Options Appraisal Report

Prepared for

Slapton Line Partnership

February 2018

JACOBS ch2m

CH2M is now Jacobs
Ash House
Falcon Road
Sowton
Exeter
EX2 7LB

Contents

Section Page

Document History

Reference Number: **689979**

Client Name: Slapton Line Partnership

This document has been issued and amended as follows:

Version	Date	Description	Created By	Verified By	Approved By
v1	24.01.2018	Draft	Emma Allan	Alan Frampton	Alan Frampton
v2	21.02.2018	Final	Emma Allan	Emma Allan	Emma Allan
v3	28.02.2018	Final	Emma Allan	Alan Frampton	Alan Frampton

Executive Summary

This Options Appraisal Report is a supporting document to the BMP and provides full details of the options appraisal that was completed to identify the potential future coastal flood and erosion risk management options for the Slapton Sands BMP frontage.

The selection of a preferred option / management approach for the BMP frontage was undertaken via a staged approach, which rationalised a long-list of options to a short-list of options, from which a preferred option(s) was selected.

The options appraisal is underpinned by the information and evidence presented in the four baseline studies:

- Coastal Processes Baseline: coastal processes, shoreline interactions and shoreline evolution.
- Environmental Baseline: environmental setting and features.
- Defence Baseline: coastal defence assets, condition and performance.
- Economics Baseline: economic basis (i.e. the economic benefits) for both ongoing and future beach management and coastal flood and erosion risk management activities.

Stakeholder engagement was integral to the options appraisal process and the definition of a preferred option. Consultation with the SLP took place during the BMP development to seek local knowledge/information and to help guide the selection of beach management options. In addition, public consultation on the long-list options was conducted in July 2017. All comments made have informed the options appraisal.

Within the BMP area there are:

- Up to 48 residential properties at risk of coastal flooding. The discounted Present Value (PVd) of these properties is estimated to be £1,162k (over a 20-year appraisal period).
- Roads and tourism benefits arising from the area. The discounted Present Value (PVd) is estimated to be £30,550k (over a 20-year appraisal period).
- No properties at risk of coastal erosion along the BMP frontage during the 20-year appraisal period.
- No account of any additional flood risk from fluvial flooding has been made as part of this project.
- In total therefore, the Do-Nothing scenario damages for the BMP frontage could be up to £31,712k.

In order to obtain a 100% PF score for Torcross/Slapton Sands against £31,712k of benefits and 48 properties being at risk of flooding under a 1:100 year event (moderate risk) being moved to low risk, then approximately £1,778k of FCERM-GiA could be available from the Environment Agency before third-party contributions are needed to deliver solutions.

Following the rigorous options appraisal process (including an assessment of the technical and environmental suitability of the proposed management options), and allowing for the estimate of funds available, the overall strategy going forward is to recognise that reactive work should be done, but only to patch and mend the defences and road as required over the next 20 years. This is in line with funding available via FCERM-GiA. Further options do exist but their implementation is wholly dependent on the availability of third-party funds. Preparations should be made for the next 50 years, and not to leave a legacy of unmanageable and unaffordable solutions to future generations.

The preferred management approach to reduce the flood and coastal erosion risk between Torcross and Strete Gate over the next 20 years is defined as follows:

Maintain the Existing Seawall at Torcross (Option 10) - Funding Source: FCERM-GiA (Environment Agency)

- Maintain the existing seawall at Torcross for the next 20 years at a PV cost of £376,244 to provide a robust defence for the properties at Torcross against flooding via wave overtopping and protection of the A379 road behind from erosion.

Concrete Seawall Improvements (Option 10) - Funding Source: FCERM-GiA (Environment Agency)/SHDC/DCC (Highways)

- Works to improve the existing condition and level of protection of the concrete seawall adjacent to the Torcross seawall should be undertaken to protect the seawall from outflanking and in turn protect the road from erosion, as listed below. Funding for these works should be sort from Environment Agency FCERM-GiA and SHDC/DCC (Highways).
    - Maintain the existing 23m concrete seawall along landward edge of slipway (reference 'Concrete Seawall 3' in the Defence Baseline Report) to address signs of cracking and loss of structural concrete at the crest and raise to the same standard as the adjacent sheet pile wall to the north.
    - Maintain existing 60m Sheet Pile Wall at Torcross (replaced approximately one year ago in 2016 to a cost in the region of £180,000).
    - Upgrade and improve existing 60m concrete seawall at Torcross (reference 'Concrete Seawall 4' in the Defence Baseline Report) to the same standard as the adjacent sheet pile wall to the south. The estimated costs to undertake these works could be in the region of £250k.
- *Note: This option assumes the ongoing maintenance of the seawall at Torcross and seeks to maximise its performance.*

Rock revetment Repairs (Option 10) – Funding Source: SHDC/FCERM-GiA (Environment Agency)

- Although a scheme may not be possible, there are works that can be done to address the state of the existing defences, including repairs to the existing rock revetment. Presently, there is approximately 700m of rock revetment that has become displaced along the barrier. The estimated costs to undertake these works could be in the region of £500k.
- At present, some of this rock is providing some degree of protection to the barrier from wave attack. Recovering and re-profiling of the rock in conjunction with concrete seawall improvements (as described above) may attract some FCERM-GiA contribution. However, if undertaken in isolation it is less likely to achieve FCERM-GiA funding. Therefore, in order for this option to be implemented, it recommended that funds are identified via SHDC to support any FCERM-GiA that may be available.
- *Note: This option assumes the ongoing maintenance of the seawall at Torcross and seeks to maximise its performance.*

