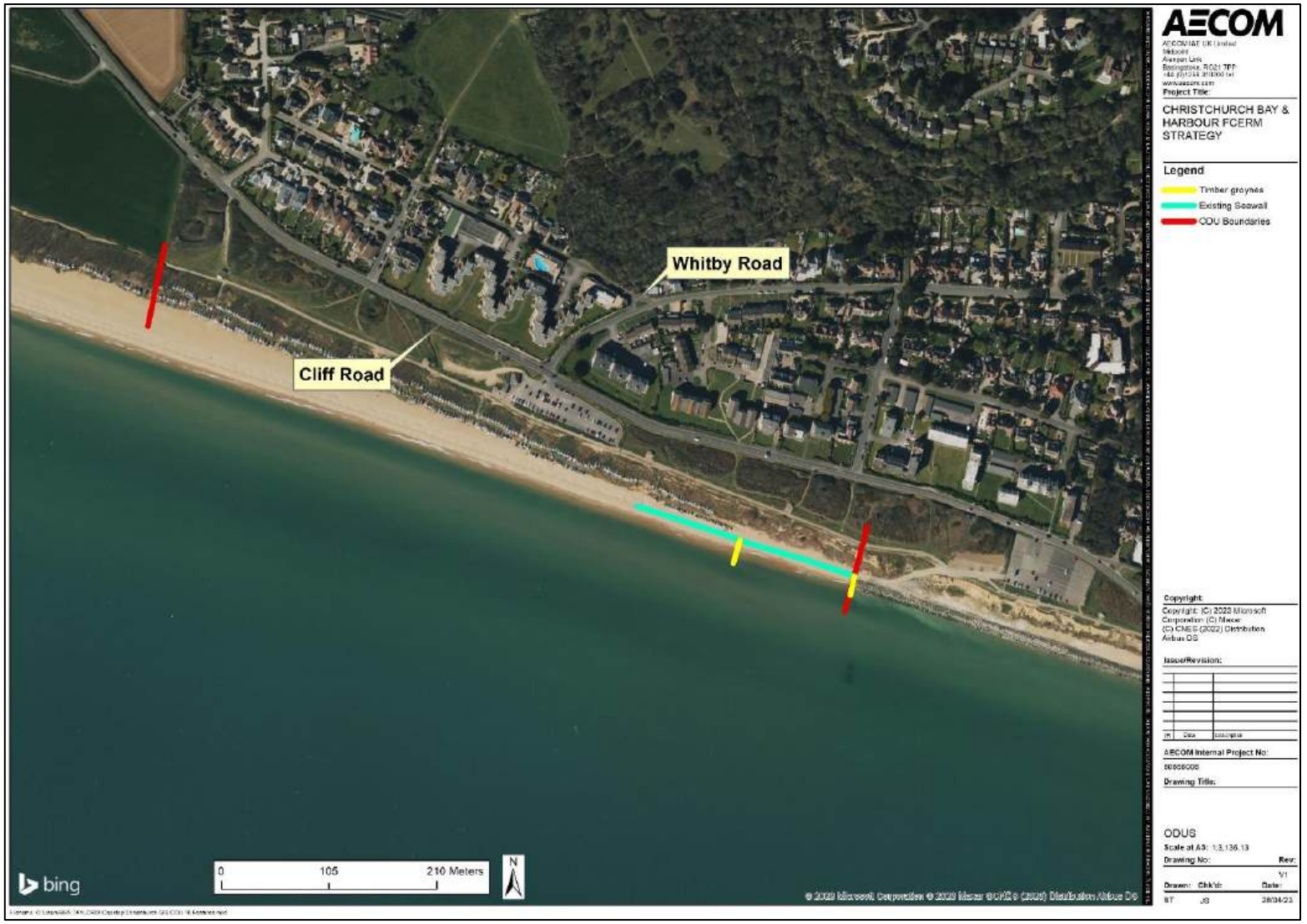

Figure 8-2: Key features in ODU 16

8.2.1 Short List of Options

The Short List of Strategic Options for ODU 16 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 8-3 shows a map of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 16 this would result in failure of the existing defences at the eastern end of the unit. Over time with projected sea level rise the cliff would be expected to erode leading to a loss of property in the future, particularly later in the appraisal period (epoch 2 and 3). As part of the Do Nothing scenario it would also not be viable for the beach huts to stay in their current position in the future as they would be next to an actively eroding cliff and will become unsafe.

The Do Nothing scenario is not a viable way forward, but it is important to include in the short list as it forms the baseline for the appraisal, against which all other options are compared. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum option would involve undertaking reactive small scale maintenance to the existing defences in the east part of the unit. This would typically take the form of patch and repair maintenance whereby localised damage to the defences is repaired on an ad-hoc basis. Beach management would not be undertaken as part of this option.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reach the end of their service life the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis.

Given that the majority of the ODU is undefended this option would not provide any economic benefits relative to the Do Nothing scenario. The undefended cliff line in the unit would still be subject to erosion at a similar point in time. The Do Minimum option also permits undertaking works to ensure health and safety compliance of defences that fail as part of this option. For example, clearance of failed defences and or removing access to unsafe areas.

Maintain

The Maintain Strategic option would involve undertaking maintenance to the existing defences and undertaking beach management to help sustain the beach level in this location.

The maintenance would be in the form of refurbishments to existing defences / replacing larger areas of the defence in the eastern part of the unit to ensure the structures can perform as intended with respect to flood and erosion risk. This option is likely to extend the service life of the existing defences by a longer duration than the Do Minimum option but would only provide defence in the east part of the unit.

In the west part of the unit the beach management would be the primary means of defending the cliff toe and beach huts. For the beach management it has been assumed that regular small scale renourishment would be undertaken (of the order of 2,500m^3 every two years which is similar to the current beach management approach in ODU 18).

Through the beach management activities and refurbishment of defences in the east part of the unit, there would continue to be a form of protection to the cliff toe which would help to slow rates of cliff erosion in the future. However, the erosion would not be stopped entirely. For the purposes of the economic appraisal it has been assumed that for the Maintain Option the Do Nothing erosion damages during epochs 1, 2 and 3 would be delayed to a later point in time in the appraisal period.

The beach management / small scale renourishment in this unit may provide benefit to areas in the east (ODU 17 and 18) although the quantities of material being added to the beach would be small.

Improve A

The intent of the Improve A option would be to provide a robust defence to the toe of the cliff along the full length of the unit, aiming to minimise the amount of erosion in the future.

This would be achieved through the construction of a new hard defence such as a rock revetment along the length of the unit at the toe of the cliff. This new defence would be constructed in epoch 1 (assumed between years 5-10 in the option costing) and would provide protection to the cliff toe and help to minimise the rate of erosion of the cliff. As part of the approach it may be necessary to remove the existing beach huts that are currently located along the base of the cliff to make space for the hard defence / rock revetment.

Managed Realignment A

The Managed Realignment approach would seek to control the rate of cliff erosion and transition the coastline position into a more sustainable position over time, creating a wider space for the beach to adjust to sea level rise. This would result in some erosion to the cliff top (more so than the Improve Option) but this would be controlled through the use of toe defences in strategic locations and beach nourishment. This option would allow some erosion of the open space between the cliff top and the Cliff Road but would aim to prevent the erosion progressing to the main road and beyond. This would minimise property loss but is likely to lead to erosion of the Hordle Cliff west car park in the future.

In epoch 1 this option would involve undertaking beach nourishment along the full frontage to provide the primary defence to the cliff toe. For costing purposes it has been assumed that the volume of material added to the beach would be approximately 100,000m^3. Further design work will be required after the Strategy to determine if this is an appropriate volume, and to determine placement location. There are a variety of placement options which could be explored during design and the nourishment does not need to be contained within the ODU 16 frontage only if required (for example it could be extended into ODU 15 depending on the required beach design).

In addition to the beach nourishment, at the base of the cliff beneath the junction between Cliff Road and Whitby Road a local strong point would be constructed (likely rock armour). This will need to be designed during concept / outline design but it is envisaged that it would be a rock structure approximately 50-100m in length. It would act to hold the position of the coastline in this location, providing a local anchor point for the cliff line to the west and east. The option includes successive beach nourishment interventions in epochs 2 and 3 to sustain the beach levels and control rates of erosion.

In the option costing it has been assumed that the initial capital interventions described above would be undertaken between years 5-10 in the appraisal period.

In addition to the FCERM benefits that this option would provide, the larger / wider beach would likely also ensure that the area could continue to be used for recreation / amenity purposes. As the toe of the cliff and cliff line erodes over time it may be possible to reposition the beach huts further inland (there is more scope to do this with this option compared to the Improve option). However, this is unlikely to be straightforward and there may be periods of time where the beach huts needs to be removed for health and safety reasons before being reinstated once the cliff has moved into a safe position and more space is available. The feasibility of moving the beach huts is uncertain with this option should it be taken forward then it is recommended that an adaptation plan for the beach huts is put in place to help manage any potential impacts.

Managed Realignment B

Managed Realignment B is the same overall approach as Managed Realignment A, except the initial interventions would be delayed until the start of epoch 2. In the option costing it has been assumed that the initial interventions would be undertaken in years 20-25 in the appraisal period. This would lead to more erosion of the cliff in the interim period and may make it more challenging to prevent the cliff from eroding further inland in the future. With this approach it is likely that greater investment would be required to reduce the rate of erosion in the future and therefore it has been assumed that a longer length of defence would be required for the strong point (150-200m) and an increased amount of beach nourishment material (50% increase; 150,000m^3).

Managed Realignment C

Managed Realignment C is the same overall approach as Managed Realignment A and B, except the initial interventions would be delayed further until approximately mid-way through epoch 2. In the option costing it has been assumed that the initial interventions would be undertaken in years 30-35 of the appraisal period. This would lead to more erosion of the cliff in the interim period. Based on the estimated rates of erosion from the

SMP erosion zones, the mid-point of epoch 2 is likely to be latest point in time that the intervention could be made, without threatening erosion of Cliff Road. With this approach it has been assumed that an even longer length of defence would be required for the strong point (250-300m) and an increased amount of beach nourishment material (100% increase; 200,000m^3) as more investment would likely be required when intervening to prevent further cliff erosion in the future.

Figure 8-3: ODU 16 Options

8.2.2 Economic Appraisal of Options

Cost benefit analysis

Table 8-1 below presents the economic costs, damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 16 cannot be ordered based on AEP because they are focussed on managing the erosion risk and have therefore been ordered according to the NPV. The Managed Realignment C option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

It is noticeable that Managed Realignment A and B also have an ABCR greater than unity. These options follow the same approach as Managed Realignment C but with the initial capital interventions occurring sooner, in either the first part of epoch 1 (Managed Realignment) or the start of epoch 2 (Managed Realignment B) rather than the mid-point of epoch 2.

Table 8-1: ODU 16 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Managed Realignment C	4,405	15	7,400	1.68	2,995	X
Managed Realignment B	5,069	15	7,400	1.46	2,331	
Managed Realignment A	5,612	15	7,400	1.32	1,788	
Maintain	1,791	4,398	3,017	1.68	1,226	
Do Nothing	-	7,415	-	-	-	
Do Minimum	469	7,415	0	-	-469	
Improve	7,954	0	7,415	0.93	-539	

Sensitivity tests

The main uncertainties with the options in this location relate to option cost, and changes to the estimated costs could influence the choice and viability of different options. Given the large role of beach nourishment in the Managed Realignment options, the specific cost of this intervention is likely to have an overweighted influence on the viability of these options as a whole and the selection process.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include generic cost uplift of 10% or 25% and also amended costs for the beach nourishment element of the options (see Appendix A).

The original beach nourishment cost applied in the cost estimates was £33.30 per m^3 of material which is considered to be a reasonable, mid-level estimate of nourishment costs at the Strategy level. However there could be potential to reduce this cost if local sources of material were to be used or with optimisations to the dredging / placement approach. In addition, smaller quantities of material or material with different characteristics (e.g. coarser material) could also be used to achieve a similar FCERM function. The sensitivity test on beach nourishment costs undertaken assumes a 50% cost reduction in the beach nourishment interventions.

The cost increase sensitivity tests of 10% and 25% have been applied to just the Managed Realignment C option to determine how the cost increase would alter the choice of leading options. The sensitivity tests show that with a 10% increase in costs, Managed Realignment C is the option that has the highest NPV and would therefore remain the provisional National Leading Economic Option. With a 25% increase in cost, the National Leading Economic Option would switch to Managed Realignment B. However, it is likely that scenarios where the cost of Managed Realignment C increased, the cost for Managed Realignment B would also increase.

In the sensitivity test focused on beach nourishment, the 50% reduction in beach nourishment costs has been applied to all options that include beach nourishment. As can be seen in Appendix A, the choice of the provisional National Economic Leading Option in this scenario would remain unchanged, however, the economic case of the each of the Managed Realignment options would improve and the cost required to deliver options with an intervention sooner (e.g. Managed realignment A or B) would reduce.

8.2.3 Social and Environmental Appraisal

Social Appraisal

Based on the feedback from stakeholders and the public to date during the Strategy development and engagement round 4, the key feedback for the ODU 16 frontage includes:

- Indicates general support for the wide range of defence measures included on the short list. Improvements to the cliff stability, groynes and beach nourishment had the most agree responses, with a rock revetment and seawall having the least (although these options still had more respondents agreeing than disagreeing).

Similar to the situation at Barton on Sea, there is an area of open space at the top of the cliff between the cliff top and Cliff Road. This area of land acts as a 'buffer' and the economic appraisal demonstrates that an intervention is not needed immediately to defend properties in this location. However, if funding can be found, the NFDC FCERM team have an aspiration to intervene sooner and to minimise the amount of erosion to the open space at the top of the cliff. This may reduce the risk of property damage in the future by retaining the buffer area.

For each of the options in this location there is likely to be social impacts associated with the beach huts. The options will either result in the loss of the beach huts through erosion or disruption to the beach hut owners due to either the beach huts being moved or removed. It is recommended that the local FCERM team works with the local community to develop an adaptation plan for the beach huts in this location.

Table 8-2 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key aspirations of key stakeholders / public and the FCERM team.

Table 8-2: ODU 16 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public / FCERM aspirations. Would result in extensive loss of property in the future and likely to negatively impact local community.
Maintain	Previous engagement from stakeholders / public suggests support for maintenance and repairs as well as beach management activities that would be included as part of this option. However, this option would still result in loss of property in the future and would only delay the onset of erosion.
Improve A	Overall a rock revetment in this location appeared to be supported during the previous engagement results but compared to other options it had a high proportion of respondents disagreeing with the approach (4/15). A rock revetment along the full length early on in epoch 1 could lead to loss of amenity of this area and would also likely involve removing the beach huts which may impact community support.
Managed Realignment A, B, C	Primary defence for this option is beach nourishment which had strong support during the previous engagement phase. A localised strong point (most likely a rock revetment) would also be on a smaller scale than the Improve A option. Cliff would erode in the future which may impact beach huts and therefore community support. The initial intervention of Managed Realignment A would be sooner than in Managed Realignment B and C, and therefore this approach may have better support / align with local aspirations. Likely to be social impacts associated with impacts to the beach huts with this option, however, this is the case with all options. Greater scope in these options (compared to Improve) to reposition beach huts further inland as cliff line erodes.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 8-3 below provides a summary of the appraisal results and indicates if there are any major negative impacts associated with any of the options which may make them unviable from an environmental perspective.

The Do Nothing / Do Minimum options could have negative impacts on most of the categories considered. This is due to the erosion risk with these options, leading to negative impacts across all the categories except biodiversity / geodiversity. For this category the lack of upgraded defence interventions in the future would enable natural coastal processes to resume, leading to erosion of the cliff face and a potential benefit to the SSSI.

The Maintain option could have similar impacts to Do Minimum. Whilst the rate of erosion would be slowed with Maintain, it would only delay the erosion of assets on the cliff top and therefore in the long term would be expected to have negative impacts across a range of categories.

The Improve options could provide a positive benefit to the vast majority of categories by reducing the erosion risk. For example, these options could lead to major positive impacts in climate change, historic environment, and land, soil and water resources, population and communities and transport and movement. New hard defences such as a rock revetment could lead to negative landscape impacts (given that the area is generally undefended currently).

No major negative impacts are expected with the Managed Realignment options, and they could lead to positive impacts in most categories. This includes potential positive impacts in biodiversity / geodiversity as erosion of the cliff could lead to exposures of interest in the SSSI. The construction of the local strong point as part of the Managed Realignment option would not be in the SPA designation (but would be in proximity to it). Construction impacts could be mitigated and opportunities for biodiversity net gain could be explored as part of the Managed Realignment options. There is a potential negative impact in the transport and movement category due to potential erosion of the car park.

Table 8-3: Summary of potential environmental impacts in ODU 16

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Could lead to major negative impacts across all categories except biodiversity / geodiversity where a positive impact would be anticipated.
Maintain	Similar negative impacts as Do Nothing / Do Minimum, except delayed so considered minor negative in SEA.
Improve A	Could lead to positive impacts across majority of categories due to reduction in erosion risk. Potential for negative landscape impact.
Managed Realignment A-C	Could have positive impacts across majority of categories as erosion risk would be better controlled along the length of the frontage. Minor positive benefits could also occur to the SSSI as whilst erosion would be controlled, it would still occur that could lead to exposure of features of interest in this location. Construction of local strong point in proximity to SPA but not within it and mitigation could be undertaken. Potential for negative impact in transport and movement category due to potential erosion of car park.

8.2.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified Managed Realignment C option as being the National Economic Leading Option.

The SEA has not identified any major negative impacts for this option and there are expected to be positive environmental impacts, including the potential for improvements to the condition of the SSSI in the future.

The primary defence measure as part of this option is beach nourishment and the social appraisal indicates that this measure had a high level of support during the previous engagement phase. The Managed Realignment C option would involve erosion of the cliff line in the future and the potential impact that this may have on the beach

huts currently located along the foot of the cliff could impact local community support for this option. The alternative options on the short list would all also have impacts on the beach huts and therefore it is not considered to be a determining factor for the selection of options. However if Managed Realignment C is taken forward, it is recommended that an adaptation plan for the beach huts is put in place to help manage any potential impacts.