Beach Recycling (Option 22) – Funding Source: Environment Agency/SHDC/DCC (Highways)

- Beach recycling would not provide protection to the full length of the eroding frontage, rather used to bolster areas along the beach where levels are low. This would provide a temporary protection measure, but the is not guarantee the material will stay in place. Beach control structures would need to be used and, as the appraisal process has identified, there are pros and cons to implementing such structures.
- *Note: This option assumes the ongoing maintenance of the seawall at Torcross and seeks to maximise its performance.*
- Beach recycling may attract some FCERM-GiA contribution if supporting measures to address outflanking of the Torcross seawall. However, if undertaken to protect the road, it is less likely to achieve FCERM-GiA funding. Therefore, in order for this option to be implemented, it

recommended that funds are identified via SHDC and/or DCC (Highways) to support any FCERM-GiA that may be available.

Emergency Reactive Realignment (Options 27 and 29A) – Funding Source: FCERM-GiA (Environment Agency)/DCC (Highways)

- Reactive realignment would achieve funding from both FCERM-GiA and DCC (Highways) and should be used to fund emergency works as and when they are needed. Any further works required to implement the northern realignment should be undertaken as per the existing planning application, and as much preparatory work relating to consents, planning and funding should be undertaken from the remainder of the A379 along The Line to facilitate a prompt realignment should the need arise.

Coastal Change Management and Adaption

- It is evident from undertaking the Slapton Sands BMP that funding for the management of flood and coastal erosion risk at Slapton Sands is limited and that there is little that can be done to combat the effects of ongoing coastal change. Over time, the road may become irreparable and even breach. It is therefore important to formally recognise this in the immediate future and define 'The Line' as a 'Coastal Change Management Area' in order to drive future coastal change adaptation efforts in the area.
- Recommendations to address coastal change adaptation include:
    - Build on the work completed for the Coastal Change Pathfinder Project, including:
        - High quality education and engagement – communicate with the public about the changing processes and landscape and the realities of this.
        - Wider use of local land charges registers for getting this information out there.
    - Prepare for eventuality of road failure including any required pre-existing planning and EIA work.
    - Preparing for the eventually of a breach and the need for a new road link – identify a suitable inland road network and make movements to improving it. To assist with the BMP project, work is being undertaken by DCC (Highways) to estimate costs associated with improving and upgrading inland routes.
    - Work with the SHDC planning department and develop the Local Plan. Investigate adaptive solutions and make provisions to 'roll back' properties and assets at risk, including defining a plan for compensation, changes to planning restrictions, relocation etc.

SECTION 1

Introduction

1.1 Background

This Options Appraisal Report has been prepared for the Slapton Line Partnership (SLP) and their partners South Hams District Council (SHDC), the Environment Agency and Devon County Council (DCC). The Beach Management Plan (BMP) study area covers the Slapton Sands coastline from Torcross in the south, to Strete Gate in the north, as shown in Figure 1.1. The central section of the BMP study area, which separates the freshwater lake, Slapton Ley lagoon, from Start Bay is locally referred to as 'The Line' and supports a section of the A379 road.