Based on the above points the Managed Realignment C option is confirmed as the National Economic Leading Option. Managed Realignment C is in line with the SMP policy for the area and is largely based on its recommendations (e.g. using a strong point to help manage rates of erosion). From a strategic perspective, the placement of beach material in ODU 16 is also likely to have a beneficial impact on beach levels downdrift, in ODUs 17-18.

Local Aspirational Leading Option

The initial capital intervention for Managed Realignment C would not be until the mid-point of epoch 2. There is an aspiration to intervene sooner if funding can be secured and therefore a Local Aspirational Leading Option has also been selected as being either Managed Realignment A or Managed Realignment B.

Managed Realignment A and B follow the same overall approach as Managed Realignment C. However, the first capital intervention would be much sooner, either in the first part of epoch 1 (Managed Realignment A) or the start of epoch 2 (Managed Realignment B).

These options would meet the aspiration to intervene sooner in this location and have therefore been identified as the Local Aspirational Leading Option. The timing of the first intervention and whether to follow Managed Realignment A or Managed Realignment B would be determined by funding availability, specifically whether non-GiA funding could be found and the timing of these contributions.

Given that Managed Realignment A has the earliest intervention, this is the initial option that NFDC will aim for, but if funding cannot be secured for this option, then the Local Aspirational Option would revert to Managed Realignment B. Intervening sooner reduces the funding shortfall but provides less time to find the finding amount required to deliver the option.

The upper limit of GiA funding for Local Aspirational Leading Options is capped at the amount available for the National Economic Leading Option.

8.2.5 Funding

Partnership Funding

Indicative Partnership Funding calculations have been undertaken for the first capital intervention for the Managed Realignment C option (National Economic Leading Option) and Managed Realignment A and B options (Local Aspirational Leading Options). The indicative Partnership Funding scores are provided in Table 8-4 below.

As can be seen, the National Economic Leading Option (Managed Realignment C) and the Local Aspirational Leading Options (Managed Realignment A / Managed Realignment B) have Partnership Funding scores between 19-29%. Each of the options would require significant contributions to be deliverable (between £3.2-8.3million). The maximum amount of GiA available for the scheme is estimated to be just over £1.9million, for the Managed Realignment C approach. Whilst this option would be eligible for the highest amount of GiA, this option would also require the largest contribution as it has the largest / longest local strong point and highest volume of beach nourishment. Therefore the advantage of delaying the initial scheme is offset by the increased investment required to deliver a larger defence to protect Cliff Road.

Within the context of the overall scheme cost the reduction in FCERM-GiA availability between the National Economic Leading Option (Managed Realignment C) and the Local Aspirational Leading Options (Managed Realignment A and B) is small. This indicates that if funding contributions can be found sooner, then the Local Aspirational Leading Options are a viable approach and would not result in a significant amount of potential GiA for a scheme not being used.

Table 8-4: Indicative Partnership Funding Scores for ODU 16

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention*
National Economic Leading Option: Managed Realignment C	10,220	1,780	12,00	17,552	65 years	19%	1,932	8,288
Local Aspirational Leading Option: Managed Realignment B	7,371	1,981	9,352	11,690	80 years	21%	1,564	5,807
Local Aspirational Leading Option: Managed Realignment A	4,523	2,010	6,533	8,957	90 years	29%	1,301	3,221

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

Backup Option if funding cannot be secured

Additional funding is required to deliver either Managed Realignment C or Managed Realignment A/B options and this presents a risk to the delivery of these options. If the funding cannot be secured then the options could not be delivered. If this were to be the case, then it is recommended that funding opportunities for the Maintain option are sought instead.

This option has a lower present value cost (estimated to be approximately PV £1.8million) that is comprised of successive defence refurbishments and ongoing beach management. The one-off cost of each intervention would be expected to be much lower than the capital schemes associated with the National Economic and Local Aspirational options and therefore funding could potentially be more achievable to secure.

The Maintain option would not deliver the same level of benefits as the Managed Realignment options and would result in extensive loss of property in the future. However relative to the Do Nothing scenario, it would help to delay the onset of erosion to properties at the top of the cliff and would provide time for an adaptation plan to be implemented. If no funding can be secured for options in ODU 16, the approach would revert to the baseline Do Nothing scenario.

8.2.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 8-1, the National and Local Aspirational Options is also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 8-1. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £26million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National or Local Options could help avoid a proportion of these damages to the local economy (creating local economic benefits), although there is uncertainty as to the extent of the benefits to the beach huts and car park. When these local benefits are considered, it strengthens the economic case of this option considerably.

8.2.7 Summary

Table 8-5 below summarises the leading options in ODU 16.

Table 8-5: Summary of ODU 16 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Managed Realignment C: control rate of cliff erosion with major beach nourishment scheme and local strong point from mid-way through epoch 2	4,405	1,932
Local Aspirational	Managed Realignment A / B: as Managed Realignment C, except an earlier intervention (epoch 1 for Managed Realignment A and epoch 2 for Managed Realignment B).	5,069 – 5,612	1,301 - 1,564
Backup	Maintain: refurbish existing defences and undertake small scale beach nourishment on a regular basis	1,759	To be determined during subsequent appraisal

Alignment with SMP

The SMP policy in this area is Managed Realignment, with the intent to construct a local strong point to help control rates of erosion. The National Economic and Local Aspirational options fully align with this policy.

8.3 ODU 17 – Rook Cliff

ODU 17 is located between the start of the Rook Cliff defences and the Hurst Road West car park (just to the east of the White House). There are a variety of defences in ODU 17 including a concrete seawall fronted by a rock revetment, timber groynes and rock groyne. The defence condition varies, with some defences being in a poor condition with a low residual life. Recent emergency work has been undertaken in this area to stabilise the defences following a failure at Westover.

The main land use landward of the coastal defences is a combination of car parks, coastal footpath and residential / non-residential properties. At the eastern end of the ODU the White House building is located immediately landward of the defences. The main risk in this location is from erosion and mainly in epoch 3. Over the next 100 years the total number of properties at risk of erosion is estimated to be 287, with the total PV damages for this area estimated to be over £11.5million.

The SMP policy for this area is to Hold the Line in the short, medium and long term. The SMP refresh (2020) recommended investigating options for future management (due to serious damage to defences during the 2019/20 storms) and potentially revisit the SMP policy subject to the outcome of the investigations.

The key features in ODU 17 are shown in Figure 8-4.

Figure 8-4: Key Features in ODU 17

8.3.1 Short List of Options

The Short List of Strategic Options for ODU 17 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 8-5 to Figure 8-7 show maps of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figures have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 17 this would result in failure of the existing defences at the base of the cliff, leading to erosion of the cliff toe and then retreat of the cliff top. Over time with projected sea level rise the rate of erosion would be expected to increase. This scenario would lead to a loss of property in the future, particularly later in the appraisal period (epoch 2 and 3).

The Do Nothing scenario is not a viable way forward, but it is important to include in the short list as it forms the baseline for the appraisal, against which all other options are compared. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum option would involve undertaking reactive small scale maintenance to the existing defences. This would typically take the form of patch and repair maintenance whereby localised damage to the defences is repaired on an ad-hoc basis. Beach management would not be undertaken as part of this option.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reach the end of their service life the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis.

The Do Minimum option does not have any economic benefit relative to the Do Nothing scenario in this unit given that there is no erosion risk to properties during epoch 1. Over the longer term Do Minimum would not be able to extend the length of the existing defences for long enough to have an economic impact.

The Do Minimum option also permits undertaking works to ensure health and safety compliance of defences that fail as part of this option. For example, clearance of failed defences and or removing access to unsafe areas.

Maintain

The Maintain Strategic option would involve undertaking proactive maintenance to the existing defences at the toe of the cliff. The maintenance would typically be in the form of capital refurbishments to existing defences / replacing larger areas of the defence to help the structures can perform as intended with respect to flood and erosion risk. This option is likely to extend the service life of the existing defences by a longer duration than the Do Minimum option.

Recent emergency works were undertaken to stabilise the recently failed section of seawall at Westover by placing new rock armour. The Maintain option does not include the construction of a new defence to replace the failed seawall defence section but does include for maintenance of the rock revetment that was put in place where the seawall failed.

The long term stability of the existing defences is uncertain in this location given the recent failure and lowering beach levels. The Maintain option would involve refurbishing the existing defence via a series of interventions over time, but this may not be sufficient to provide robust long term robust protection to the cliff toe. A new more substantial defence designed to accommodate further falls in beach levels and rising sea levels may be required (see Improve options). Residual damages from erosion have therefore been included for the Maintain option to reflect this uncertainty in the economic appraisal.

Improve A

Improve A would aim to minimise the amount of erosion to Rook Cliff and would achieve this by upgrading the defences at the cliff toe. Should the leading options be implemented in ODU 16 to the west there could be an

increased feed of material from the west due to the beach nourishment scheme and therefore the groynes in ODU 17 would be used to capture this material.

The initial intervention would be undertaken in the first half of epoch 1. In the option costing it has been assumed that this would occur between the years 5-10 in the appraisal period. This would involve constructing an upgraded rock revetment along the majority of the frontage that would be designed to accommodate variable beach levels and sea level rise. It has been assumed that the rock revetment would not be required in the section of frontage that was recently stabilised with rock given the long existing residual life of this part of the defence system (>20 years). In addition, rock or timber groynes would also be constructed to help capture beach material (from ODU 16).

In epoch 3, costs have been included to refurbish the new defences (rock revetment) given the exposed nature of this frontage and higher potential for damage to occur.

In the economic appraisal it has been assumed that this approach would minimise the rate of cliff erosion and would defend all property in ODU 17.

Improve B

It is recognised that the economic case for Improve A is likely to be marginal and therefore Improve B has also been included in the appraisal. Improve B follows the same approach as Improve A, but the initial capital interventions would be delayed until the start of epoch 2. In the option costing it has been assumed that the capital interventions would occur between years 20-25 in the appraisal period.

In the interim period during epoch 1 small scale maintenance would be undertaken on the existing defences with the aim of extending the life of the assets until the new scheme is delivered in epoch 2. There is uncertainty as to whether this approach will be sufficient to extend the life of the assets until epoch 2 and it will therefore be important to undertake regular defence condition assessments to develop an understanding of how the condition of the defences is changing over time. This will inform decisions on when interventions can reasonably be delayed until and which adaptive pathway to take through the options when delivering the Strategy. It acknowledged that the risk of the defences failing in epoch 1 is increased with this option (relative to Improve A) but it is important to include the Improve B option in the appraisal as there may not be a strong enough economic case to intervene with the timings outlined in Improve A.

Improve C

Improve C is the same overall approach as Improve A and B, however the initial capital intervention to upgrade the toe defences would be delayed even further until the mid-point of epoch 2. In the option costing it has been assumed that the capital interventions would occur between years 30-35 in the appraisal period.

It is very unlikely that the existing toe defences could be maintained until the mid-point of epoch 2 with just small scale maintenance, and therefore this option also includes a refurbishment of the existing toe defences during the first part of epoch 1 (assumed to occur between 5-10 years in the option costing). By delaying the main investment to upgrade the defences until the mid-point of epoch 2, the economic case of the option improves because the investment is at a point in time even closer to when the damages would be expected to occur.

As with the Improve B option, it will be important to undertake regular defence condition assessments to develop an understanding of how the condition of the defences is changing over time before the first major intervention. This will inform decisions on when interventions can reasonably be delayed until and which adaptive pathway to take through the options when delivering the Strategy.

Managed Realignment A

Managed Realignment A would aim to transition the coastline into a new position in the centre of the unit between the apex of Park Lane Road and the White House. This would provide more space in front of the cliff line to accommodate a beach. The beach would provide a defence to the cliff toe and would also improve recreation / amenity opportunities at the location. The existing strong points at either end of the ODU at the western end of Rook Cliff and the White House would be upgraded. These strong points would provide two anchor points for the coastline to evolve between, likely creating a small embayment with the cliff line eroding into the open space to the south of Park Lane.

This approach is in line with the details of the SMP policy for the area and the first intervention would occur during the mid-point of epoch 1 (assumed to occur around year 10 of the appraisal period in the option costing). This would involve:

- Upgrade to the existing rock revetments at the western end Rook Cliff and the White house (the strong points).
- Removal of the rock / seawall in the areas where the cliff is to be realigned.
- A beach nourishment to increase the beach volume in the area to be realigned. For costing purposes it has been assumed that approximately 70,000m^3 of material would be placed here. However this would need to be recalculated / revisited during outline design as part of a formal beach design process.
- Construction of a rock groynes to help retain beach material in this location. There is potential to re-use rock from the existing rock revetment in the part of the frontage to be realigned.

To help manage the rate of cliff erosion over time there would need to be successive beach nourishment interventions as part of this option. Whilst the cliff would be allowed to erode into the open space to the south of Park Road, through beach management the rate of erosion would be controlled and the aim would be to prevent erosion of the road itself and the properties behind. The economic benefits of this option are therefore of a similar magnitude to the Improve options.

Managed Realignment B

Managed Realignment B would involve the construction of nearshore breakwaters to help retain beach material in this location and control rates of erosion. This would coincide with undertaking beach nourishment as well as refurbishing and undertaking ongoing maintenance to the existing rock revetment. In the costing it has been assumed that this scheme would be undertaken during the mid-point of epoch 1 (around year 10 of the appraisal period).

The design details for the breakwaters would need to be determined during concept / outline design if this option were to be taken forward. The design would need to consider the preferred beach response to achieve the objective of this option – whether that is to create a limited beach response, to create salients or tombolos.

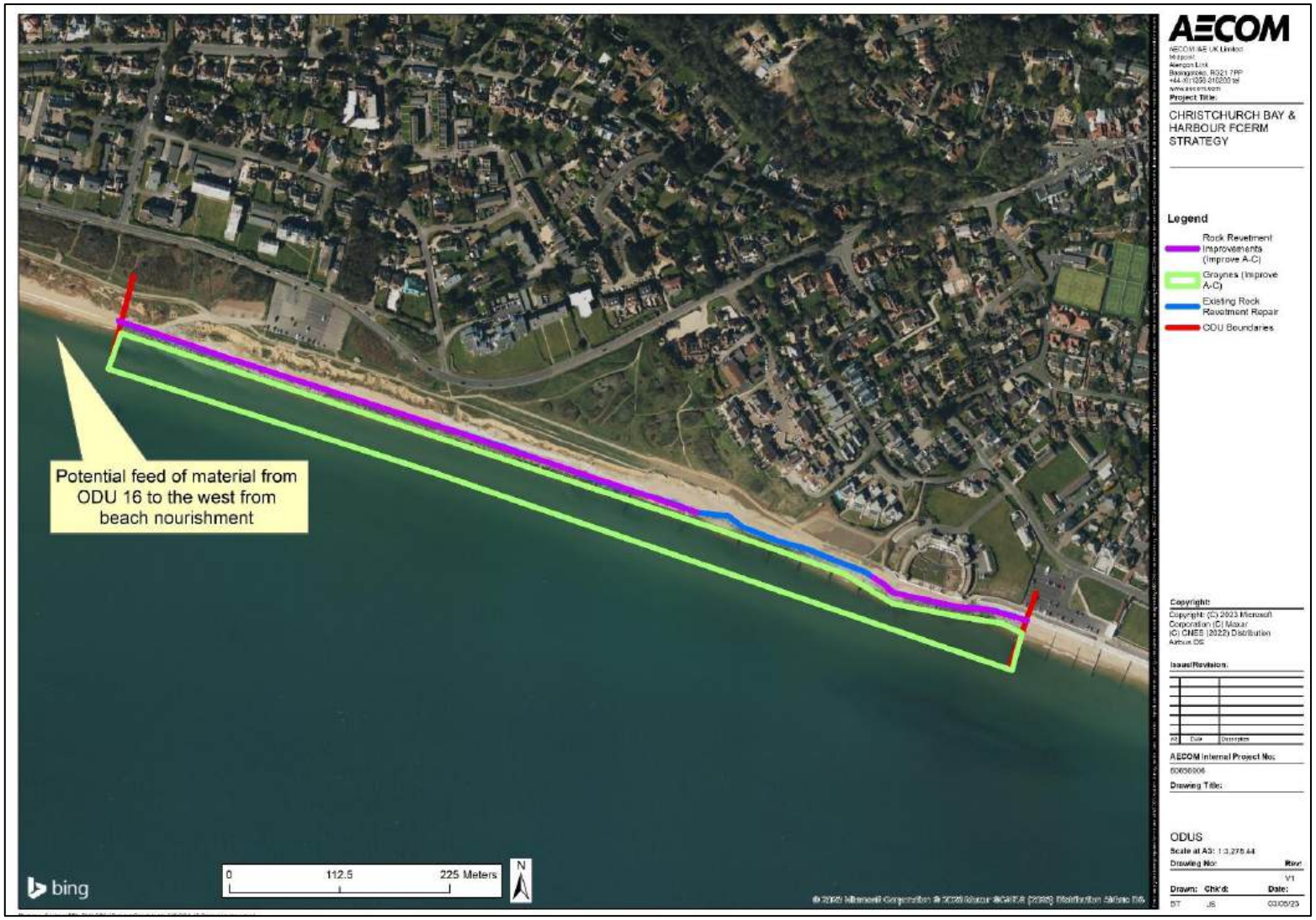

Figure 8-5: ODU 17 Improve Options

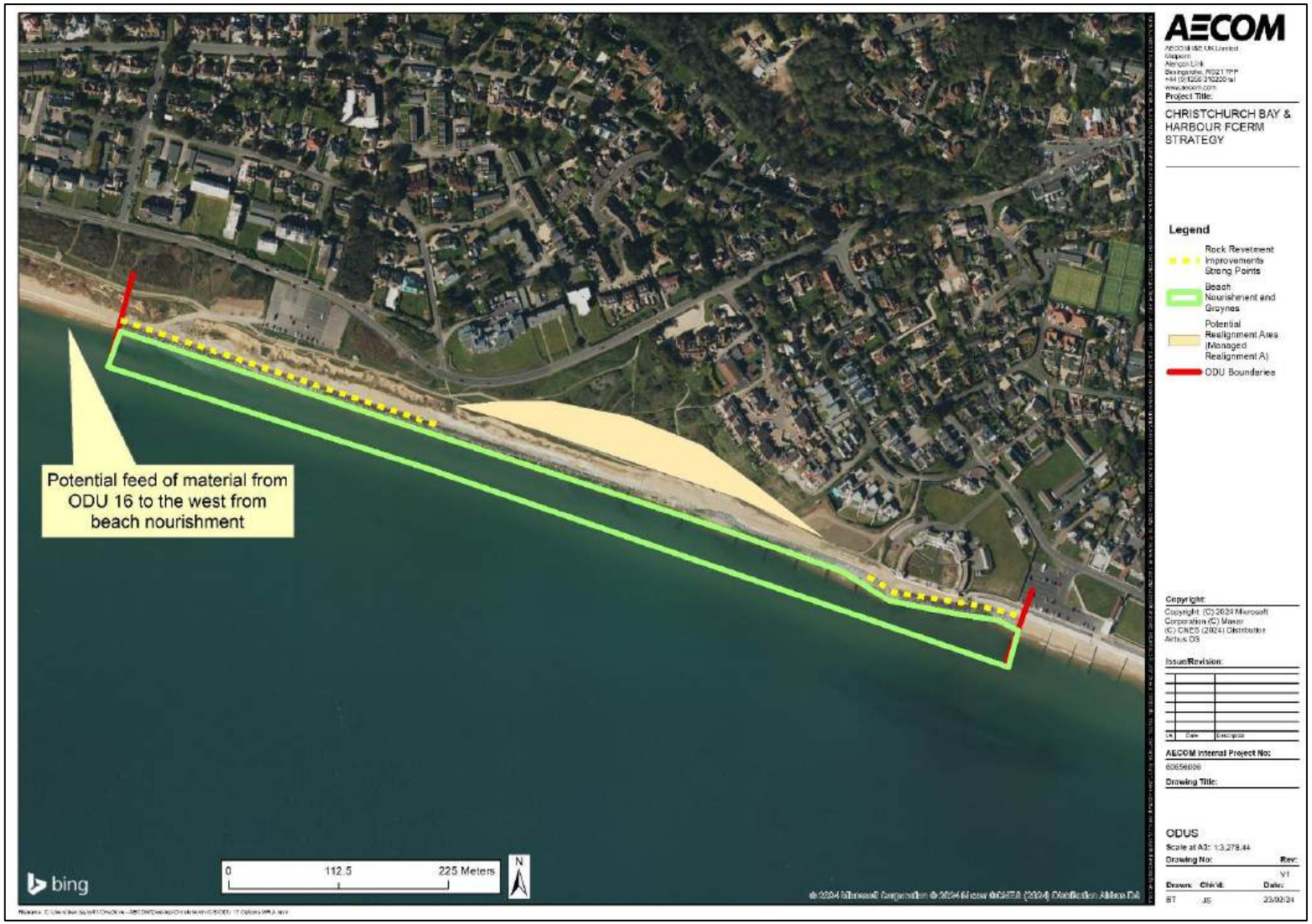

Figure 8-6: ODU 17 Managed Realignment A

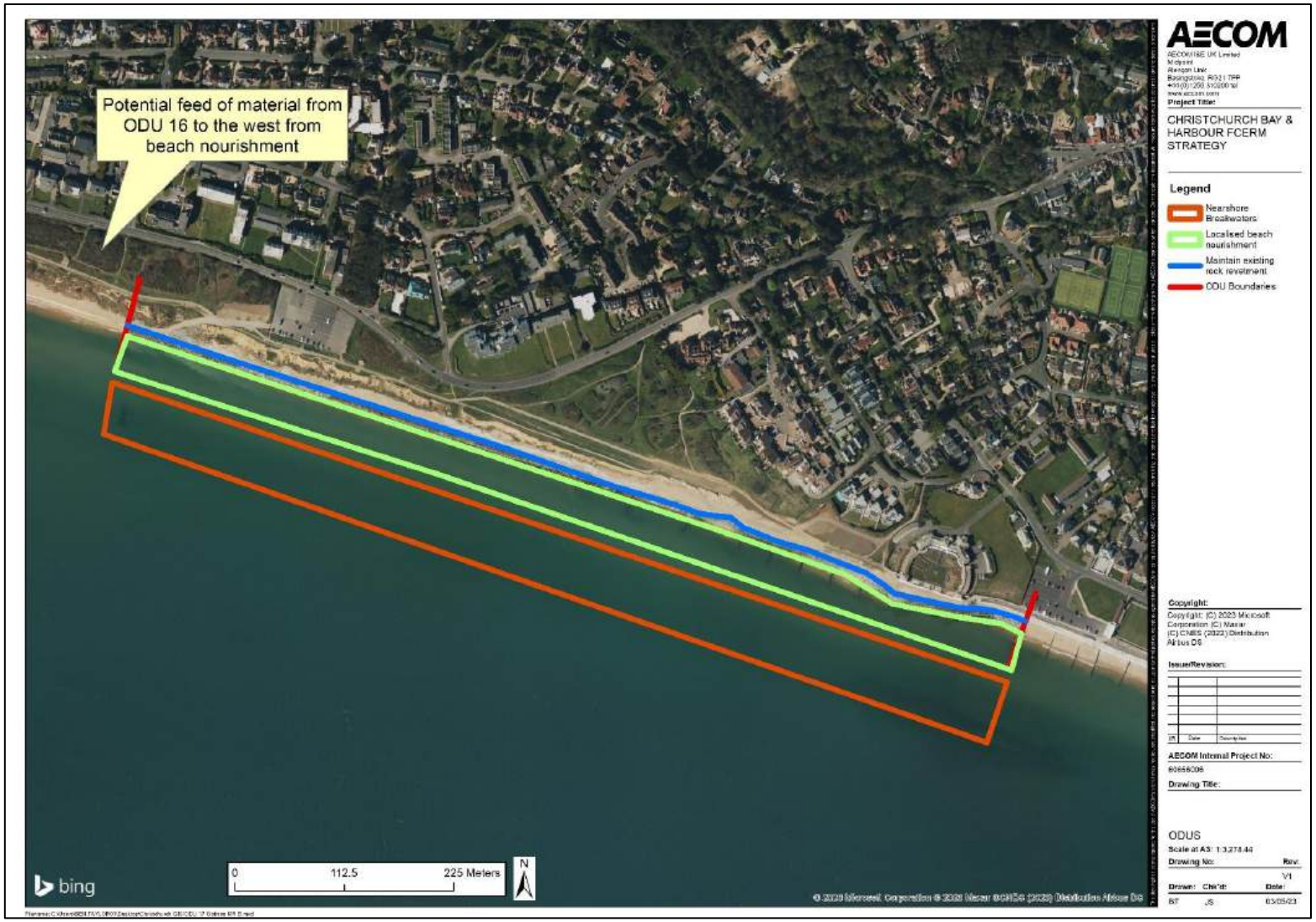

Figure 8-7: ODU 17 Managed Realignment B

8.3.2 Economic Appraisal of Options

Cost benefit analysis

Table 8-6 below presents the economic costs of each option, the economic damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 17 cannot be ordered based on AEP because they are focussed on managing the erosion risk and have therefore been ordered according to the NPV. The Improve C option has the highest NPV and is therefore selected as the provisional National Economic Leading Option.

Table 8-6: ODU 17 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve C	9,055	0	11,516	1.27	2,461	X
Improve B	9,376	0	11,516	1.23	2,140	
Maintain	4,110	7,294	4,222	1.03	112	
Improve A	11,471	0	11,516	1.00	45	
Do Nothing	-	11,516	-			
Do Minimum	241	11,516	0	-	-241	
Managed Realignment A	14,021	1,424	10,092	0.72	-3,929	
Managed Realignment B	17,269	0	11,516	0.67	-5,753	

Sensitivity tests

The main uncertainties with the options in this location relate to option cost, and changes to the estimated costs could influence the choice and viability of different options. A sensitivity test has been undertaken to test the choice of options with a cost uplift of 10% and 25% for Improve C (the provisional National Economic Leading Option). Appendix A provides a summary of the results.

The sensitivity tests show that with a 10% and 25% increase in costs, the choice of option would change to Improve B. However, given that each option has broadly the same interventions (just at different times in the appraisal period), in a situation where the cost of Improve C increased, there would also likely be similar increases in cost for Improve B. In the event that costs for both options increases by the same percentage, Improve C would be retained as the National Economic Leading Option. The choice of the Improve C as the provisional National Economic Leading Option has therefore not been changed as a result of the sensitivity tests.

8.3.3 Social and Environmental Appraisal

Social Appraisal

Based on the feedback from stakeholders and the public to date during the Strategy development and engagement round 4, the key feedback for the ODU 17 frontage includes:

- Indicates general support for the wide range of defence measures included on the short list. The following measures had the most ‘agree’ responses; cliff stabilisation and drainage, rock revetment, groynes and maintenance / repairs.
- Rock revetment was the measure identified as most important by the highest number of respondents.

Similar to the situation at ODU 16, there is an area of open space at the top of the cliff between the cliff top and Cliff Road. This area of land acts as a ‘buffer’ and the economic appraisal demonstrates that an intervention is not needed immediately to defend properties in this location. However, if funding can be found, the NFDC

FCERM team have an aspiration to intervene sooner and to minimise the amount of erosion to the open space at the top of the cliff. This may reduce the risk of property damage in the future by retaining the buffer area.

Table 8-7 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key aspirations of key stakeholders / public and the FCERM team.

Table 8-7: ODU 17 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public / FCERM aspirations. Would result in extensive loss of property in the future and likely to negatively impact local community.
Maintain	Previous engagement from stakeholders / public suggests strong support for maintenance and repairs that would be included as part of this option. However, this option would still result in loss of property in the future and would only delay the onset of erosion. Could have more support as part of an Improve option.
Improve A-C	The Improve options are focused on improving the rock revetment at the toe of the cliff and the groynes, both of which appeared to have a high level of support in the feedback from the previous round of engagement.
Managed Realignment A, B	The defence measures that would be used to implement the managed realignment options had more 'agree' than 'disagree' responses during the previous round of engagement. However, it is unclear if there would be support for the overall intent of this option as it would involve realigning the coastline position. It is likely that there would be some opposition to the realigning the coastline in this position.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 8-8 below provides a summary of the appraisal results and indicates if there are any major negative impacts associated with any of the options which may make them unviable from an environmental perspective.

The Do Nothing / Do Minimum options could have negative impacts on most of the categories considered. This is due to the increased erosion risk with these options, leading to potential negative impacts across all the categories except biodiversity / geodiversity. For this category the lack of upgraded defence interventions in the future would enable natural coastal processes to resume, leading to erosion of the cliff face and likely potential benefits to the SSSI. The Maintain option could also have minor negative impacts on categories such as population and communities, but impacts are uncertain given the more uncertain coastal evolution as part of this option.

The Improve options could provide a positive benefit to the vast majority of categories by reducing the erosion risk. For example, these options could lead to major positive impacts in climate change, landscape, historic environment, population and communities and transport and movement. A neutral impact would be expected in the biodiversity / geodiversity category. These options would defend the cliff toe and limit further erosion of the cliff however the SSSI is currently in an unfavourable condition in this location so this would not be making the condition worse relative to the baseline. There would be opportunities to explore BNG as part of these options, for example creating intertidal habitats as part of the works to upgrade the rock defences. No major potential negative impacts were identified in the SEA with the Improve options.

The Managed Realignment A option could lead to both positive and negative impacts. Minor negative impacts could occur for a range of categories including population and communities and landscape due to the loss of the open space landward of the existing defence line. The Managed Realignment A option is likely to be favourable from a geodiversity perspective as the managed realignment approach would allow part of the cliff to erode, which could have a positive impact on the condition of the SSSI. No major potential negative impacts have been identified for this option.

The Managed Realignment B option is likely to have similar impacts to the Improve Options but could have a negative impact in the landscape category due to use of nearshore breakwaters.

Table 8-8: Summary of potential environmental impacts in ODU 17

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Could lead to major negative impacts across all categories except biodiversity / geodiversity where a positive impact would be anticipated due to erosion of the cliff face and improvement to SSSI.
Maintain	Uncertain impacts for majority of categories due to uncertainty around long term coastal evolution as part of this option. Could have minor negative impacts on population and communities.
Improve A-C	Positive impacts could occur across vast majority of categories due to reduction in erosion risk.
Managed Realignment A	Could have both minor positive and minor negative impacts. Minor negative impacts could occur in the population and community and landscape categories. Positive impact on biodiversity / geodiversity associated with erosion of the coastline that could have a positive benefit to the SSSI.
Managed Realignment B	Similar positive impacts and rationale to the Improve Options. However, potential negative impact in the landscape category due to use of nearshore breakwaters.

8.3.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified Improve C option as being the National Economic Leading Option.

The SEA has not identified any major negative impacts for this option. There could be a minor negative impact associated with minimising erosion of the cliff face. However, the SSSI is currently in an unfavourable condition and the option would not be making the condition worse.

The primary defence measure as part of this option is a rock revetment and the social appraisal indicates that these measures had a high level of support during the previous engagement phase.

Based on the above points the Improve C option is confirmed as the National Economic Leading Option. Improve C is in line with the intent of SMP policy for the area (Hold the Line) however, it would involve holding the position of the current defences rather than creating a setback defence alignment. Should the Improve C option be taken forward for implementation it is recommended that the details of the SMP policy are revisited as part of the SMP refresh process.

Local Aspirational Leading Option

The initial capital intervention / upgrade for Improve C would not be until the mid-point of epoch 2. There would be a capital refurbishment of the existing defence sooner than this, but this would primarily be focussed on reducing the likelihood of the defence failing rather than increasing the standard of the defence and robustness against sea level rise. There is an aspiration to intervene with the main upgrade sooner than the mid-point of epoch 2 if funding can be secured and therefore a Local Aspirational Leading Option has also been identified; either Improve A or Improve B.

Improve A and B follow the same overall approach as Improve C. However, the first capital intervention / upgrade would be much sooner, either in the first part of epoch 1 (Improve A) or the start of epoch 2 (Improve B). These options would meet the aspiration to intervene sooner in this location and have therefore been identified as the Local Aspirational Leading Option. The timing of the first intervention and whether to follow Improve A or Improve B would be determined by funding availability, specifically whether non-GiA funding could be found and the timing of these contributions. The upper limit of GiA funding for Local Aspirational Leading Options is capped at the amount available for the National Economic Leading Option.

There are potential efficiencies that could be found if the timing of the upgrade in ODU 17 were to coincide with the upgrade / initial capital intervention in ODU 16. Both areas could be delivered as one scheme which could lead to efficiencies in appraisal costs, procurement and construction costs (e.g. need for temporary works, site compound costs etc.).

8.3.5 Funding

Partnership Funding

Indicative Partnership Funding calculations have been undertaken for the first capital intervention and whole life maintenance for the Improve C option (National Economic Leading Option) and Improve A and B options (Local Aspirational Leading Options). The indicative Partnership Funding scores are provided in Table 8-9 below.

Note that for Improve C, the Partnership Funding score shown in Table 8-9 is for the intervention to upgrade the defences in the mid-point of epoch 2. The score does not include the costs associated with refurbishing the existing defences in epoch 1. Given the setback distance of most properties in this unit and the short benefit duration period of the initial capital refurbishment in epoch 1, there are likely to be very limited economic benefits / GiA associated with this refurbishment when considered in isolation.

As can be seen, the National Economic Leading Option (Improve C) and the Local Aspirational Leading Options (Improve A / Improve B) have Partnership Funding scores between 15-20%. Each of the options would require significant contributions to be deliverable (between £11.2-14.8million). The maximum amount of GiA available for the scheme is estimated to be just over £3.4million, for the Improve C approach.

The reduction in FCERM-GiA availability between the National Economic Leading Option (Improve C) and the Local Aspirational Leading Options with the earliest intervention (Improve A) is approximately £1million.

Table 8-9: Indicative Partnership Funding Scores for ODU 17

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention*
National Economic Leading Option: Improve C	17,471	809	18,280	30,711	65 years	20%	3,457	14,014
Local Aspirational Leading Option: Improve B	17,471	823	18,294	19,757	80 years	15%	2,676	14,795
Local Aspirational Leading Option: Improve A	13,625	832	14,458	14,826	90 years	18%	2,400	11,225

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

Backup Option if funding cannot be secured

Additional funding is required to deliver either the Improve C or Improve A/B options and this presents a risk to the delivery of these options. If the funding cannot be secured, then the options could not be delivered. If this were to be the case, then it is recommended that funding opportunities for the Maintain option are sought instead.

This option has a lower present value cost (estimated to be approximately PV £4.1million) that is comprised of successive defence refurbishments. The one-off cost of each refurbishment would be expected to be much lower than the capital schemes associated with the National Economic and Local Aspirational options and therefore funding could potentially be more achievable to secure.

The Maintain option would not deliver the same level of benefits as the Improve options and is likely to result in extensive loss of property in the future. However relative to the Do Nothing scenario, it would help to delay the onset of erosion to properties and would provide time for an adaptation plan to be implemented. If no funding can be secured for options in ODU 17, the approach would revert to the baseline Do Nothing scenario.

8.3.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 8-6, the National and Local Aspirational Options are also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 8-6. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £17million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National or Local Options could help these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of these options considerably.

8.3.7 Summary

Table 8-10 below summarises the leading options in ODU 17.