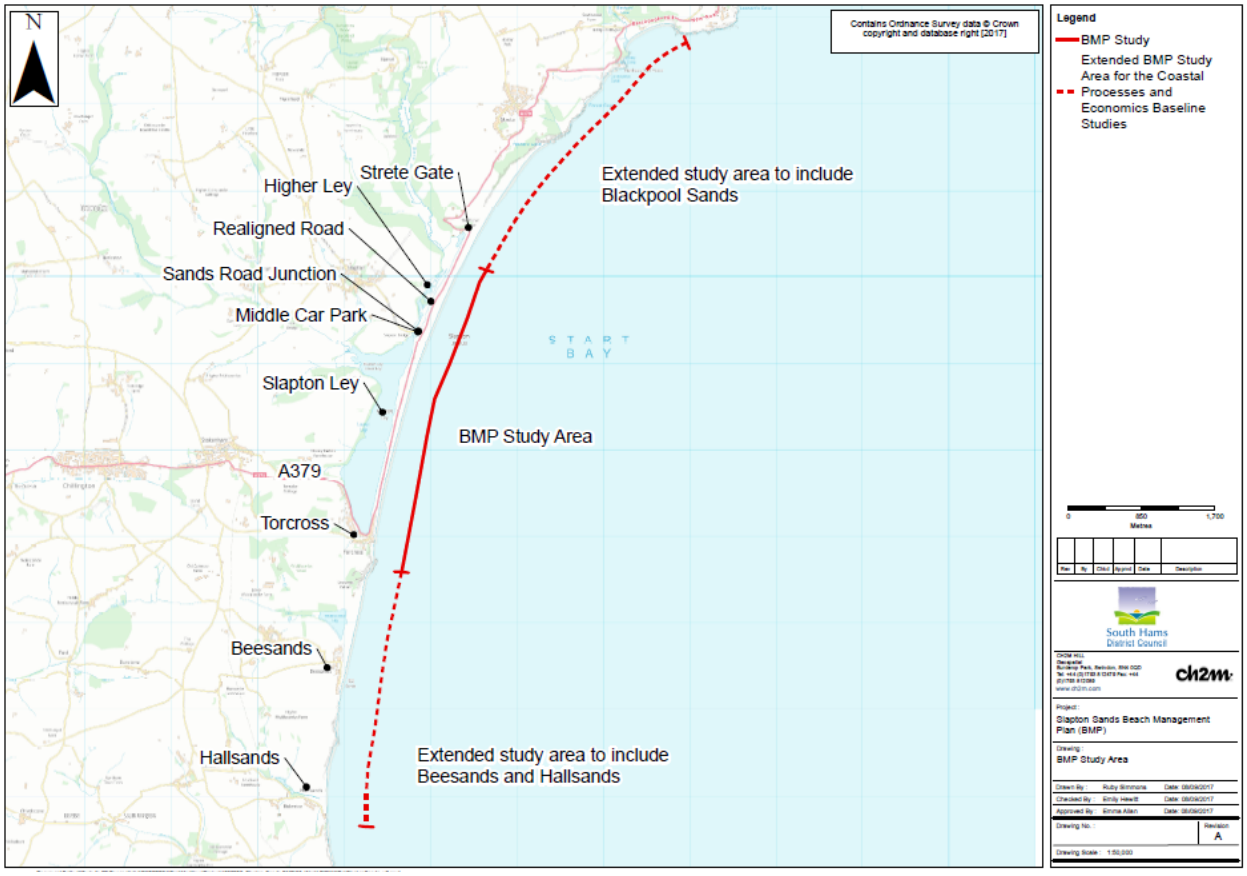

Figure 1-1 Slapton Sands BMP study area

1.2 The Problem

The Slapton Sands coastline is at risk of both coastal flooding and erosion. To reduce these risks, various coastal defences have been constructed along the frontage over the years, with the existing defences consisting of a concrete seawall & sheet piling, rock revetment, block armour work, and periodic beach recycling. These coastal defences protect a number of assets, including:

- Up to 48 properties at risk of flooding under a 'Do-Nothing' scenario at Torcross; the discounted Present Value (PV) of these properties is estimated to be £1,162,000: and,
- The A379 road, which at risk of flooding and collapse via erosion of the underlying shingle barrier and beach during storms. The A379 provides an important transport link to the area for both local traffic and tourists. Sea level rise predictions and increased storminess will continue to increase the vulnerability of beach and shingle barrier and its associated infrastructure to damage. The discounted Present Value (PV) of damages arising from the impact of temporary

and permanent closure of the A379 on local/tourist traffic and tourism revenue is estimated to be £30,550,000.

1.3 Aims and Objectives of the Beach Management Plan

The purpose of the BMP is to identify the management activities that could be undertaken to reduce the flood and coastal erosion risk between Torcross and Strete Gate over the next 20 years whilst recognising and managing the environmental and amenity implications of doing so.

The specific objectives of the SLP in developing the BMP are:

- To review and better understand the coastal processes which contribute to change along the study boundary.
- To assess the performance of the existing coastal defences.
- To assess the local economic benefit of future management options.
- To appraise each short-listed option against technical, economic, environmental and social criteria and identify the preferred management approach.
- Present a monitoring and intervention plan to sustain the A379 for the next 20 years.
- To develop and implement more sustainable longer-term solutions with consideration of the current 'Shoreline Management Plan' (as set out in Table 1.1).
- To consider immediate and long-term changes to both funding and local policy.
- Consider that impact of any management solution on the Slapton Line which is in a National Nature Reserve and SSSI designated for vegetated shingle, freshwater lakes and wetlands, geomorphologic features and rare plants and birds.

Table 1-1 Summary of the SMP policies that apply to the BMP area
Source: Halcrow, 2011

Policy Unit	Short Term (to 2025)	Medium Term (to 2055)	Long-term (to 2105)
6b75 - Strete to Torcross North (Slapton Sands)	Allow the barrier to retreat, through Managed Realignment, with local beach management as necessary to support localised realignment of the A379.	Allow the barrier to retreat, through Managed Realignment, with local beach management as necessary to support localised realignment of the A379. Studies to investigate implementation of No Active Intervention.	Allow the barrier to retreat, with localised beach management as necessary through Managed Realignment, with No Active Intervention once the road is abandoned.
6b76 - Torcross North to Limpet Rocks	Continue to maintain existing defences through a Hold the Line policy.	Maintain the existing defences for as long as technically possible, through a Hold the Line policy.	Build new defences in a more sustainable set-back position, through Managed Realignment.

1.4 Development of the BMP

The BMP has been developed utilising best practice contained in the CIRIA Beach Management Manual, 2nd Edition (CIRIA, 2010). It has been prepared in six stages, with ongoing communications with stakeholders throughout. A diagram showing the staged approach to preparing the BMP is presented in Figure 1 2.

- Stage 1 – Desktop Review: The purpose of this stage was to review the suitability of the existing and available data, identify any critical data gaps, and refine the scope of works for Stage 2 of the BMP. The findings of the review were recorded within a Baseline Scoping Report.
- Stage 2 – Technical Updates: The purpose of this stage was to update the existing baseline information on coastal processes, coastal defences, environment and economics, which underpins the BMP options development and decision-making process (see Stage 4). The findings of the work were recorded within four reports; Coastal Processes Baseline, Environmental Baseline, Defence Baseline, and Economics Baseline (discussed in Section 1.5 and included in Appendix B to E respectively).
- Stage 3 – Stakeholder Engagement and Funding: Stakeholder engagement was integral to the options appraisal process and the definition of a preferred option. Consultation with the SLP took place during the BMP development to seek local knowledge/information and to help guide the selection of beach management options. In addition, public consultation on the long-list options was conducted in July 2017. All comments made have informed the options appraisal.
- Stage 4 – Options Development and Economics: The options development stage identified and appraised the different management activities that could be implemented to manage flood and coastal erosion risk between Torcross and Strete Gate over the next 20 years. The options appraisal was completed in accordance with best practise guidance and followed a staged approach to ensure that the decision-making process was transparent and auditable. **This report covers this stage of the BMP development process.**
- Stage 5 – Community Engagement: In additional to the main BMP report, the findings of the BMP will be disseminated via a non-technical summary, suitable for a wide range of readers.
- Stage 6 – BMP Development: This stage involves the production of the main BMP document and Options Appraisal Report. In line with the aims and objectives, the BMP identifies the measures to develop and implement more sustainable longer-term solutions along the BMP frontage and sets out a plan to maintain and monitor the beach. Going forward, the BMP will then be used by SHDC, the SLP, Environment Agency and DCC to inform, guide and assist them when making decisions on how to best manage the coast going forward. The BMP also includes recommendations for further studies and investigations to refine the preferred long-term option and inform its implementation.

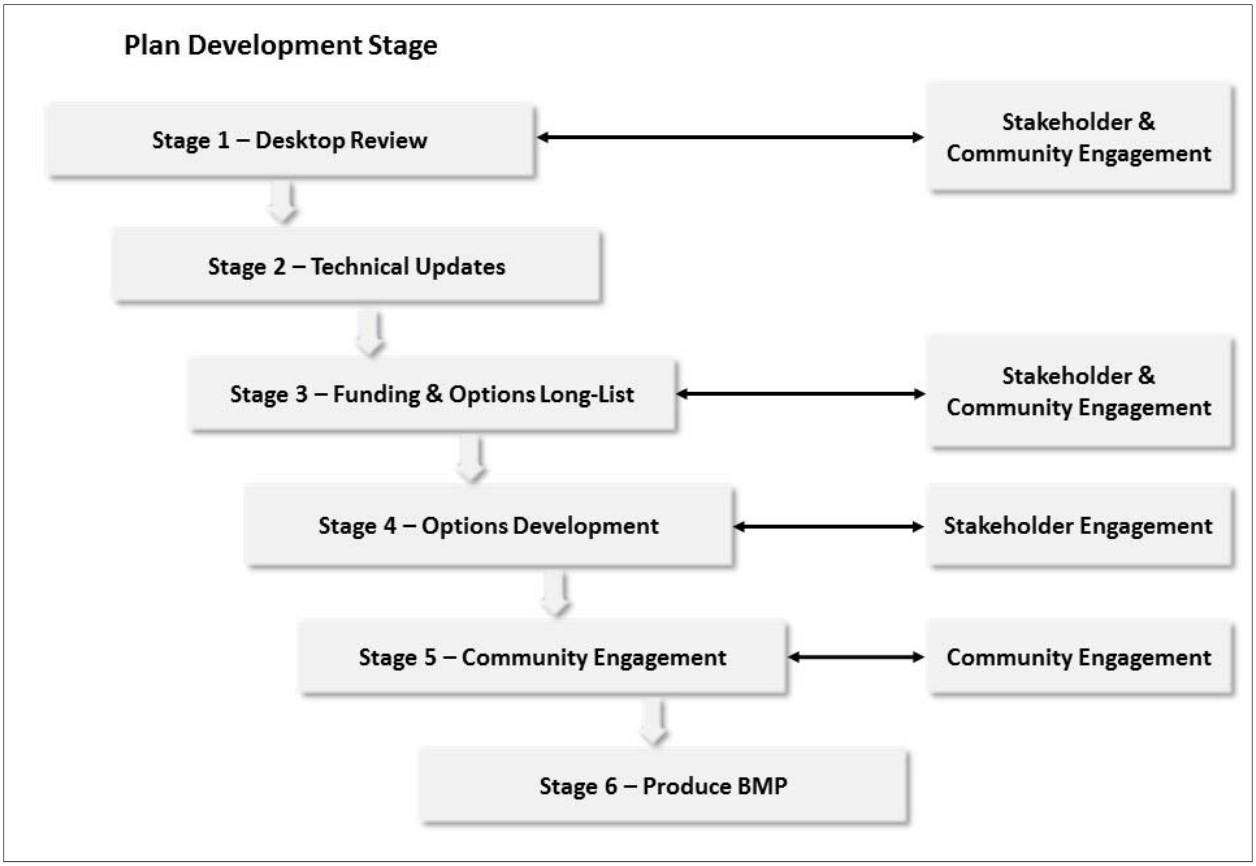

Figure 1-2 BMP development process

1.5 The Basis of this Report

This Options Appraisal Report is a supporting document to the BMP and covers Stage 4 of the BMP development process (as described in Section 1.2 and shown in Figure 1-2). This report provides full details of the options appraisal that was completed to identify the potential future coastal flood and erosion risk management options for the Slapton Sands BMP frontage.