Table 8-10: Summary of ODU 17 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Improve C: upgrade defences at the cliff toe (revetment and groynes) from mid-way through epoch 2.	9,055	3,457
Local Aspirational	Improve A / B: as Improve C, except an earlier intervention (epoch 1 for Improve A and epoch 2 for Improve B).	9,376 – 11,471	2,400 – 2,676
Backup	Maintain: refurbish existing defences	4,110	To be determined during subsequent appraisal

Alignment with SMP

The SMP policy for this area is to Hold the Line in the short, medium and long term. The SMP refresh (2020) recommended investigating options for future management (due to serious damage to defences during the 2019/20 storms) and potentially revisit the SMP policy subject to the outcome of the investigations. The National Economic and Local Aspirational options align with the overall Hold the Line policy, however, the intent of this approach is different in that it will not be recommending any realignment or use of nearshore breakwaters in the vicinity (which the SMP recommended). Following adoption of the Strategy it is recommended that the leading options from the Strategy are used to inform the SMP refresh review.

8.4 ODU 18 – Milford on Sea Frontage

ODU 18 covers the area between Hurst Road West car park and the eastern end of Hurst Road, at the start of the rock revetment at the west end of Hurst Spit. There are a variety of defences in ODU 18, including rock and timber groynes and concrete seawalls. The estimated residual life of most of the defences in this unit is less than 10 years.

Since 2000 the beach in this location has undergone significant erosion. Small scale beach recharges have been undertaken on this beach since 2004, but with increased frequency after 2008 after a seawall failure. However, the erosion of the beach is ongoing and beach volumes are declining. The beach in ODU 18 is used for recreation / amenity. Beach huts are on the seawall / promenade at the western half of this frontage. Hurst Road runs parallel to the coastline in this unit and provides the only vehicular access route onto Hurst Spit.

The main risk to the area is from coastal erosion, however, there is also a risk of flooding due to wave overtopping along the frontage (particularly at the east end) and also from tidal inundation from the behind Hurst Spit from the Keyhaven direction. In the Valentine's storm of February 2014 extensive damage occurred to this frontage (due to wave impact on structures) as well as flooding (wave overtopping caused flooding of up to 1m in the Marine Café). Over the next 100 years the total PV damages from the erosion and flood risk are estimated to be over £11.4million.

The SMP policy for ODU 18 is to Hold the Line in the short term, followed by Managed Realignment in the medium and long term. Two primary approaches for Managed Realignment were discussed in the SMP for this location:

- The first approach discussed was to allow realignment of the coastline and loss of areas of existing seafront between the White House and the start of Hurst Spit, principally the areas of the car park and some property towards the eastern end of the frontage. The loss of some of these facilities and property would be offset by a gain in allowing development of a healthy beach in front of setback defences.
- The second approach discussed was to construct offshore reefs or nearshore breakwaters to provide a sheltered area for the development of a wider beach defending Milford Seafront.

Benefits of both of these approaches outlined in the SMP were that they could lead to a more direct management link to the main coast and management of Hurst Spit by ensuring a continuous beach.

The key features in ODU 18 are shown in Figure 8-8.

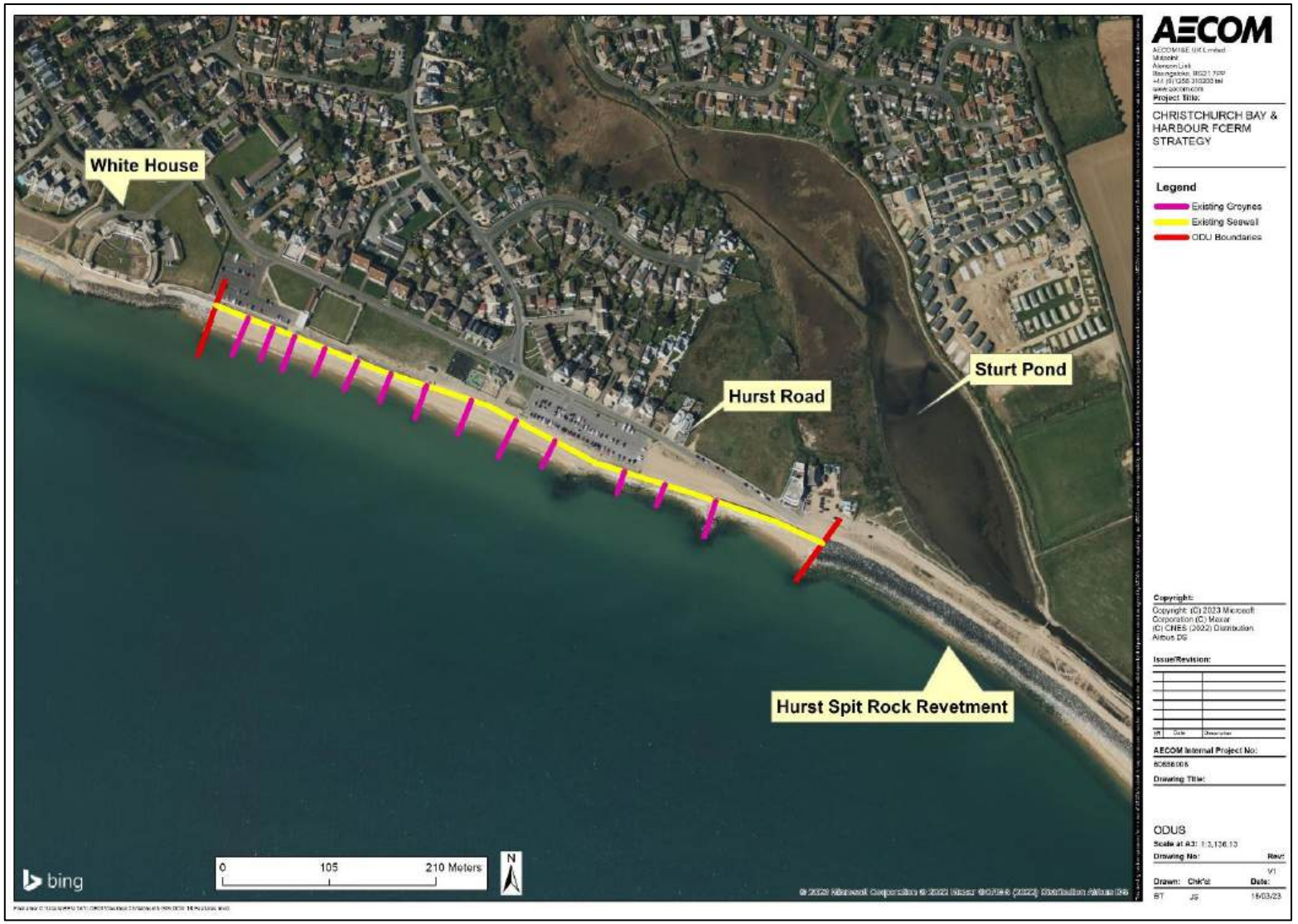

Figure 8-8: Key Features in ODU 18

8.4.1 Short List of Options

The Short List of Strategic Options for ODU 18 are outlined below. This includes details of the local measures as well as the timings and areas defended for each option. Figure 8-9 to Figure 8-11 show maps of the key interventions mentioned in each option description. Note that the defence alignment / locations shown in the figure have been developed to inform the Strategy costing and economic appraisal only and are therefore likely to be subject to significant changes during the concept / outline design of schemes and from stakeholder engagement.

As a basis for the option development, it has been assumed that the rock revetment at the proximal end of Hurst Spit will remain in place for the duration of the Strategy appraisal period. The rock revetment is outside of the Strategy area and falls within the Hurst Spit to Lymington Strategy area. Through discussions with the Hurst Spit to Lymington Strategy project team, it is understood that it is the intention of the Hurst Spit to Lymington Strategy to hold the revetment in place over time as part of the leading options for Hurst Spit.

Do Nothing (baseline for appraisal)

The Do Nothing scenario is a hypothetical 'walk away' scenario whereby further maintenance of existing defences is not undertaken. In ODU 18 this would result in failure of the existing defences and erosion of the land behind. Hurst Road is located in the open space behind the existing defences and with the Do Nothing scenario the road would be expected to erode, cutting off a key access route onto Hurst Spit.

Over time with projected sea level rise the rate of erosion and flood risk would be expected to increase. This scenario would lead to extensive flood damages to property In the future as well as permanent loss of property due to erosion, particularly later in the appraisal period (epoch 2 and 3). The flood risk would come from both wave overtopping from the open coast as well as 'backdoor' tidal flood risk from the Sturt Pond direction.

The Do Nothing scenario is not a viable way forward but it is important to include in the short list as it forms the baseline for the appraisal, against which all other options are compared. The Do Nothing option may include health and safety measures to make safe the existing defences once they fail.

Do Minimum

The Do Minimum option would involve undertaking reactive small scale maintenance to the existing defences. This would typically take the form of patch and repair maintenance whereby localised damage to the defences is repaired on an ad-hoc basis. Beach management would not be undertaken as part of this option.

This option is likely to extend the service life of the existing defences but only by a relatively small period of time (i.e. 5-10 years). Over time, as the defences reach the end of their service life the repair / maintenance requirements would increase and it would not be sustainable to be frequently repairing different parts of the defence on an ad-hoc basis.

The Do Minimum option would only provide very minor benefits relative to the Do Nothing scenario by delaying the initial onset of erosion by a few years. The flood risk would not be improved by this option. The Do Minimum option also permits undertaking works to ensure health and safety compliance of defences that fail as part of this option. For example, clearance of failed defences and or removing access to unsafe areas.

Maintain

The Maintain Strategic option would involve undertaking proactive maintenance to the existing defences and undertaking small scale beach management to help sustain the beach level in this location (e.g. beach recharge / recycling).

The maintenance would typically be in the form of capital refurbishments to existing defences / replacing larger areas of the defence to ensure the structures can perform as intended with respect to flood and erosion risk. This option is likely to extend the service life of the existing defences by a longer duration than the Do Minimum option.

For the beach management it has been assumed that regular small scale renourishment would be undertaken. In the costing this has been assumed to be of the order of 2,500m^3 every two years which is similar to the current approach in ODU 18. More work following the Strategy would be required to determine if this is the appropriate volume (for example through the development of a beach management plan).

However, there is long term uncertainty about how sustainable it would be to continue to maintain the existing defences in their current form. If the trend of beach levels falling in this location continues, this would be difficult to manage with small scale beach management, and which could result in potential defence failure (as seen at Westover previously). The long term viability of this approach is therefore uncertain.

The Maintain option would not help reduce the risk of flooding as defences would not be raised and the 'backdoor' risk of tidal flooding from the Keyhaven direction would persist.

Improve A

The aim of this approach would be to improve beach levels in this location to improve the protection provided to the toe of the defences and to reduce flood risk by constructing setback defences.

The first intervention in this option is outlined for the first part of epoch 1 (in the option costing assumed to be between years 5-10 in the appraisal period). This would involve a large scale capital beach nourishment scheme to add significant quantities of material to the beach in this location. For the purposes of costing it has been assumed that the approximate volume of material placed here would be 75,000m^3. In future epochs the beach nourishment would need to be repeated to ensure the beach volume stayed as desired. In the costing it has been assumed that repeat placement of approximately 37,500m^3 of material would be needed in the future.

At the same time as undertaking the initial beach nourishment, new groynes would also be constructed to help to retain the material placed in this location (type of groyne to be determined during outline design). The groynes would help retain material in ODU 18 initially, but over time some of the beach nourishment material is likely to drift eastwards to Hurst Spit. This would help achieve the SMP intention of managing the Milford on Sea and Hurst Spit frontage as one continuous beach frontage.

The seawall in this unit would also be upgraded in epoch 1. This would likely involve raising the crest level of the defence to reduce wave overtopping risk.

To reduce the risk of tidal flood risk from the Sturt Pond direction the Improve A option would involve constructing a setback defence at the eastern end of Milford on Sea. There is not an economic case to extend this defence to defend all properties at risk, so property level protection would be used to manage the flood risk to properties not in the defence benefit area. The setback defence would not be required until epoch 2.

Improve B

Improve B follows the same approach as Improve A except the initial major beach nourishment scheme (75,000m^3) and defence upgrades would not be undertaken until the start of epoch 2. In the option costing this has been assumed to occur between years 20-25 in the appraisal period. In the interim period the existing defences would be refurbished (such as installing toe protection and re-facing sections with a lower residual life), to extend the service life until the new defence scheme in epoch 2 (refurbishments assumed to occur around years 5-10 in the option costing). In addition during epoch 1 repeat small scale beach renourishment would be continued (as per the existing practice – assumed approximately 2,500m^3 every 2-3 years).

This option provides more time for NFDC to secure funding for the defence upgrades but with the trend of falling beach levels in this location there is uncertainty around how long the existing defences may be able to last and provide an effective FCERM function. There may be a requirement to intervene sooner than the start of epoch 2 with the beach nourishment / defence improvement scheme.

Managed Realignment A

The Managed Realignment A option would involve retaining the strong points at the White House and the rock revetment at the root of Hurst Spit but realign the shoreline position in between these locations by removing the existing defences.

The aim of this approach would be to create an area of wider space for a beach to be located which may help create a more sustainable approach to managing the shoreline in the long term. This approach is in line with the recommendations of the SMP in this location. It is envisaged that the shoreline would realign into the area of open space between Hurst Road and the existing defence alignments. Given the importance of Hurst Road to the access onto Hurst Spit, the aim would be to prevent the road from eroding. There is considerable uncertainty with this option which is discussed later in this section.

This approach would be achieved by refurbishing the strong points at either end of the unit and then either allowing the seawall in the central part of the unit to fail, or demolishing / removing the wall. However, once the shoreline has realigned to its desired position a new defence would need to be constructed to hold the shoreline in the new location and prevent further erosion. Alternatively the new defence could be constructed prior to the shoreline naturally eroding to increase confidence in setting position of the new shoreline. In the costing it has been assumed that the new defence would be required during the mid-point of epoch 1 (approximately around year 10 of the appraisal period), providing time for the coastline to realign beforehand as required.

As per the Improve options, to reduce the risk of tidal flood risk from the Sturt Pond direction the Managed Realignment A option would also involve constructing a setback defence at the eastern end of Milford on Sea. There is not an economic case to extend this defence to defend all properties at risk, so property level protection would be used to manage the flood risk to properties not in the defence benefit area. The setback defence would not be required until epoch 2.

A major uncertainty with this approach would be how effectively the rate of erosion could be controlled after the existing seawall fails or is removed. There is a tendency for 'catch-up' erosion to occur immediately following defence removal on the coastline, so initial rates of erosion could be rapid, especially considering the lowering beach levels in this location. There is a risk with this approach that the erosion could be difficult to control in a cost effective manner. This could lead to more erosion than anticipated or more costly defence requirements and the key issues with this are outlined below:

- If the erosion was difficult to control it could have implications on the morphology of the wider coastline given that ODU 18 is where Hurst Spit attaches to the mainland.
- A breach could occur through to Sturt Pond which would lead to Hurst Spit becoming detached from the mainland. This could have a detrimental impact on Hurst Spit and also on managing the flood and erosion risk in ODU 18.
- It is also directly in conflict with the emerging leading options being developed in the adjacent Hurst Spit to Lymington FCERM Strategy.
- Excess erosion could also sever the access to Hurst Spit if Hurst Road is eroded.

To help manage this uncertainty / risk, the Strategy costing has included a cost for beach nourishment in this location to help control rates of erosion once defences are removed, but uncertainty still remains as the coastline is likely to be highly dynamic. If this option were to be taken forward it is recommended that further work is undertaken following the Strategy to study the viability of this option in more detail.

In addition to the key uncertainties with this option, in practice it could also be challenging to deliver this option given that it would result in loss of the existing promenade, beach huts, toilet block, a number of properties and car park. This area at Milford on Sea is widely used for amenity and recreation and is one of the few locations in NFDC jurisdiction where people visit to access the beach. The option is unlikely to get political or local support.

Managed Realignment B

Managed Realignment B would involve the construction of nearshore breakwaters to help retain beach material in this location and control rates of erosion. This would coincide with undertaking beach nourishment as well as constructing new setback defences to manage the flood risk. In the costing it has been assumed that this scheme would be undertaken during the mid-point of epoch 1 (around year 10 of the appraisal period). In the interim a refurbishment of the seawall would be undertaken (assumed to be between years 5-10 in the option costing).

The design details for the breakwaters would need to be determined during concept / outline design if this option were to be taken forward. The design would need to consider the preferred beach response to achieve the objective of this option – whether that is to create a limited beach response, to create salients or to create tombolos. At the Strategy stage there is considerable uncertainty about the design of the breakwater structures therefore conservative assumptions have been applied to the costing of this option.

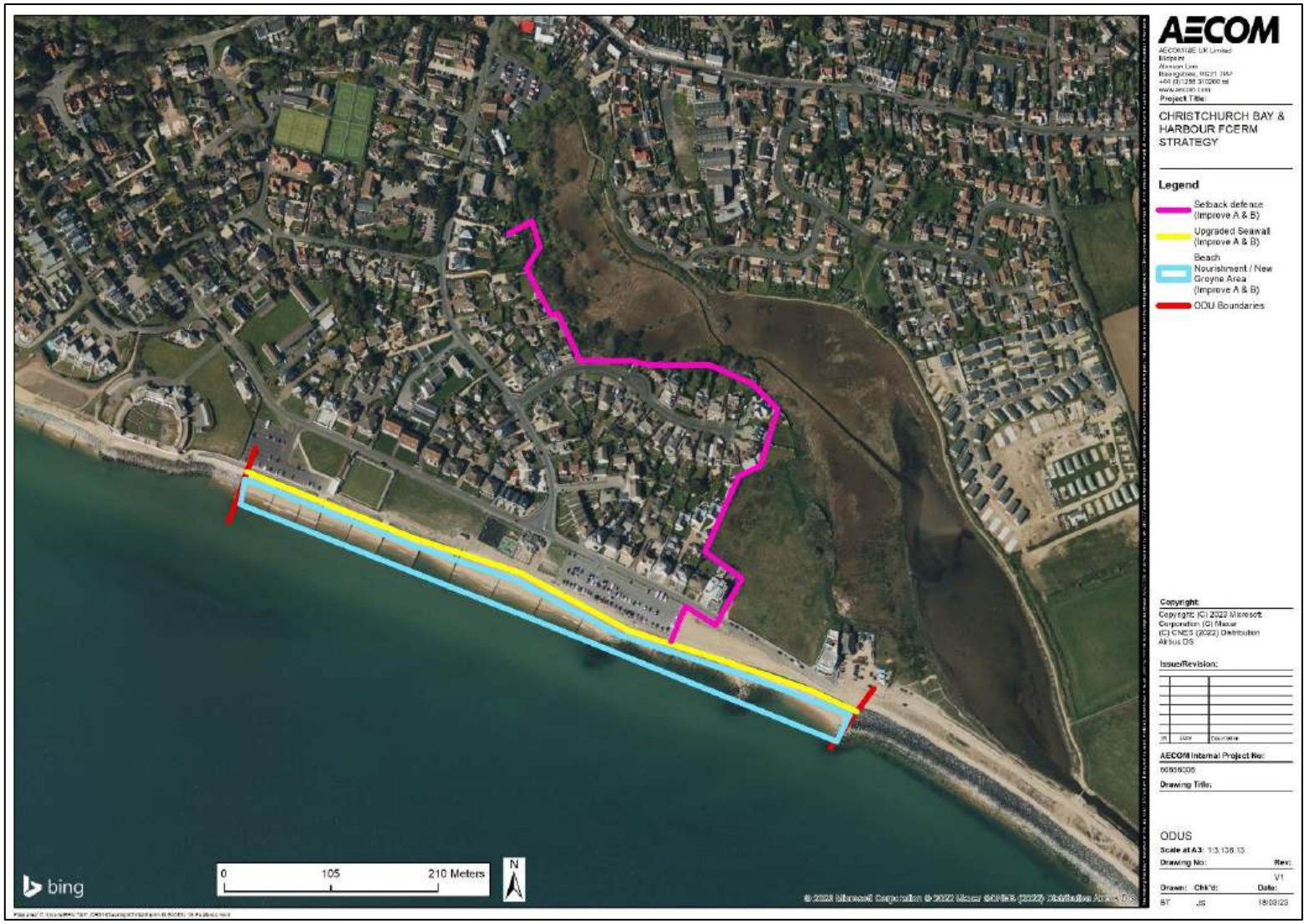

Figure 8-9: ODU 18 Improve Options

Figure 8-10: ODU 18 Managed Realignment A

Figure 8-11: ODU 18 Managed Realignment B

8.4.2 Economic Appraisal of Options

Cost benefit analysis

Table 8-11 below presents the economic costs of each option, the economic damages and benefits of each option and the average benefit cost ratios. All costs and benefits are presented in discounted present value (PV) terms. The options on ODU 18 cannot be ordered based on AEP because they are primarily focussed on managing the erosion risk; the flood risk management component of the overall cost is considerably smaller than the erosion risk management component. The options have therefore been ordered according to the NPV. The NPV of Improve B and Improve A are very similar and therefore both options have been taken through for further consideration as provisional National economic options.

Table 8-11: ODU 18 economic appraisal

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve B	11,035	330	11,155	1.01	120	X
Improve A	11,060	330	11,155	1.01	95	X
Maintain	8,872	2,552	8,933	1.01	61	
Do Nothing	-	11,485	-	-	-	
Do Minimum	963	11,402	83	0.09	-880	
Managed Realignment B	12,269	330	11,155	0.91	-1,114	
Managed Realignment A	11,999	3,867	7,618	0.63	-4,381	

Sensitivity tests

The main uncertainties with the options in this location relate to option cost, and changes to the estimated costs could influence the choice and viability of different options. Given the large role of beach nourishment in the Improve and Managed Realignment options, the specific cost of this intervention is likely to have an overweighted influence on the viability of these options as a whole and the selection process.

A range of sensitivity tests have been undertaken to address these uncertainties. Sensitivity tests for this area include generic cost uplift of 10% or 25% and also amended costs for the beach nourishment element of the options (see Appendix A).

The original beach nourishment cost applied in the cost estimates was £33.30 per m^3 of material which is considered to be a reasonable, mid-level estimate of nourishment costs at the Strategy level. However there could be potential to reduce this cost if local sources of material were to be used or with optimisations to the dredging / placement approach. In addition, smaller quantities of material or material with different characteristics (e.g. coarser material) could also be used to achieve a similar FCERM function. The sensitivity test on beach nourishment costs undertaken assumes a 50% cost reduction in the beach nourishment interventions.

The cost increase sensitivity tests of 10% and 25% have been applied to both the Improve A and Improve B options to determine how the cost increase would alter the choice of leading options. The sensitivity tests show that with a 10% and 25% increase in costs, the choice of option would change to Maintain. However, whilst this may be the case, in a scenario whereby the cost of the Improve B option were to increase, given the similarities in the approach with the Maintain option it is likely that the Maintain option would also have similar cost increases.

In the sensitivity test focused on beach nourishment, the 50% reduction in beach nourishment costs has been applied to all options that include beach nourishment. As can be seen in Appendix A, the choice of the provisional National Economic Leading Option in this scenario would be Improve A.

8.4.3 Social and Environmental Appraisal

Social Appraisal

Based on the feedback from stakeholders and the public to date during the Strategy development and engagement round 4, the key feedback for the ODU 18 frontage includes:

- Indicates general support for the wide range of defence measures included on the short list with the exception of land raising. The following measures had the most 'agree' responses; groynes, maintenance / repairs, seawall, beach management (recycling and nourishment).
- Groynes was the measure identified as most important by the highest number of respondents.

Given the trend of falling beach levels in this location and the uncertainty that this creates for the existing defences the NFDC FCERM team have an aspiration to intervene sooner and to minimise the risks of defences failing if possible / funding can be sourced.

Table 8-12 below presents the social appraisal of options for this location. For each option, consideration has been made as to whether the option aligns with the key aspirations of key stakeholders / public and the FCERM team.

Table 8-12: ODU 18 social appraisal

Option(s)	Comments
Do Nothing, Do Minimum	Options do not appear to align with stakeholder / public / FCERM aspirations. Would result in extensive loss of property in the future and likely to negatively impact local community,
Maintain	Previous engagement from stakeholders / public suggests support for maintenance and repairs that would be included as part of this option. However, there is considerable uncertainty as to how long the existing defences could be maintained in their current form with falling beach levels so this option could still result in a loss of property. Could have more support as part of an Improve option.
Improve A-B	The Improve options are focused on upgrading the defences (e.g. seawall) with a large scale beach nourishment scheme, both of which appeared to have a high level of support in the feedback from the previous round of engagement.
Managed Realignment A, B	The defence measures that would be used to implement the managed realignment options had more 'agree' than 'disagree' responses during the previous round of engagement. However, it is unclear if there would be support for the intent of the Managed Realignment A option as it would involve realigning the coastline position. For Managed Realignment A this option is likely to lead to loss of properties, beach huts, the existing promenade, coastal access, the toilets and the car park in this location. It is likely that this option would therefore have little local or political support.

Environmental Appraisal

The Strategic Environmental Appraisal (SEA) has undertaken a detailed environmental appraisal of the short list options. Table 8-13 below provides a summary of the appraisal results and indicates if there are any major negative impacts associated with any of the options which may make them unviable from an environmental perspective.

The Do Nothing / Do Minimum options would likely have negative impacts on all of the categories considered. This is due to the increased erosion and flood risk with these options, potentially leading to negative impacts across all the categories. The Maintain option could also have minor negative impacts on categories such as population and communities and transport and movement, but impacts are uncertain given the more uncertain coastal evolution as part of this option.

The Improve options could provide a positive benefit to the vast majority of categories by reducing the flooding and erosion risk. For example, these options could lead to positive impacts in climate change, landscape, historic environment, population and communities and transport and movement.

Positive impacts are also expected in the biodiversity / geodiversity category for the Improve options. These options involve construction of new defences which would help to preserve the integrity of the designated sites / habitats in this location. For the proposed defences in this unit there is generally sufficient space available to construct outside of the SPA / Local Nature Reserve designations or within the footprint of the existing defences but due to the proximity of the designations then more detailed consideration will be needed during scheme appraisal alongside a project level HRA. Impacts during construction could be mitigated by avoiding construction during sensitive periods. No major negative impacts are anticipated for the Improve Options.

The Managed Realignment A option could lead to both positive and negative impacts. Negative impacts could occur for a range of categories including population and communities and transport and movement. This is due to the loss of the open space and car park situated landward of the existing defence line. Currently the car park is the only access point to a beach in the area for people with limited mobility.

The Managed Realignment B option is likely to have similar impacts to the Improve Options but could have a negative impact in the landscape category due to use of nearshore breakwaters in this area that is popular for amenity and recreation.

Table 8-13: Summary of potential environmental impacts in ODU 18

Option(s)	Summary of Environmental Impacts
Do Nothing / Do Minimum	Could lead to major negative impacts across most categories.
Maintain	Uncertain impacts for majority of categories due to uncertainty around long term coastal evolution as part of this option. Could have minor negative impacts on population and communities, and transport and movement.
Improve A-B	Positive impacts could occur across vast majority of categories due to reduction in flood and erosion risk.
Managed Realignment A	Could have both positive and negative impacts. Negative impacts could occur in including population and community and transport and movement. Impacts could occur due to loss of coastal access, car parks and property.
Managed Realignment B	Similar positive impacts and rationale to the Improve Options. However, potential negative impact in the landscape category due to use of nearshore breakwaters.

8.4.4 Leading Option Selection

National Economic Leading Option

The economic appraisal provisionally identified the Improve A and B options as being contenders for the National Economic Option. Both of these options have a similar benefit cost ratio and net present values. As per stage 3 of the FCERM-AG decision rules, when two options have a similar economic case then wider factors and uncertainty should be considered to help identify the National Economic Leading Option.

Both Improve A and Improve B involve the same capital interventions but the key difference between the options is the timing of when the first major capital scheme would occur. For Improve A it has been assumed that this would occur in the first part of epoch 1 whereas for Improve B it has been assumed to occur at the start of epoch 2. Major defence refurbishments would be required in the interim with Improve B to prevent defence failure.

Currently the defences in ODU 18 are in a poor condition and threatened by lowering beach levels. NFDC need to frequently top up beach levels to ensure there is enough material to protect the defence toe and reduce the risk of failure. As such, with the earlier capital scheme, Improve A provides significantly more certainty to the success of the option. By shortening the time until the capital scheme is undertaken, the existing assets will not need to be relied upon for as long, leading to a reduced risk of defence failure before the scheme is implemented. Furthermore, should beach nourishment costs reduce (see sensitivity test), the economic case of Improve A improves relative to Improve B. Based on these factors, Improve A is identified as the National Economic Leading Option.

The SEA has not identified any major negative impacts for this option. There could be a minor negative impact associated with the biodiversity / geodiversity impact of construction in proximity to environmental designations.

The primary defence measures as part of this option are a seawall, beach nourishment and groynes and the social appraisal indicates that these measures had a high level of support during the previous engagement phase.

No Local Aspirational Option has been identified in ODU 18 but two Backup options have been identified and are outlined in the Funding section.

SMP policy

The SMP policy in ODU 18 is formally defined as Managed Realignment in the medium and long term as it would involve moving the position of the defence line (backwards or forwards). Two Managed Realignment options have been considered as part of the Strategy for ODU 18 but have not been recommended as a leading option because:

- Managed Realignment A: through discussions with NFDC it is felt that the Managed Realignment A option is unlikely to be feasible due to the negative impact on amenity that this option would have (e.g. loss of seafront parking, access, extended period of disruption to realign the coastline). This option is unlikely to achieve community or political support and would detract from the local character / attractiveness of the area that draw visitors to Milford on Sea. Milford on Sea is one of a small number of locations in NFDC where people go to visit the beach and disruption or loss of this function is unlikely to be acceptable. In addition, there is considerable uncertainty around how effectively the erosion could be controlled once existing defences are removed which could increase the risk of a breach forming and in turn impact Hurst Spit.
- Managed Realignment B: this option includes nearshore breakwaters and at the Strategy stage there is uncertainty around the design of these structures (geometry, location, size of rock etc). Due to this uncertainty conservative assumptions have been made in the option costing which results in this option being comparatively expensive and from an economic standpoint this option is unfeasible (ABCR <1).
- Managed Realignment B: from a technical perspective, breakwaters in this location are likely to be a robust solution to the key risks (such as lowering beach levels) and would not lead to the same level of negative amenity impacts on the frontage as Managed Realignment A. It is notable that the nearshore breakwater constructed to the east of the Hurst Spit revetment has been very successful in managing the position of the Spit in this location. Therefore, whilst this option has been ruled out due to cost at the Strategy stage, it is recommended that nearshore breakwaters are reconsidered when developing the scheme design when more cost certainty can be provided.

Whilst not strictly following a Managed Realignment policy, Improve A is generally in line with the intent of the SMP policy as it aims to minimise damages to properties and infrastructure. One of the main aims of the SMP policy in this location was the creation of a continuous link to Hurst Spit for sediment transport / FCERM management. This would still be largely achieved by the Improve A option because the large scale beach nourishment and ongoing beach management would increase the feed of material to Hurst Spit relative to the existing situation. The construction of new improved groynes in ODU 18 would limit the amount of material bypassing this area but, in combination with the beach nourishment, could be designed in a way that promotes a sustained flow of material to the spit.

Recommendations for scheme level appraisal

The National Economic Option (Improve A) option recommends using new groynes to control the movement of beach material, but the choice of beach control structure will need to be revisited when more information is available. Further consideration of the most appropriate beach control structures should be undertaken when developing the scheme appraisal and design, including:

- Develop sediment transport model of this location – to better understand relationship between longshore and cross shore sediment transport here and the key drivers to the lowering beach level trend.
- Design of beach control structures and nourishment scheme – different designs should be considered, such as timber groynes, rock groynes, fishtail groynes and nearshore breakwaters. The numerical sediment transport modelling will help inform the choice of the beach control structures and should also inform their design. The modelling will also help to inform the quantities and grading of beach nourishment required.

- Nearshore breakwaters – were not included in the Leading Option here primarily due to high cost. At the Strategy stage, due to the uncertainty around the design of these structures, conservative costing assumptions were made which resulted in a poor benefit cost ratio (leading to the Managed Realignment B option not being identified as a potential Leading Option). However it is recommended that this is revisited during scheme appraisal when there will be more information developed on the design of these structures which will allow for more cost certainty and potentially reduced costs. From a technical perspective it is likely that nearshore breakwaters would help to control beach levels well in this location and may have a similar / improved level of performance to groynes.
- Link to Hurst Spit – the design of options here should consider the wider interaction with Hurst Spit. If desired, the beach control structures and nourishment scheme could be designed to facilitate bypassing of material in this location and provide a greater feed of material to the spit.

8.4.5 Funding

Partnership Funding

An indicative Partnership Funding calculation has been undertaken for the first capital intervention and whole life maintenance for the Improve A option (National Economic Leading option).

The first capital intervention of this option covers the open coast and does not include the setback flood defences part of the option (i.e. setback defences adjacent to Sturt Pond and PLP in epoch 2). The benefits for this calculation have therefore been assumed to only include the erosion damages that would be avoided by improving the open coast defences. This assumption is appropriate for the Strategy as the funding calculations are only meant to be indicative. However at OBC stage it will be necessary to revisit these assumptions and identify a suitable division between erosion and flooding benefits for the schemes as part of this option.

The indicative Partnership Funding score for Improve A is provided in Table 8-14 below. As can be seen, the Option has a Partnership Funding score of 12%. The option would require significant contributions to be deliverable (9.5million). The maximum amount of GiA available for the scheme is estimated to be just over £1.3million.

Table 8-14: Indicative Partnership Funding Scores for ODU 18

Option	Estimated capital cost (£k) at time of scheme	PV maintenance cost (£k)	PV total cost (£k)	PV benefits (£k)	Benefit period	Partnership Funding score	PV maximum eligible FCERM GiA (£k)	Minimum PV contribution / saving required (£k) at time of intervention *
National Economic Leading Option: Improve A	10,907	1,513	12,420	13,999	90 years	12%	1,355	9,552

**Note that for schemes led by Local Authority risk management authorities, contributions to future costs are not included in GiA calculations. Therefore the GiA availability and minimum contributions shown in the table are for the capital costs only.*

Backup Options if funding cannot be secured

The funding shortfall for the National Economic Leading Options is significant and therefore two Backup Options have been identified for ODU 18:

- Improve B is the first backup option and would be selected as an adaptive pathway should funding for Improve A in the first part of epoch 1 not be secured. By delaying the capital scheme until he start of epoch 2, this would provide more time to secure non-GiA funding to deliver the option. There would be a capital refurbishment of the existing defence sooner than this, but this would primarily be focussed on reducing the

likelihood of the defence failing rather than increasing the standard of the defence and robustness against sea level rise.

- The second Backup option is Maintain. This would involve refurbishing existing defences and undertaking small scale beach nourishment for as long as is feasible but would come with an increased risk of defence failure over time. The one-off cost of each refurbishment would be expected to be much lower than the capital schemes associated with the National Economic Option and therefore funding could potentially be more achievable to secure. There is long term uncertainty as to how long this option may be effective in reducing risks. However, relative to Do Nothing, it would help delay the onset of erosion to properties and provide time for an adaptation plan to be implemented.

8.4.6 Local Benefits

In addition to the nationally eligible economic benefits outlined in Table 8-11, the National Option is also likely to generate a range of local economic benefits. These local economic benefits are not eligible to be included in Partnership Funding applications or an FCERM-AG compliant appraisal and are therefore not shown in Table 8-11. However, they could be used to strengthen the evidence base to attract non-GiA sources of funding.

The Economics Appraisal report (AECOM, 2024) outlines that there could be approximately £23million of damages to the local economy over the appraisal period under the Do Nothing scenario. Delivering the National Option (and also the Improve B Backup Option) could help these damages to the local economy (creating local economic benefits). When these local benefits are considered, it strengthens the economic case of these options considerably.