The selection of a preferred option / management approach for the BMP frontage was undertaken via a staged approach, which rationalised a long-list of options to a short-list of options, from which a preferred option(s) was selected. This is shown in Figure 1-3, and references to the relevant sections within this report are listed below:

- Long-list appraisal (described in detail in Section 2).
- Short-list appraisal (described in detail in Section 3); and
- Selection of the preferred option (described in detail in Section 4).

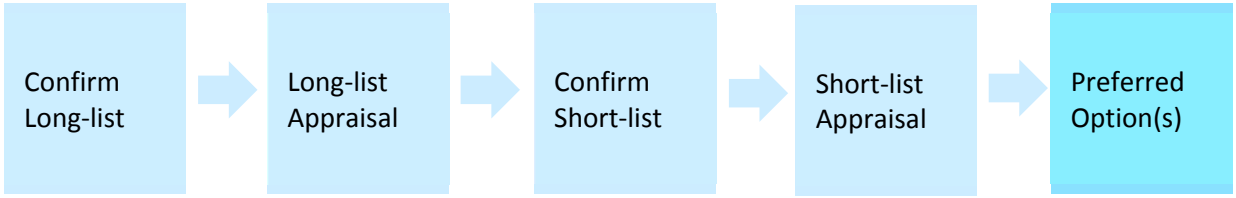

Figure 1-3 Options appraisal process – staged approach to option selection

The options appraisal is underpinned by the information and evidence presented in the four baseline studies:

- Coastal Processes Baseline: coastal processes, shoreline interactions and shoreline evolution (presented in Appendix A).

- Environmental Baseline: environmental setting and features (presented in Appendix B).
- Defence Baseline: coastal defence assets, condition and performance (presented in Appendix C).
- Economics Baseline: economic basis (i.e. the economic benefits) for both ongoing and future beach management and coastal flood and erosion risk management activities (discussed in more detail in Section 1.6 and Appendix D).

As indicated in Figure 1.1, the study area was extended to include Blackpool Sands, Beesands and Hallsands for two of the four baseline studies prepared for BMP; including the Coastal Processes Baseline study and the Economics Baseline study. The reasons for this are outlined below:

- The Coastal Processes Baseline inherently covers the wider coastal processes operating to the north and south of the study area, however, the study area was extended to include new high-level trends analysis for the wider coastline at Blackpool Sands, Hallsands and Beesands. This ensured that the options appraisal process is underpinned by the best possible evidence and analysis of coastal processes and shoreline change. This information will also be available for use in any future studies.
- The Economics Baseline was extended to include damages arising from erosion risk at Blackpool Sands and Hallsands and flood risk at Beesands in lieu of the potential benefits that may arise from works that could be undertaken in the future or alongside those at Slapton and to inform any future studies.

The Do-Nothing scenario is appraised and presented within the four baseline studies. 'Do-Nothing' as an option was discounted at long-list stage. All options considered going forward are 'Do-Something' and seek to prevent the occurrence of flood and coastal erosion risk damages.

1.6 Funding of Beach Management Activities

1.6.1 Funding Opportunities

Funding for flood and coastal erosion risk management can be achieved via a number of sources, some examples are provided below, with additional information presented in Section 2.3.3 and full details provided in Appendix D; Section 4.4.

- Environment Agency via FCERM-GiA. FCERM-GiA funding must be used to provide measures that protect against flood and erosion damages and realise the 'benefits'. Any business case submitted to the Environment Agency National Projects Assurance Services must demonstrate 'confidently' that the problem of flooding/erosion would be 'solved' and not need further protecting for the duration of the 'benefits' claimed.
- Environment Agency funding streams (as identified in Operational instruction 492_09, Environment Agency, 2017), including:
    - Capital budgets – allocated to the construction, provision, purchase and replacement of assets owned and managed by the Environment Agency. This is expenditure that leads to the creation of tangible and intangible assets which are included on the Environment Agency asset register. Capital assets must have a value greater than the £5k.
    - Capital Works Expensed in a Year (CWEiY) – this is budget allocated to works on assets that are not included on the Environment Agency asset register and includes works to replace an existing asset or structure / significantly improve the useful life of the existing asset or structure beyond its original design. CWEIY is treated by Defra as part of the grant in aid capital allocation.
    - Revenue Budgets – allocated as operating expenditure. This includes the likes of maintenance of existing structures of the structure that is not below target or useable condition; or capital works valued to be less than £5k).

- Directly via the assets owner / responsible authority, such as SHDC via local levy, or Devon County Council.
- Third party funding, such as utilities companies, local landowners and residents.

1.6.2 Method to Calculate Available Funding

The economic appraisal is based on assessment of the costs and benefits of each option. This is expressed as the benefit:cost ratio (BCR) for each option. The BCR then forms part of the Partnership Funding calculation to determine how much of the required costs can be claimed from central Government via the FCERM-GIA, and how much of the costs will have to be found from other sources of funding (refer to BOX 1 below). This partnership funding calculation also takes into account the numbers of properties protected against the risk of flooding and erosion, the level of social deprivation of the areas at risk, and legal environmental requirements.

To provide the costs part of the BCR, for each option appraised broad costs have been developed based on industry standard rates and recent CH2M 'now Jacobs' experience of similar types of works. In accordance with national guidance, a 60% optimism bias is then applied to total calculated costs.