8.4.7 Summary

Table 8-15 below summarises the leading options in ODU 18.

Table 8-15: Summary of ODU 18 Leading Options

Leading Option Type	Option description	Estimated cost of option (PV £k)	Estimated GiA funding for initial capital intervention (undiscounted cash £k)
National Economic	Improve A: major beach nourishment scheme, new groynes and upgraded seawall from epoch 1. Setback floodwall adjacent to Sturt Pond in epoch 2.	11,060	1,355
Backup	Improve B: major beach nourishment scheme, new groynes and upgraded seawall from epoch 2. Setback floodwall adjacent to Sturt Pond also in epoch 2.	11,035	TBC during OBC
Backup	Maintain: refurbish existing defences and small scale beach nourishment	8,872	TBC during OBC

Alignment with SMP

The SMP policy for this location was Hold the Line in the short term, followed by Managed Realignment in the medium and long term (i.e. moving the defence line forward or back). The SMP policy has an aim of promoting an improved sediment transport supply to Hurst Spit. The National Economic Option would not change the position of the defences (unless nearshore breakwaters are used), but it is still generally in line with the intent of the SMP policy as it aims to minimise damages to properties and infrastructure and would increase the feed of material to Hurst Spit relative to the existing situation

9. Summary of Draft Leading Options

9.1 Key features of Leading Options

Table 9-1 overleaf provides a summary of the draft leading options in each ODU. The key points are provided below:

- In ODUs 1 and 2 it is important to sustain the FCERM function of the Mudeford Sandbank as uncontrolled erosion / movement of Mudeford Sandbank could have uncertain impacts on the wider morphology of the area, potentially impacting flood risk, navigation, sediment transport and buried services in the vicinity. The local aspirational options for this location are focussed on maintaining the existing FCERM function of the Sandbank over the course of the appraisal period. On a national basis there is not a strong economic case to deliver the Local Aspirational Options in ODUs 1-2, but it is important for these to be delivered to ensure the leading options in ODUs 3-10 are successful.
- In ODUs 3-10 the main risk is from tidal flooding to properties and other assets. Where there is an economic case, the leading options are generally focussed on upgrading the SoP provided by defences in these locations. This could be achieved by raising existing defences or constructing new defences as required. Different timings are recommended for defence upgrades based on a range of factors such as the onset of risk and the residual life of existing defences. Another risk in ODUs 3-10 is historic landfill sites and the potentially contaminated materials that could be exposed should these locations be undefended and erode. The different approaches to managing this risk (with respect to timings and cost) have been explored in the appraisal and are picked up in the leading options.
- In ODU 11 it is important to sustain the FCERM function of the existing quay walls as erosion / damage to the quay could lead to more widespread morphological changes and impact flood risk elsewhere in the area. The local aspirational option in this location aims to prevent the quay from eroding and provides property level protection to the properties on the quay at risk from flooding. Similar to ODUs 1 and 2, on a national basis there is not a strong economic case to sustain the function of the quay walls in ODU 11, but it is important for the function of these assets to be continued to ensure the leading options in ODUs 3-10 and ODU 12 can be delivered successfully.
- In ODUs 12-18, along this open coast part of the Strategy frontage the leading options are underpinned by a series of strategically placed beach nourishment interventions over time. The placement locations have been identified to provide an immediate benefit to the placement location but also to provide a long term benefit to areas downdrift over the Strategy period, including Hurst Spit. The leading options recommend beach nourishment is undertaken in ODU 12, ODU 13, ODU 16 and ODU 18 at various points over the next 100 years. There is an opportunity to explore a joined-up approach to scheme delivery in these locations which could deliver efficiencies and cost-savings that could make the economic case more affordable than currently identified. If a combined source of material could be secured for all or many of the areas, the adaptive pathways between the leading options in the Strategy provides the flexibility in timings of interventions to deliver nourishment schemes for each location simultaneously rather than treating each location individually. The beach nourishment will ensure that the beach can continue to provide an integral part of the overall defence system along the open coast. However, in some locations it would need to be supplemented with additional hard defence structures and cliff slope stabilisation.
- The leading options are adaptable to future changes in risks, community aspirations and funding availability. Generally each option includes a series of interventions through time (in three epochs) that can be brought forward or delayed as required. In addition, up to three types of leading options have been identified in each ODU, providing the FCERM delivery team with suitable flexibility to change course between options as required based on new information / funding that may become available over the course of the Strategy implementation.
- For each of the leading options (National and/or Local Aspirational), the partnership funding score for their initial schemes is typically less than 50%. This indicates that significant funding contributions from non-GiA sources will need to be found to deliver the Strategy and its recommendations. Typically the initial schemes are not recommended to occur for several years at least (with many recommended to occur even later during epoch 2 / 3). This provides the BCP / NFDC FCERM teams with time to source funding contributions and one of the recommendations following the Strategy will be to develop a funding action plan to plan, identify and secure contributions before schemes are required.

Table 9-1: Summary of Draft Leading Options (- shows where funding has not been calculated or an option not identified)

ODU	Criteria	National Economic Leading Option	Local Aspirational Leading Option	Backup Option
1 – Hengistbury Head East	**Option**	Do Minimum	Managed Realignment	-
	Details	Small scale repairs to existing defences (i.e. patch-repairs)	Maintain toe defences and undertake beach recycling from epoch 1. Erosion of cliff would be controlled but not stopped entirely	-
	Option cost (PV £k)	340	2,823	-
	Option benefits (PV £k)	0	0	-
	ABCR	-	-	
2 – Mudeford Sandbank	**Option**	Do Minimum	Maintain with Adaptation	-
	Details	Small scale repairs to existing defences (i.e. patch-repairs)	Sustain the FCERM service of the Sandbank by holding its form over time and aiming to keep it broadly in its current position. Achieved through beach nourishment and defence maintenance. Property level protection to permanent properties on the Sandbank.	-
	Option cost (PV £k)	680	5,456	-
	Option benefits (PV £k)	0	89	-
	ABCR	-	0.02	
3 – Christchurch Harbour South	**Option**	Adaptation / Resilience A	Adaptation / Resilience C	-
	Details	Property level protection to properties at risk	As per Adaptation / Resilience A, but with localised erosion defences to the access road to Hengistbury Head and around Wick historic landfill site	-
	Option cost (PV £k)	118	776	-
	Option benefits (PV £k)	669	811	-
	ABCR	5.67	1.05	-

ODU	Criteria	National Economic Leading Option	Local Aspirational Leading Option	Backup Option
4 - Wick	**Option**	Sustain C	Sustain B	-
	Details	Raise and lengthen existing setback embankment defence from epoch 1, and then progressively over time to keep pace with sea level rise	As per Sustain C, however, repeat maintenance / refurbishments would also be undertaken on the frontline quay wall to prevent erosion of historic landfill	-
	Option cost (PV £k)	1,490	3,499	-
	Option benefits (PV £k)	3,898	3,638	-
	ABCR	2.62	1.04	-
5 – Willow Drive and the Quomps	**Option**	Improve D-F (alignment to be decided)	Improve A-C (alignment to be decided)	Adaptation / Resilience
	Details	Raise height of defences to improve SoP from epoch 2. Maintain / replace frontline defence adjacent to historic landfill site at the Quomps	As per Improve D-F, except defence height would be raised in epoch 1 rather than epoch 2	Maintain frontline defences and undertake property level protection to properties at risk of flooding
	Option cost (PV £k)	11,397 – 14,702	13,660 – 22,507	11,927
	Option benefits (PV £k)	35,206 – 37,306	34,439 – 36,532	16,526
	ABCR	2.54 – 3.09	1.62 – 2.52	1.39
6 – River Avon West Bank	**Option**	Adaptation / Resilience	-	-
	Details	Maintain frontline defences and undertake property level protection to properties at risk of flooding	-	-
	Option cost (PV £k)	2,802	-	-
	Option benefits (PV £k)	2,877	-	-
	ABCR	1.03	-	-
7 – Rossiters Quay	**Option**	Improve A	-	Adaptation / Resilience
	Details	Raise existing / construct new flood defences in epoch 2	-	Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding
	Option cost (PV £k)	4,118	-	2,630
	Option benefits (PV £k)	5,329	-	3,253
	ABCR	1.29	-	1.24

ODU	Criteria	National Economic Leading Option	Local Aspirational Leading Option	Backup Option
8 -River Avon East Bank	Options to be appraised separately by Environment Agency	-	-	-
9 - Stanpit	**Option**	Sustain A	-	Adaptation / Resilience
	Details	Raise existing / construct new flood defences from epoch 2 and then raise over time to keep pace with sea level rise. Defences would defend Stanpit historic landfill site	-	Maintain / refurbish existing defences and undertake property level protection to properties at risk of flooding
	Option cost (PV £k)	10,960	-	8,271
	Option benefits (PV £k)	37,809	-	12,554
	ABCR	3.45	-	1.52
10 - Mudeford	**Option**	Improve A	-	Adaptation / Resilience
	Details	Property level protection to properties at risk in epochs 1 and 2. Construct new flood defences in epoch 3 to increase the SoP against flooding	-	Maintain / refurbish existing quay walls and undertake property level protection to properties at risk of flooding
	Option cost (PV £k)	8,373	-	5,473
	Option benefits (PV £k)	11,124	-	2,777
	ABCR	1.33	-	0.51
11 – Mudeford Quay	**Option**	Do Minimum	Adaptation / Resilience	-
	Details	Small scale repairs to existing defences (i.e. patch-repairs)	Property level protection to properties at risk. Maintain existing quay walls.	-
	Option cost (PV £k)	340	9,530	-
	Option benefits (PV £k)	0	680	-
	ABCR	-	0.07	-

ODU	Criteria	National Economic Leading Option	Local Aspirational Leading Option	Backup Option
12 Avon Beach and Friars Cliff	**Option**	Improve A	Improve C	'Scaled back' Improve A
	Details	Maintain / refurbish existing defences from epoch 1. Undertake beach nourishment from epoch 2 as well as new rock groynes and raising Avon Beach seawall. Localised property level protection in epoch 3 to manage flood risk.	As per Improve A but undertake broader public realm enhancements (such as promenade raising)	Reduce beach nourishment volume / scale of defence improvements to reduce cost and improve affordability
	Option cost (PV £k)	8,443	14,030	-
	Option benefits (PV £k)	8,978	8,978	-
	ABCR	1.06	0.64	-
13 - Highcliffe	**Option**	Improve C	Improve A	'Scaled back' Improve C
	Details	In epoch 1 construct rock armour defence at east end of unit to reduce outflanking risk. In epoch 1 and 2 maintain existing defences and undertake beach recycling. From epoch 3 undertake beach nourishment, construct new rock groynes and refurbish defences	As per Improve C, except the beach nourishment in epoch 3 would be brought forward to be undertaken from epoch 2. New rock groynes from epoch 3	Reduce beach nourishment volume / scale of defence improvements to reduce cost and improve affordability
	Option cost (PV £k)	5,431	6,689	-
	Option benefits (PV £k)	6,946	6,946	-
	ABCR	1.28	1.04	-
14 – Naish Cliff and Barton on Sea	**Option**	Managed Realignment A	-	Managed Realignment B; or Managed Realignment D; or Maintain
	Details	Improved toe defences and cliff stabilisation / drainage in the area between Marine Drive West and the eastern end of Barton on Sea during the first part of epoch 1. This would help to slow rates of cliff top recession but not stop it entirely.	-	Managed Realignment B: As per Managed Realignment A, except defence improvements would be undertaken during epoch 2. Managed Realignment D: As per Managed Realignment B, except no new cliff drainage and toe protection at Marine Drive West.

ODU	Criteria	National Economic Leading Option	Local Aspirational Leading Option	Backup Option
				Maintain: Maintain existing defences and functioning drainage but no new defences constructed.
	Option cost (PV £k)	22,211	-	Managed Realignment B: 19,718 Managed Realignment D: 14,218 Maintain: 5,927
	Option benefits (PV £k)	23,489	-	Managed Realignment B: 20,077 Managed Realignment D: 14,391 Maintain: 5,959
	ABCR	1.06	-	Managed Realignment B: 1.02 Managed Realignment D: 1.01 Maintain: 1.01
15 – Barton on Sea to Hordle Cliff	**Option**	Do Nothing	-	-
	Details	No defence maintenance or beach management undertaken. Undertake health and safety activities following cliff erosion events to make safe public spaces.	-	-
	Option cost (PV £k)	-	-	-
	Option benefits (PV £k)	-	-	-
	ABCR	-	-	-
16 – Cliff Road	**Option**	Managed Realignment C	Managed Realignment A or B	Maintain
	Details	From second half of epoch 2 undertake beach nourishment and construct local strong point to control rate of cliff erosion. Cliff top recession would still occur but intent would be to prevent it reaching Cliff Road.	As per Managed Realignment C, except beach nourishment and strong point would be constructed much sooner, in either epoch 1 (Managed Realignment A) or start of epoch 2 (Managed Realignment B)	Maintain existing defences and undertake beach recycling to control beach levels. In the long term this is likely to lead to more erosion than the Managed Realignment options.
	Option cost (PV £k)	4,405	5,069 – 5,612	1,791
	Option benefits (PV £k)	7,400	7,400	3,017
	ABCR	1.68	1.32 – 1.46	1.68

ODU	Criteria	National Economic Leading Option	Local Aspirational Leading Option	Backup Option
17 – Rook Cliff	**Option**	Improve C	Improve A or B	Maintain:
	Details	Refurbish existing cliff toe defences in epoch 1. From second half of epoch 2 upgrade defences at cliff toe.	As per Improve C, except toe defence improvements would be constructed much sooner, in either epoch 1 (Managed Realignment A) or start of epoch 2 (Managed Realignment B)	Maintain existing defences at the toe of the cliff. Long term sustainability of this approach is uncertain given lowering beach levels in this location and this option is therefore likely to lead to more erosion than the Improve options.
	Option cost (PV £k)	9,055	9,376 – 11,471	4,110
	Option benefits (PV £k)	11,516	11,516	4,222
	ABCR	1.27	1.00 – 1.23	1.03
18 – Milford on Sea	**Option**	Improve A	-	Improve B; or Maintain
	Details	Upgrade seawall, construct new groynes and undertake major beach nourishment from epoch 1. Construct setback tidal flood defences at eastern end of Milford on Sea to reduce risk of flooding from Sturt Pond direction in epoch 2.	-	Improve B: As per Improve A, except upgrade coastal defences and beach nourishment in epoch 2. Refurbish existing defences in epoch 1 to extend service life until upgrade. Maintain: Maintain existing defences and undertake beach recycling. Long term effectiveness is uncertain.
	Option cost (PV £k)	11,060	-	Improve B: 11,035 Maintain: 8,872
	Option benefits (PV £k)	11,155	-	Improve B: 11,155 Maintain: 8,933
	ABCR	1.01	-	Improve B: 1.01 Maintain: 1.01

9.2 Strategic links between ODUs

There are up to three types of leading options in each ODU and therefore flexibility as to which options may be implemented in each location. For the successful delivery of the Strategy, it is important that a choice of which leading option to implement in any given ODU, does not negatively impact the delivery of options in adjacent units.

Table 9-2 below provides a summary of how changing from the Local Aspirational Leading Option to the delivery of either the National Economic or Backup Option could impact the delivery of options in adjacent units. This comparison assumes that the order of priority to deliver the options will be firstly the Local Aspirational Leading Option as the priority (if there has been one identified in a unit), followed by the National Economic Option and then the Backup Option (if there has been one identified).

Generally if the leading options are delivered then the Strategy forms a cohesive long term approach to managing the flood and erosion risks along the Strategy frontage. Decisions on which of the leading options to deliver would not be expected to impact the flood risk or delivery of leading options in adjacent units. The main exception to this is in ODUs 1, 2 and 11.

In ODUs 1, 2 and 11 it is important that the Local Aspirational Options are delivered. The National Economic options in these units are Do Minimum and if this is the route that is followed there is a risk that there could be morphological changes to the harbour and harbour entrance due to the natural evolution of Mudeford Sandbank and Quay. This could have knock-on impacts to the successful delivery of the leading options in ODUs 3-10 and ODU 12, emphasising the importance of delivering the local aspirational option in ODUs 1, 2 and 11.

At Milford on Sea (ODU 16-18) there is clear link between the ODUs and there is a reliance on the delivery of one of the leading options in each unit to ensure a cohesive approach is implemented. If none of the leading options are delivered in one unit this could have a knock on impact on the successful delivery of the leading options in the adjacent units. To help manage this uncertainty it is recommended that schemes in ODU 16-18 are delivered concurrently where possible to provide more certainty in the approach and outcomes delivered.

Table 9-2: Strategic links between ODUs

ODU	First choice / priority option	Potential impact on option delivery if first choice option not delivered in adjacent units
1 – Hengistbury Head East	Local Aspirational – Managed Realignment	If the Local Aspirational Leading Option (Maintain with Adaption) in ODU 2 is not delivered, the second choice option in ODU 2 would be the National Economic Option (Do Minimum). Delivery of the Do Minimum option in ODU 2 could make it more challenging to control the rate of erosion in ODU 1 as part of the Managed Realignment option.
2 – Mudeford Sandbank	Local Aspirational – Maintain with Adaptation	If the Local Aspirational Leading Option (Managed Realignment) in ODU 1 is not delivered, the second choice option in ODU 1 would be the National Economic Option (Do Minimum). Doing Minimum in ODU 1 could impact the delivery of the Maintain with Adaptation Option in ODU 2 as it could lead to erosion of ODU 1 which may create a disconnect in the shoreline position between Hengistbury Head and Mudeford Sandbank. This could impact the sediment transport in the area and also increase the risk of breaching of the Sandbank. This emphasises the importance of delivering the Local Aspirational Options in ODU 1 and 2 (rather than the National economic option of Do Minimum). In ODU 3 if the Local Aspirational Leading Option (Adaptation / Resilience C) is not delivered, the second choice option in ODU 3 is the National Economic Option (Adaptation / Resilience). Delivery of the Adaptation / Resilience option in ODU 3 would not impact the delivery of the Maintain with Adaptation Option in ODU 2.
3 – Christchurch Harbour South	Local Aspirational – Adaptation / Resilience C	If the Local Aspirational Leading Option (Maintain with Adaption) in ODU 2 is not delivered, the second choice option in ODU 2 would be the National Economic Option (Do Minimum). Delivery of the Do Minimum Option in ODU 2 could impact the delivery of the Adaptation /

ODU	First choice / priority option	Potential impact on option delivery if first choice option not delivered in adjacent units
		Resilience Option in ODU 3 as there is a risk of morphological changes in the harbour / harbour entrance. If the Local Aspirational Leading Option (Sustain B) in ODU 4 is not delivered, the second choice option in ODU 4 would be the National Economic Option (Sustain C). Delivery of the Sustain C option in ODU 4 would not impact the delivery of the Adaptation / Resilience C option in ODU 3.
4 - Wick	Local Aspirational – Sustain B	In ODU 3 if the Local Aspirational Leading Option (Adaptation / Resilience C) is not delivered, the second choice option in ODU 3 is the National Economic Option (Adaptation / Resilience). Delivery of the Adaptation / Resilience option in ODU 3 would not impact the delivery of the Sustain B option in ODU 4. The defence alignment in the east side of ODU 4 as part of the Sustain B option is setback and there is no reliance on the erosion defence at Wick historic landfill site to deliver flood defence to ODU 4. In ODU 5 if the Local Aspirational Leading Option (Improve A-C) is not delivered, the second choice option would be the National Economic Option (Improve D-F) and the third choice option would be the Backup Option (Adaptation / Resilience). Delivery of either of these alternative options would not impact the delivery of Sustain B in ODU 4 because ODU 5 is on the opposite side of the River Stour and the flood cell is separate. Therefore there is no reliance on new defences in ODU 5 for the defences in ODU 4. If the local aspirational options are not delivered at ODUs 1,2 and 11 then it could be challenging to deliver the leading options in ODU 4 successfully as there is a risk of morphological changes in the harbour / harbour entrance with the National Economic options in these locations.
5 – Willow Drive and the Quomps	Local Aspirational – Improve A-C	If the Local Aspirational Leading Option (Sustain B) in ODU 4 is not delivered, the second choice option in ODU 4 would be the National Economic Option (Sustain C). Delivery of the Sustain C option in ODU 4 would not impact the delivery of Improve A-C in ODU 5 because ODU 4 is on the opposite side of the River Stour and the flood cell is separate. Therefore there is no reliance on new defences in ODU 4 for the defences in ODU 5. The Strategy modelling indicates that in 2124 there could be flood risk from the River Stour to the north-west of the proposed defences in ODU 5, between Tuckton Bridge and the railway bridge further upstream. The modelling used in the Strategy for this location is uncertain but there could be a potential need for a new defence approximately 100m long to the south of the railway bridge in epoch 3 to prevent outflanking risk to the benefit area. This would not impact the viability of this option. There is no Backup Option to the National Economic Option (Adaptation / Resilience) in ODU 6. If the Adaptation / Resilience Option in ODU 6 is not delivered this would not impact the delivery of Improve A-C in ODU 5. This is because the high ground at Christchurch Priory is located at the boundary between the two ODUs which limits the movement of water from ODU 6 into ODU 5. Costs have been included for the Improve A-C options in ODU 5 to provide a tie-in into the high ground to prevent outflanking from ODU 6. If the local aspirational options are not delivered at ODUs 1,2 and 11 then it could be challenging to deliver the leading options in ODU 5 successfully as there is a risk of morphological changes in the harbour / harbour entrance with the National Economic options in these locations.
6 – River Avon West Bank	National Economic – Adaptation / Resilience	If the Local Aspirational Leading Option is not delivered in ODU 5 (Improve A-C) or the National Economic in ODU 7 (Sustain A) this would not impact the delivery of the Adaptation / Resilience option in ODU 6. The Adaptation / Resilience option is focused on providing flood

ODU	First choice / priority option	Potential impact on option delivery if first choice option not delivered in adjacent units
		defence at the property by property level and therefore any connection with adjacent flood cells does not impact this option. If the local aspirational options are not delivered at ODUs 1,2 and 11 then it could be challenging to deliver the leading options in ODU 6 successfully as there is a risk of morphological changes in the harbour / harbour entrance with the National Economic options in these locations.
7 – Rossiters Quay	National Economic – Sustain A	ODU 7 is a separate flood area than adjacent units and therefore has no reliance on the delivery of options in directly adjacent units. However if the local aspirational options are not delivered at ODUs 1,2 and 11 then it could be challenging to deliver the leading options in ODU 7 successfully as there is a risk of morphological changes in the harbour / harbour entrance with the National Economic options in these locations.
8 – River Avon East Bank	NA	Leading options have not been identified for ODU 8. Options to be appraised as part of the Lower River Avon Strategy.
9 - Stanpit	National Economic – Sustain A	At the north end of this unit (adjacent to ODU 8) in epoch 3 the Sustain A option in ODU 9 may require defences to prevent outflanking around the area at Christchurch Bypass if no defences are constructed in ODU 8. In ODU 10 the National Economic Option is Improve A which would involve constructing new defences from epoch 3 onwards. If this is not delivered then the defence alignment for the Sustain A option in ODU 9 would need to be extended by approximately 100m at its eastern end to prevent outflanking from the ODU 10 direction. This would not be expected to significantly impact the overall delivery of this scheme or choice of option in the appraisal. If the local aspirational options are not delivered at ODUs 1,2 and 11 then it could be challenging to deliver the leading options in ODU 9 successfully as there is a risk of morphological changes in the harbour / harbour entrance with the National Economic options in these locations.
10 – Mudeford	National Economic – Improve A	If the National Economic Option (Sustain A) in ODU 9 is not delivered, the second choice option in ODU 9 would be Adaptation / Resilience. In this situation there could be an outflanking risk from ODU 9 for the new defences planned in epoch 3 as part of the Improve A option. The defence alignment would need to be extended by approximately 100m at its western end to prevent this outflanking. This would not be expected to significantly impact the overall delivery of this scheme or choice of option in the appraisal. The Improve A option includes new defences along the Bure Brook which forms the boundary with ODU 11. Therefore the delivery of the Improve A option is not reliant on any new raised flood defences in ODU 11. Note that if the quay walls in ODU 11 were to fail there could potentially be flood risk impacts in ODU 10 but also the wider harbour area. If the local aspirational options are not delivered at ODUs 1,2 and 11 then it could be challenging to deliver the leading options in ODU 10 successfully as there is a risk of morphological changes in the harbour / harbour entrance with the National Economic options in these locations.
11 – Mudeford Quay	Local Aspirational – Adaptation / Resilience	The approach for the Adaptation / Resilience option would be to use property level protection to manage risk at the property level. Therefore there is no reliance on whether the National Economic Option in ODU 10 (Improve A) or Local Aspirational Leading Option in ODU 12 (Improve C) is delivered.

ODU	First choice / priority option	Potential impact on option delivery if first choice option not delivered in adjacent units
12 – Avon Beach and Friars Cliff	Local Aspirational – Improve C	Implementation of the Adaptation / Resilience option in ODU 11 would ensure the standard of service of the quay walls in ODU 11 was sustained which would support the delivery of the Improve C option in ODU 12. In epoch 3 the property level protection in ODU 12 would be to a small number of properties and would not be reliant on flood defences elsewhere as it would focus on reducing risk on a property by property basis. However, if the local aspirational option is not delivered in ODU 11 and the national economic option is delivered instead (Do Minimum), there could be a risk to the delivery of options in ODU 12. At the eastern part of the unit there is no reliance on the delivery of the leading options in ODU 13 for the Improve C option. The ODU boundary is in an area of open space and it is unlikely that erosion to the east of the boundary would impact the defended properties in ODU 12.
13 - Highcliffe	Local Aspirational – Improve A	If the Local Aspirational Leading Option (Improve C) in ODU 12 is not delivered, the second choice option in ODU 12 would be the National Economic Option (Improve A). Both options involve beach nourishment in ODU 12 which would help support beach levels in ODU 13. However, the Improve A option in ODU 13 also includes beach nourishment and therefore it would not be reliant on a feed of beach material from the west to be successful. At the eastern end of the unit in ODU 13, new outflanking defences would be constructed. This ensures that there is no reliance on the delivery of the leading options in ODU 14.
14 – Naish Cliff and Barton on Sea	National – Managed Realignment A	There is potential for the Local Aspirational or National Economic Options in ODU 13 to provide a benefit to ODU 14 through the addition of beach material that could drift to ODU 14. However there is not a reliance on this happening as the toe defences as part of the Managed Realignment A option would provide the required defence to the cliff toe. With the drift direction from west to east, there is no reliance on defence measures being implemented further to the east in ODUs 15-18.
15 – Barton on Sea to Hordle Cliff	National Economic – Do Nothing	Successful implementation of the Do Nothing scenario is not influenced by defences in adjacent units.
16 – Cliff Road	Local Aspirational – Managed Realignment A / B	The Managed Realignment A / B option is not reliant on any defence measures to the west. Whilst there could be a benefit from beach nourishment activities further to the west, such as in ODU 12, 13 or 14, this is not required for the delivery of the option in ODU 16 as it would involve a separate beach nourishment intervention in ODU 16 itself. To the east there is a reliance on continued defences in ODU 17. The Local Aspirational Leading Option in ODU 17 is Improve A/B and if this were not deliverable then the National Economic Leading Option is Improve C and the Backup Option is Maintain. If the leading options were not delivered in ODU 17, or if the Maintain option could not successfully control rates of erosion, the delivery of the leading options in ODU 16 could be challenging. There is potential for schemes in ODU 16 and 17 to be combined to increase the robustness / linkage between the areas and to provide more certainty on the outcome measures delivered.
17 – Rook Cliff	Local Aspirational – Improve A / B	If the Local Aspirational Leading Option in ODU 16 (Managed Realignment A/B) is not delivered, the second choice option in ODU 16 is the National Economic Option (Managed Realignment C) followed by the Backup Option of Maintain. If the leading options were not delivered in ODU 16, or if the Maintain option could not successfully control rates of erosion, the delivery of the leading options in ODU 17 could be challenging as the western end of the defences could be outflanked. There is potential for schemes in ODU 16 and 17 to be combined to increase the robustness / linkage between the areas and to provide more certainty on the outcome measures delivered. This scenario also applies to the link with ODU 18 to the east. If the leading options are successfully implemented in ODU 18 then the leading options in ODU 17 could be delivered

ODU	First choice / priority option	Potential impact on option delivery if first choice option not delivered in adjacent units
		successfully (assuming the maintain option in ODU 18 could control erosion successfully). However, if erosion was uncontrolled in ODU 18 there is a risk that the east part of the defences at ODU 17 could be outflanked, potentially making it more challenging to maintain defences in ODU 17 and more difficult to deliver the option outcomes.
18 – Milford on Sea	National Economic – Improve A	In ODU 18 if the Local Aspirational Leading Option in ODU 17 (Improve A/B) is not delivered, the second choice option in ODU 17 is the National Economic Option (Improve C) followed by the Backup Option of Maintain. If the leading options were not delivered in ODU 17, or if the Maintain option could not successfully control rates of erosion, the delivery of the leading options in ODU 18 could be challenging as the western end of the defences could be outflanked. To the east of ODU 18 is the Hurst Spit rock revetment. Through discussions with the Hurst Spit to Lymington project team it is understood that the leading options for Hurst Spit involve keeping the rock revetment in place throughout the next century. Therefore if this is delivered as expected there is not a risk to the delivery of the Improve A option. The Improve A option has the potential to provide a benefit to Hurst Spit as the beach nourishment in ODU 18 could lead to a larger feed of material to the east over time.

Appendix A - Sensitivity Tests

ODU 3 – Christchurch Harbour South

Table A-0-1: ODU 3 economic appraisal sensitivity test +10% cost increase for Adaptation / Resilience A

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Adaptation / Resilience A	130	331	669	5.15	539	X
Adaptation / Resilience B	253	331	669	2.64	416	
Adaptation / Resilience C	776	189	811	1.05	35	
Do Nothing	-	1,000	0	-	-	
Do Minimum	44	1,000	0	-	-44	
Maintain A	204	1,000	0	-	-204	
Maintain B	727	857	143	0.20	-584	

Table A-0-2: ODU 3 economic appraisal sensitivity test +25% cost increase for Adaptation / Resilience A

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Adaptation / Resilience A	148	331	669	4.54	522	X
Adaptation / Resilience B	253	331	669	2.64	416	
Adaptation / Resilience C	776	189	811	1.05	35	
Do Nothing	-	1,000	0	-	-	
Do Minimum	44	1,000	0	-	-44	
Maintain A	204	1,000	0	-	-204	
Maintain B	727	857	143	0.20	-584	

ODU 4 – Wick

Table A-0-3: ODU 4 economic appraisal sensitivity test +10% cost increase for Sustain C

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Sustain C (75yr SoP)	1,615	598	3,586	2.22	1,971	X
Improve C (75yr SoP – end of appraisal period)	2,889	334	3,850	1.33	961	
Sustain B (75yr SoP)	3,499	546	3,638	1.04	139	
Do Nothing	-	4,184	0	-	-	
Do Minimum	340	4,176	8	0.02	-332	
Improve B (75yr SoP – end of appraisal period)	4,919	282	3,902	0.79	-1,017	
Maintain	2,684	4,145	39	0.01	-2,645	
Sustain A (75yr SoP)	6,301	546	3,638	0.58	-2,663	
Improve A (75yr SoP – end of appraisal period)	10,818	282	3,902	0.36	-6,916	

Table A-0-4: ODU 4 economic appraisal sensitivity test +25% cost increase for Sustain C

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Sustain C (75yr SoP)	1,762	598	3,586	2.04	1,824	X
Improve C (75yr SoP – end of appraisal period)	2,889	334	3,850	1.33	961	
Sustain B (75yr SoP)	3,499	546	3,638	1.04	139	
Do Nothing	-	4,184	0	-	-	
Do Minimum	340	4,176	8	0.02	-332	
Improve B (75yr SoP – end of appraisal period)	4,919	282	3,902	0.79	-1,017	
Maintain	2,684	4,145	39	0.01	-2,645	
Sustain A (75yr SoP)	6,301	546	3,638	0.58	-2,663	
Improve A (75yr SoP – end of appraisal period)	10,818	282	3,902	0.36	-6,916	

Table A-0-5: ODU 4 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Sustain C (75yr SoP)	2,948	598	3,586	1.22	638	X
Do Nothing	-	4,184	0	-	-	
Do Minimum	340	4,176	8	0.02	-332	
Sustain B (75yr SoP)	4,979	546	3,638	0.73	-1,341	
Maintain	2,684	4,145	39	0.01	-2,645	
Improve C (75yr SoP – end of appraisal period)	5,307	334	3,850	0.73	-1,457	
Improve B (75yr SoP – end of appraisal period)	7,337	282	3,902	0.53	-3,435	
Sustain A (75yr SoP)	8,005	546	3,638	0.45	-4,367	
Improve A (75yr SoP – end of appraisal period)	13,006	282	3,902	0.30	-9,104	

ODU 5 – Willow Drive and the Quomps

Table A-0-6: ODU 4 economic appraisal sensitivity test +10% cost increase for Improve D, E, F

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve F (75yr SoP – end of appraisal period)	12,521	3,532	34,424	2.75	21,903	X
Improve E (75yr SoP – end of appraisal period)	15,348	1,532	36,424	2.37	21,076	X
Improve C (75yr SoP – end of appraisal period)	13,660	3,517	34,439	2.52	20,779	X
Sustain F (75yr SoP)	11,059	6,204	31,752	2.87	20,693	X
Improve D (75yr SoP – end of appraisal period)	16,008	1,532	36,424	2.28	20,416	X
Sustain E (75yr SoP)	13,943	4,507	33,449	2.40	19,506	
Sustain D (75yr SoP)	16,547	4,507	33,449	2.02	16,902	
Sustain C (75yr SoP)	15,398	6,187	31,769	2.06	16,371	
Improve B (75yr SoP – end of appraisal period)	20,908	1,424	36,532	1.75	15,624	
Improve A (75yr SoP – end of appraisal period)	22,507	1,424	36,532	1.62	14,025	
Sustain B (75yr SoP)	21,130	4,475	33,481	1.58	12,351	
Sustain A (75yr SoP)	24,435	4,475	33,481	1.37	9,046	
Adaptation / Resilience	11,927	21,430	16,526	1.39	4,599	
Do Minimum	340	37,136	820	2.41	480	
Do Nothing	-	37,956	0	-	-	
Maintain	9,079	30,280	7,676	0.85	-1,403	

Table A-0-7: ODU 4 economic appraisal sensitivity test +25% cost increase for Improve D, E, F

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve C (75yr SoP – end of appraisal period)	13,660	3,517	34,439	2.52	20,779	X
Sustain F (75yr SoP)	11,059	6,204	31,752	2.87	20,693	X
Improve F (75yr SoP – end of appraisal period)	14,229	3,532	34,424	2.42	20,195	X
Sustain E (75yr SoP)	13,943	4,507	33,449	2.40	19,506	X
Improve E (75yr SoP – end of appraisal period)	17,441	1,532	36,424	2.09	18,983	X
Improve D (75yr SoP – end of appraisal period)	18,191	1,532	36,424	2.00	18,233	X
Sustain D (75yr SoP)	16,547	4,507	33,449	2.02	16,902	
Sustain C (75yr SoP)	15,398	6,187	31,769	2.06	16,371	
Improve B (75yr SoP – end of appraisal period)	20,908	1,424	36,532	1.75	15,624	
Improve A (75yr SoP – end of appraisal period)	22,507	1,424	36,532	1.62	14,025	
Sustain B (75yr SoP)	21,130	4,475	33,481	1.58	12,351	
Sustain A (75yr SoP)	24,435	4,475	33,481	1.37	9,046	
Adaptation / Resilience	11,927	21,430	16,526	1.39	4,599	
Do Minimum	340	37,136	820	2.41	480	
Do Nothing	-	37,956	0	-	-	
Maintain	9,079	30,280	7,676	0.85	-1,403	