The benefits part of the BCR is based upon the Do-Nothing scenario damages calculated in the economics baseline (refer to Appendix D). In summary, this calculated that there are up to 48 residential properties at risk of coastal flooding, with Present Value damages (PVd) calculated over a 20-year appraisal period to be £1,162k. No account of any additional flood risk from fluvial flooding has been made as part of this project. There are 0 properties at risk of coastal erosion along the BMP frontage during the 20-year appraisal period. In addition, there are calculated to be £30,550k of tourism and road closure benefits over the appraisal period. In total therefore, the Do-Nothing scenario damages for the BMP frontage could be up to £31,712k.

In order to obtain a 100% PF score for Torcross/Slapton Sands against £31,712k of benefits and 48 properties being at risk of flooding under a 1:100 year event (moderate risk) being moved to low risk, then approximately £1,778k of FCERM-GiA could be available before third-party contributions are needed to deliver solutions.

BOX 1: Future funding of coastal defences

The way in which flood and coastal erosion risk management schemes are funded in England changed in April 2012. The previous system of funding, whereby only the highest priority schemes received 100% grant-in-aid (GIA) from central government was replaced by a new funding system.

Whilst some schemes will still be eligible for the full 100% grant-in-aid from central government, the new approach allows more schemes to be delivered with a lower percentage GIA contribution from central government, with the shortfall in funding to be made up from other funding sources – this is referred to as 'Partnership Funding' (Defra, 2011(a); Defra, 2011(b); and EA, 2012).

This Partnership Funding approach will allow schemes that would have historically been deferred, due to failure to meet the 100% GIA qualifying criteria, to proceed earlier than would be expected if they were solely dependent on receiving central government funding.

This change in approach reflects the fact that flood and coastal erosion risk management schemes provide multiple benefits to communities, not just protection against flood and erosion risks. For example, a defence may reduce risks to transport and services infrastructure that is critical to an area's economy and development potential. A defence may also provide public space or, where a beach is recharged, an important tourism and recreational resource.

The different, multiple beneficiaries from FCERM funded schemes presents the potential to access the various funding sources that are used by those beneficiaries, and this may be one way of achieving Partnership Funding. Given this possibility, the following are potential Partnership Funding routes that could be explored to deliver future FCERM activities along the coast (from McNally *et al.*, 2012).

- Private investment (e.g. developer/landowner pays);
- Water company investment;
- Community Infrastructure Levy;
- Section 106 Agreements (Town & Country Planning Act, 1990);
- Council Tax;
- Public Works Loan Board;
- Business Rate Supplements;
- Business Improvement Districts;
- Asset Backed Securities;
- General Drainage Charge/Special Drainage Charge;
- Local Authority fees and charges;
- Trusts;
- Regional Growth Fund;
- Business Rate Retention;
- Tax Increment Finance;
- Local Government Bonds; and
- Coastal Communities Fund.

SECTION 2

Long-List Options Appraisal

2.1 Derivation of the Long-List

In order to ensure transparency, all possible options to address flood and coastal erosion risk within the BMP study areas were identified using the following information and summarised as the 'long-list':

- Baseline reports (coastal processes, environmental, defence, and economics – see Section 1.5);
- Outcomes of a Stakeholder Workshop to Identify long-list options held on the 25th July 2017;
- Feedback provided from a BMP public consultation event also held on the 25th July 2017; and
- Feedback provided directly to the Slapton Line Partnership (SLP).

The full long-list is presented in Table 2-1, with the accompany appraisal table presented in Appendix E.

2.2 Step 1 - Flood and Coastal Erosion Risk Management

The options considered must address flood and coastal erosion risk, which along the Slapton Sands BMP frontage are specifically related to:

- Flooding by wave overtopping;
- Erosion by cut-back;
- Erosion by barrier rollback;
- Erosion by cut-back and barrier rollback; and
- Flooding and erosion related issues combined.

Where a long-list option did not directly reduce flooding or erosion risk in its own right, is more akin to an adaptive solution, and is unlikely to achieve FCERM-GiA, then it has been passed through an initial filtering process to discount it from the long-list appraisal (see Section 2.5). Rather, the option is considered during the short-list appraisal if/when a relevant Change Scenario applies (see Section 2.4).

2.3 Step 2 – Long-List Appraisal

The purpose of the long-list appraisal is to assess viability of each option against its technical suitability (considering coastal processes and build-ability), potential economic viability; and the impact that it may have on the environment (as described in more detail in Section 2.3.1 to 2.3.3).

The appraisal defines the advantages and disadvantages of each option accordingly and from this it has been determined as to whether the option should be taken through to the short-list. Any significant 'show-stoppers' (i.e. significant disadvantages, see cells shaded as red in the accompanying spreadsheet) identified at this early stage have been discounted and not considered further.

2.3.1 Technical Suitability

The options have been assessed against the impact that it could have on coastal processes and shoreline interaction, and what the option would entail in terms of construction, maintenance and life-span of the relevant structure. This appraisal has been informed by the information and evidence of the coastal processes and shoreline interactions presented in the Coastal Processes

Baseline Report (refer to Appendix A) and coastal asset information presented in the Defence Baseline Report (refer to Appendix C).