Table A-0-8: ODU 5 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve E (75yr SoP – end of appraisal period)	14,912	1,532	36,424	2.44	21,512	X
Improve F (75yr SoP – end of appraisal period)	13,192	3,532	34,424	2.61	21,232	X
Improve D (75yr SoP – end of appraisal period)	16,847	1,532	36,424	2.16	19,577	X
Sustain F (75yr SoP)	13,756	6,204	31,752	2.31	17,996	
Sustain E (75yr SoP)	15,481	4,507	33,449	2.16	17,968	
Improve C (75yr SoP – end of appraisal period)	17,137	3,517	34,439	2.01	17,302	
Improve B (75yr SoP – end of appraisal period)	22,817	1,424	36,532	1.60	13,715	
Sustain D (75yr SoP)	20,048	4,507	33,449	1.67	13,401	
Sustain C (75yr SoP)	19,029	6,187	31,769	1.67	12,740	
Improve A (75yr SoP – end of appraisal period)	27,070	1,424	36,532	1.35	9,462	
Sustain B (75yr SoP)	24,602	4,475	33,481	1.36	8,879	
Adaptation / Resilience	11,927	21,430	16,526	1.39	4,599	
Sustain A (75yr SoP)	30,143	4,475	33,481	1.11	3,338	
Do Minimum	340	37,136	820	2.41	480	
Do Nothing	-	37,956	0	-	-	
Maintain	9,079	30,280	7,676	0.85	-1,403	

ODU 6 – River Avon West Bank

Table A-0-9: ODU 6 sensitivity test, Sustain B with and without PLP included

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV
Sustain B (200yr SoP) – full option	3,303	3,516	3,921	1.19	618
Sustain B (200yr SoP) – north part of unit only (no PLP costs or benefits in south part of unit included)	2,352	6,381	1,056	0.45	-1,296

ODU 7 – Rossiters Quay

Table A-0-10: ODU 7 economic appraisal sensitivity test +10% cost increase for Improve A (200yr SoP)

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	5,388	0	-	-	
Do Minimum	340	5,075	313	0.92	-27	
Maintain	1,975	3,716	1,672	0.85	-303	
Adaptation / Resilience	2,630	2,135	3,253	1.24	632	
Sustain A (75yr SoP)	4,031	645	4,743	1.18	712	
Sustain A (200yr SoP)	4,090	210	5,178	1.27	1,088	
Improve A (75yr SoP – end of appraisal period)	4,060	144	5,244	1.29	1,184	X
Improve A (200yr SoP – end of appraisal period)	4,530	59	5,329	1.18	799	

Table A-0-11: ODU 7 economic appraisal sensitivity test +25% cost increase for Improve A (200yr SoP)

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	5,388	0	-	-	
Do Minimum	340	5,075	313	0.92	-27	
Maintain	1,975	3,716	1,672	0.85	-303	
Adaptation / Resilience	2,630	2,135	3,253	1.24	632	
Sustain A (75yr SoP)	4,031	645	4,743	1.18	712	
Sustain A (200yr SoP)	4,090	210	5,178	1.27	1,088	
Improve A (75yr SoP – end of appraisal period)	4,060	144	5,244	1.29	1,184	X
Improve A (200yr SoP – end of appraisal period)	5,148	59	5,329	1.04	182	

Table A-0-12: ODU 7 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	5,388	0	-	-	
Do Minimum	340	5,075	313	0.92	-27	
Maintain	1,975	3,716	1,672	0.85	-303	
Adaptation / Resilience	2,630	2,135	3,253	1.24	632	
Sustain A (75yr SoP)	4,843	645	4,743	0.98	-100	
Sustain A (200yr SoP)	4,902	210	5,178	1.06	276	
Improve A (75yr SoP – end of appraisal period)	4,589	144	5,244	1.14	655	
Improve A (200yr SoP – end of appraisal period)	4,648	59	5,329	1.15	681	X

ODU 9 - Stanpit

Table A-0-13: ODU 9 economic appraisal sensitivity test +10% cost increase for Sustain A (200yr SoP)

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	39,803	0	-	-	
Do Minimum	510	38,510	1,293	2.54	783	
Maintain	7,087	33,103	6,700	0.95	-387	
Adaptation / Resilience	8,271	27,249	12,554	1.52	4,283	
Sustain A (75yr SoP)	10,859	5,519	34,284	3.16	23,425	
Sustain A (200yr SoP)	12,056	1,994	37,809	3.14	25,753	
Improve A (75yr SoP – end of appraisal period)	11,760	2,171	37,632	3.20	25,872	
Improve A (200yr SoP – end of appraisal period)	12,082	796	39,007	3.23	26,925	X

Table A-0-14: ODU 9 economic appraisal sensitivity test +25% cost increase for Sustain A (200yr SoP)

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	39,803	0	-	-	
Do Minimum	510	38,510	1,293	2.54	783	
Maintain	7,087	33,103	6,700	0.95	-387	
Adaptation / Resilience	8,271	27,249	12,554	1.52	4,283	
Sustain A (75yr SoP)	10,859	5,519	34,284	3.16	23,425	
Sustain A (200yr SoP)	13,700	1,994	37,809	2.76	24,109	
Improve A (75yr SoP – end of appraisal period)	11,760	2,171	37,632	3.20	25,872	
Improve A (200yr SoP – end of appraisal period)	12,082	796	39,007	3.23	26,925	X

Table A-0-15: ODU 9 economic appraisal sensitivity test +0.9m crest height cost increase for Sustain and Improve Options

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	39,803	0	-	-	
Do Minimum	510	38,510	1,293	2.54	783	
Maintain	7,087	33,103	6,700	0.95	-387	
Adaptation / Resilience	8,271	27,249	12,554	1.52	4,283	
Sustain A (75yr SoP)	17,292	5,519	34,284	1.98	16,992	
Sustain A (200yr SoP)	17,350	1,994	37,809	2.18	20,459	
Improve A (75yr SoP – end of appraisal period)	16,663	2,171	37,632	2.26	20,969	
Improve A (200yr SoP – end of appraisal period)	16,663	796	39,007	2.34	22,344	X

ODU 10 - Mudeford

Table A-0-16: ODU 10 economic appraisal sensitivity test +10% cost increase for Improve A (200yr SoP)

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	12,747	0	-	-	
Do Minimum	340	12,747	0	-	-340	
Maintain	3,526	12,747	0	-	-3,526	
Adaptation / Resilience	5,473	9,970	2,777	0.51	-2,696	
Improve A (75yr SoP from epoch 3)	8,319	2,254	10,493	1.26	2,174	X
Improve B (75yr SoP from epoch 3)	9,003	2,254	10,493	1.17	1,490	
Improve A (200yr SoP from epoch 3)	9,210	1,623	11,124	1.21	1,914	
Improve B (200yr SoP from epoch 3)	9,071	1,623	11,124	1.23	2,053	

Table A-0-17: ODU 10 economic appraisal sensitivity test +25% cost increase for Improve A (200yr SoP)

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	12,747	0	-	-	
Do Minimum	340	12,747	0	-	-340	
Maintain	3,526	12,747	0	-	-3,526	
Adaptation / Resilience	5,473	9,970	2,777	0.51	-2,696	
Improve A (75yr SoP from epoch 3)	8,319	2,254	10,493	1.26	2,174	X
Improve B (75yr SoP from epoch 3)	9,003	2,254	10,493	1.17	1,490	
Improve A (200yr SoP from epoch 3)	10,466	1,623	11,124	1.06	658	
Improve B (200yr SoP from epoch 3)	9,071	1,623	11,124	1.23	2,053	

Table A-0-18: ODU 10 economic appraisal sensitivity test +0.9m crest height cost increase for all Improve Options

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	12,747	0	-	-	
Do Minimum	340	12,747	0	-	-340	
Maintain	3,526	12,747	0	-	-3,526	
Adaptation / Resilience	5,473	9,970	2,777	0.51	-2,696	
Improve A (75yr SoP from epoch 3)	8,805	2,254	10,493	1.19	1,688	
Improve B (75yr SoP from epoch 3)	9,622	2,254	10,493	1.09	871	
Improve A (200yr SoP from epoch 3)	8,859	1,623	11,124	1.26	2,265	X
Improve B (200yr SoP from epoch 3)	9,691	1,623	11,124	1.15	1,433	

ODU 12 – Avon Beach and Friars Cliff

Table A-0-19: ODU 12 economic appraisal sensitivity test +10% cost increase for Improve A

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	8,989	-	-	-	
Improve A	9,287	11	8,978	0.97	-309	
Do Minimum	510	8,827	162	0.32	-348	
Improve B	11,398	11	8,978	0.79	-2,420	
Improve C	14,030	11	8,978	0.64	-5,052	
Maintain	9,412	5,535	3,454	0.37	-5,958	

Table A-0-20: ODU 12 economic appraisal sensitivity test +25% cost increase for Improve A

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Do Nothing	-	8,989	-	-	-	
Do Minimum	510	8,827	162	0.32	-348	
Improve A	10,554	11	8,978	0.85	-1,576	
Improve B	11,398	11	8,978	0.79	-2,420	
Improve C	14,030	11	8,978	0.64	-5,052	
Maintain	9,412	5,535	3,454	0.37	-5,958	

Table A-0-21: ODU 12 economic appraisal sensitivity test 50% reduction in beach nourishment costs

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve A	7,009	11	8,978	1.28	1,969	X
Do Nothing	-	8,989	-	-	-	
Do Minimum	510	8,827	162	0.32	-348	
Improve B	11,398	11	8,978	0.79	-2,420	
Improve C	12,172	11	8,978	0.74	-3,194	
Maintain	9,412	5,535	3,454	0.37	-5,958	

ODU 13 - Highcliffe

Table A-0-22: ODU 13 economic appraisal sensitivity test +10% cost increase for Improve C

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve C	5,974	0	6,946	1.16	972	X
Improve A	6,689	0	6,946	1.04	257	
Do Nothing	-	6,946	0			
Do Minimum	177	6,946	0	-	-177	
Improve B	7,918	0	6,946	0.88	-972	
Managed Realignment A	7,562	369	6,577	0.87	-985	
Maintain	5,310	4,401	2,545	0.48	-2,765	
Managed Realignment B	11,474	369	6,577	0.57	-4,897	

Table A-0-23: ODU 13 economic appraisal sensitivity test +25% cost increase for Improve C

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve A	6,689	0	6,946	1.04	257	X
Improve C	6,789	0	6,946	1.02	157	X
Do Nothing	-	6,946	0			
Do Minimum	177	6,946	0	-	-177	
Improve B	7,918	0	6,946	0.88	-972	
Managed Realignment A	7,562	369	6,577	0.87	-985	
Maintain	5,310	4,401	2,545	0.48	-2,765	
Managed Realignment B	11,474	369	6,577	0.57	-4,897	

Table A-0-24: ODU 13 economic appraisal sensitivity test 50% reduction in beach nourishment costs

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve C	5,051	0	6,946	1.38	1,895	X
Improve A	5,680	0	6,946	1.22	1,266	
Managed Realignment A	6,553	369	6,577	1.00	24	
Do Nothing	-	6,946	0			
Do Minimum	177	6,946	0	-	-177	
Improve B	7,918	0	6,946	0.88	-972	
Maintain	5,310	4,401	2,545	0.48	-2,765	
Managed Realignment B	10,618	369	6,577	0.62	-4,041	

ODU 14 – Naish Cliff and Barton on Sea

Table A-0-25: ODU 14 economic appraisal sensitivity test +10% cost increase for Managed Realignment A

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Managed Realignment B	19,718	8,287	20,077	1.02	359	X
Managed Realignment D	14,218	13,973	14,391	1.01	173	
Maintain	5,927	22,405	5,959	1.01	32	
Do Nothing	-	28,364	-	-	-	
Managed Realignment C	15,317	13,973	14,391	0.94	-926	
Do Minimum	1,228	28,078	286	0.23	-942	
Managed Realignment A	24,432	4,875	23,489	0.96	-943	
Managed Realignment F	11,750	19,150	9,214	0.78	-2,536	
Managed Realignment E	11,836	19,150	9,214	0.78	-2,622	
Improve B	46,061	1,089	27,275	0.59	-18,786	
Improve A	55,527	1,089	27,275	0.49	-28,252	

Table A-0-26: ODU 14 economic appraisal sensitivity test +25% cost increase for Managed Realignment A

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Managed Realignment B	19,718	8,287	20,077	1.02	359	X
Managed Realignment D	14,218	13,973	14,391	1.01	173	
Maintain	5,927	22,405	5,959	1.01	32	
Do Nothing	-	28,364	-	-	-	
Managed Realignment C	15,317	13,973	14,391	0.94	-926	
Do Minimum	1,228	28,078	286	0.23	-942	
Managed Realignment F	11,750	19,150	9,214	0.78	-2,536	
Managed Realignment E	11,836	19,150	9,214	0.78	-2,622	
Managed Realignment A	27,764	4,875	23,489	0.85	-4,275	
Improve B	46,061	1,089	27,275	0.59	-18,786	
Improve A	55,527	1,089	27,275	0.49	-28,252	

ODU 16 – Cliff Road

Table A-0-27: ODU 16 economic appraisal sensitivity test +10% cost increase for Managed Realignment C

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Managed Realignment C	4,846	15	7,400	1.53	2,555	X
Managed Realignment B	5,069	15	7,400	1.46	2,331	
Managed Realignment A	5,612	15	7,400	1.32	1,788	
Maintain	1,791	4,398	3,017	1.68	1,226	
Do Nothing	-	7,415	-	-	-	
Do Minimum	469	7,415	0	-	-469	
Improve	7,954	0	7,415	0.93	-539	

Table A-0-28: ODU 16 economic appraisal sensitivity test +25% cost increase for Managed Realignment C

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Managed Realignment B	5,069	15	7,400	1.46	2,331	X
Managed Realignment C	5,506	15	7,400	1.34	1,894	
Managed Realignment A	5,612	15	7,400	1.32	1,788	
Maintain	1,791	4,398	3,017	1.68	1,226	
Do Nothing	-	7,415	-	-	-	
Do Minimum	469	7,415	0	-	-469	
Improve	7,954	0	7,415	0.93	-539	

Table A-0-29: ODU 16 economic appraisal sensitivity test 50% reduction in beach nourishment costs

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Managed Realignment C	3,071	15	7,400	2.41	4,329	X
Managed Realignment B	3,476	15	7,400	2.13	3,924	
Managed Realignment A	3,692	15	7,400	2.00	3,708	
Maintain	1,472	4,398	3,017	2.05	1,545	
Do Nothing	-	7,415	-	-	-	
Do Minimum	469	7,415	0	-	-469	
Improve	7,954	0	7,415	0.93	-539	

ODU 17 – Rook Cliff

Table A-0-30: ODU 17 economic appraisal sensitivity test +10% cost increase for Improve C

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve B	9,376	0	11,516	1.23	2,140	X
Improve C	9,961	0	11,516	1.16	1,556	
Maintain	4,110	7,294	4,222	1.03	112	
Improve A	11,471	0	11,516	1.00	45	
Do Nothing	-	11,516	-			
Do Minimum	241	11,516	0	-	-241	
Managed Realignment A	14,021	1,424	10,092	0.72	-3,929	
Managed Realignment B	17,269	0	11,516	0.67	-5,753	

Table A-0-31: ODU 17 economic appraisal sensitivity test +25% cost increase for Improve C

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV	Leading Economic Option
Improve B	9,376	0	11,516	1.23	2,140	X
Improve C	11,319	0	11,516	1.02	197	
Maintain	4,110	7,294	4,222	1.03	112	
Improve A	11,471	0	11,516	1.00	45	
Do Nothing	-	11,516	-			
Do Minimum	241	11,516	0	-	-241	
Managed Realignment A	14,021	1,424	10,092	0.72	-3,929	
Managed Realignment B	17,269	0	11,516	0.67	-5,753	

ODU 18 – Milford on Sea Frontage

Table A-0-32: ODU 18 economic appraisal sensitivity test +10% cost increase for Improve A and B

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Maintain	8,872	2,552	8,933	1.01	61	X
Do Nothing	-	11,485	-	-	-	
Do Minimum	963	11,402	83	0.09	-880	
Improve B	12,139	330	11,155	0.92	-984	
Improve A	12,166	330	11,155	0.92	-1,011	
Managed Realignment B	12,269	330	11,155	0.91	-1,114	
Managed Realignment A	11,999	3,867	7,618	0.63	-4,381	

Table A-0-33: ODU 18 economic appraisal sensitivity test +25% cost increase for Improve A and B

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Maintain	8,872	2,552	8,933	1.01	61	X
Do Nothing	-	11,485	-	-	-	
Do Minimum	963	11,402	83	0.09	-880	
Managed Realignment B	12,269	330	11,155	0.91	-1,114	
Improve B	12,139	330	11,155	0.81	-2,639	
Improve A	12,166	330	11,155	0.81	-2,670	
Managed Realignment A	11,999	3,867	7,618	0.63	-4,381	

Table A-0-34: ODU 18 economic appraisal sensitivity test 50% reduction in beach nourishment costs

Option	PV cost (£k)	PV damages (£k)	PV benefits (£k)	ABCR	NPV (£k)	Leading Economic Option
Improve A	9,731	330	11,155	1.15	1,424	X
Improve B	10,257	330	11,155	1.09	898	X
Maintain	8,872	2,552	8,933	1.01	61	
Do Nothing	-	11,485	-	-	-	
Managed Realignment B	11,812	330	11,155	0.94	-657	
Do Minimum	963	11,402	83	0.09	-880	
Managed Realignment A	10,913	3,867	7,618	0.70	-3,295	