2.3.2 Environmental Impacts

Each option has been considered against a standard suite of environmental aspects in order to identify key potential impacts. The appraisal identifies where possible, the positive and negative impacts on different environmental features of different options. It also attempts to indicate relative differences in environmental impacts between options, however this is not always possible at the high-level of appraisal that this work is undertaken at, and some aspects would only be discernible if more detailed appraisal were undertaken to develop a particular option or options if selected as the preferred option to take forward to such detailed appraisal. This appraisal has been informed by the information and evidence presented in the Environmental Baseline Report (refer to Appendix B)

2.3.3 Economic implications

The economic implications are based on a high-level understanding of the likely cost based on typical unit rates for the various options and initial indications of FCERM-GiA funding (discussed in Section 1.6 and the Economics Baseline Report Appendix D).

2.4 Step 3 – Change Scenarios

In recognition of the unique situation for which the BMP options are being developed, a series of change scenarios have been defined. The change scenarios reflect a potential breach situation, lack of funding presently (£1,778k of FCERM-GiA; see Section 1.6), and potential increase in funding in the future. The use of Change Scenarios provides the platform for options that may have otherwise been discounted for reasons of cost to be brought back into the appraisal process.

Please note that as a rule Change Scenarios have not been considered where options have been selected for short-lit appraisal. The exception to this rule however, exists for road realignment options (Options 27, 28 and 29) because even with present funding, the means of funding affects their implementation.

Six Change Scenarios have been defined, as outlined below:

1. A storm breaches the A379 road in part.
2. A storm breaches the A379 road in full.
3. Funding cannot be achieved to implement the option to maintain the A379 road.
4. Funding in the region of less than £2 million becomes available.
5. Funding in the region of £2 - 5 million becomes available.
6. Funding in the region of £5-15 million becomes available.

Table 2-1 Slapton Sands BMP long-list

Option Number	Option Description
1	Do nothing
2	Tidal barrier (enclosing a tidal lagoon to move the risk out to sea and generate energy)
3	Tidal/wave energy generation scheme (e.g. an array of surface or submerged wave energy convertors)
4	Offshore submerged reef (sand bags; surfing)
5	Offshore (partially or fully submerged) reef (sunken ships)
6	Inshore (partially submerged) breakwater
7	Offshore breakwater (large, offshore)
8	Seawall (along the length of the barrier) (continuation of Torcross)
9	Seawall (strategically placed at specific locations)
10	Seawall (maintain and upgrade existing seawall at Torcross)
11	Demountable defences (behind existing seawall)
12	Sheet pile wall (along the length of the barrier)
13	Sheet pile wall (strategically placed at specific locations)
14	Rock revetment (along the length of the barrier)
15	Rock revetment (strategically placed at specific locations)
16	Timber groynes (along length of beach between Torcross and Strete)
17	Timber groynes (strategically placed at specific locations)
18	Rock groynes (along the length of the barrier)
19	Rock groynes (strategically placed at specific locations)
20	Terminal groyne at Pilchard Cove (to prevent northerly transport of material north towards Black Pool Sands)
21	Beach recycling (move material along the beach from area of accretion in the north to area of erosion in the south)
22	Beach recycling (strategic movement of material along the coast, in support of beach retaining structures such as wooden groynes)
23	Beach recycling (move material from the road / back of the barrier back to the front)
24	Beach recycling (with the use of a lightweight railway built along the length of the barrier; the railway would be used to transport shingle collected from areas of accretion to two drop-off points; (i) off the sea front in Torcross; and (ii) in the region of the car park in the middle of the barrier. The recycled material would then be redistributed by natural processes. Loading at the north end could be facilitated by an overhead hopper, and unloading could be by done by using self unloading trucks, with the shingle being carried out to the edge of the sea by means of a conveyor belt at each of the two drop off locations. As for the economics of such a scheme, building costs would be low as most of it would simply be laid on top of the existing shingle, while profits from the passenger service would likely cover the cost of carrying shingle, the shingle operation probably only requiring two people to run it, thereby keeping costs to a minimum.
25	Beach nourishment/recharge
26	Build-up (recharge) sherries bank with similar material/plastic (to reduce the wave energy approaching the shoreline)

Option Number	Option Description
27	Reactive realignment of the road, with all planning requirements in place (emergency works)
28	Pro-active realignment of the road at locations identified as 'erosion hotspots' (similar to Option 29)
29	Realignment of the A379 road, either side of the previous realignment
30	Relocate car parks landward
31	Gravel road (cease maintenance of the tarmac road, but allow the top of the barrier to be used as a carriageway)
32	Land/road bridge connecting Torcross with Strete
33	Upgrade inland routes
34	New road (inland)
35	Road toll (to fund management of the road)
36	Car ferry (allowing the existing defences and road to fail)
37	Develop adaptation plan with adaptation phases
38	Define Slapton as a CCMA and devise adaptation plan

2.5 Options Filtered Out of the Appraisal Processes

Options discounted on the basis that they do not directly reduce flooding or erosion risk or are considered to be significant 'show-stoppers' include:

Option Number	Option Description	Summary of Rationale for Discounting from Long-list / Taking Forward to Short-List	Indicative Cost
1	Do nothing	This option does not directly reduce flooding or erosion.	Option not costed
2	Tidal barrier (enclosing a tidal lagoon to move the risk out to sea and generate energy)	A tidal barrier could help to reduce the wave energy reaching the shoreline, however, a tidal barrier is not viable on the basis of the tidal climate, costs and environmental impacts and is therefore considered to be a significant 'show stopper'.	£1.3 billion
3	Tidal/wave energy generation scheme (e.g. an array of surface or submerged wave energy convertors)	A tidal/wave generation scheme could help to reduce the wave energy reaching the shoreline, however, it is not viable on the basis of the available technologies, tidal climate, costs and environmental impacts and is therefore considered to be a significant 'show stopper'.	£1.3 billion
4	Offshore submerged reef (sand bags; surfing)	A submerged offshore reef is unlikely to provide sufficient protection to the coastline over the next 20 years, with repairs, maintenance and possible replacement. The success of the reef is very dependent on the local tidal and wave conditions, and therefore is unlikely to provide 'around the clock' protection. The option is costly with no proven success record in the UK. This is considered to be a very high-risk option. Considered to be a significant 'show stopper'.	£3 million
5	Offshore (partially or fully submerged) reef (sunken ships)	Sunken ships are unlikely to provide sufficient protection against erosion and flood risk. The option is costly with no proven success record in the UK. This is considered to be a very high-risk option. Considered to be a significant 'show stopper'.	Option not costed due to uncertainty
6	Inshore (partially submerged) breakwater	Although this option would provide sufficient protection for 20 years, it is a very expensive option. Sediment transport process down drift could be effected, thereby increasing the risk to erosion and flooding there. Considered to be a significant 'show stopper'.	£5.25 million to £13 million +
7	Offshore breakwater (large, offshore)	Although this option would provide sufficient protection for 20 years, it is an even more expensive option than 'partially submerged' breakwaters. Sediment transport process down drift could be effected, thereby increasing the risk to erosion and flooding there. There would also be substantial changes to the landscape/character of the area. Considered to be a significant 'show stopper'.	£8.1 million to £22 million +
8	Seawall (along the length of the barrier) (continuation of Torcross)	Although this option would provide sufficient protection for 20 years, it is an expensive option and does not work well with cross-shore processes. The option of a seawall is contrary to the SMP2 policy of Managed Realignment. Considered to be a significant **'show stopper'**.	£22 million

Option Number	Option Description	Summary of Rationale for Discounting from Long-list / Taking Forward to Short-List	Indicative Cost
9	Seawall (strategically placed at specific locations)	Although this option would provide sufficient protection for 20 years, there is potential for cutback and outflanking between each section of seawall, which would leave isolated hard-points. Although cheaper than the full-length seawall, the option remains expensive as there are costs associated with patch-repairs and outflanking issues. The alignment to the SMP2 Managed Realignment Policy is also questioned as the shoreline will still be 'held' in places. Considered to be a significant 'show stopper'.	£10 million
11	Demountable defences (behind existing seawall)	In isolation, demountable defences do not provide sufficient protection against erosion and flooding. They may be used in conjunction with alternative approaches to divert the flow of overtopped water, but even then, the funds available would be better spent on an all-encompassing solution. Considered to be a significant 'show stopper'.	Option not costed due to uncertainty
12	Sheet pile wall (along the length of the barrier)	This option would provide sufficient protection for 20 years. There are a number of issues relating to the corrosion of the piles, maintenance and replacement of sheet-piles, which outweigh the pros of this option. Therefore, unlike the seawall, this option will not be carried forward via a Change Scenario. The option does not work well with cross-shore processes and there are environmental impacts. The option of a sheet pile wall is contrary to the SMP2 policy of Managed Realignment. Considered to be a significant 'show stopper'.	£11 million
13	Sheet pile wall (strategically placed at specific locations)	Although this option may provide sufficient protection for 20 years, there is potential for cutback and outflanking between each section of sheet pile wall, which would leave isolated hard-points. Although cheaper than the full-length sheet pile wall, the option remains expensive and there are costs associated with patch-repairs and outflanking issues. The option does not work well with cross-shore processes and there are environmental impacts. The alignment to the SMP2 Managed Realignment Policy is also questioned as the shoreline will still be 'held' in places. Considered to be a significant 'show stopper'.	£5 million
14	Rock revetment (along the length of the barrier)	Although this option may provide sufficient protection for 20 years, it is expensive to build and maintain. A rock revetment is less reflective than a seawall or sheet pile wall and would therefore have less impact on cross-shore processes. Rock can be readily moved in response to change, which makes it more flexible. The option of a rock revetment is contrary to the SMP2 policy of Managed Realignment, so if reconsidered under different change scenarios, necessary action and agreement would be required to amend the SMP2 policy.	(>£31million)
23	Beach recycling (move material from the road / back of the barrier back to the front)	Not considered to be an option to address flooding and erosion risk in its entirety, rather an ongoing option that will be included as a recommendation for ongoing works. Therefore, the option will not be taken through the short-list appraisal.	Not costed
24	Beach recycling (with the use of a lightweight railway built along the length of the barrier; the railway would be used to transport shingle collected from areas of accretion to two drop-off points; (i) off the sea front in Torcross; and (ii) in	Recycling is considered within the options above. Costs of construction of a railway will not be funded via FCERM-GiA and not aware that there are any firm plans with investment identified to deliver such a railway, which in itself will be as vulnerable (if not more so)	Option not costed due to uncertainty

Option Number	Option Description	Summary of Rationale for Discounting from Long-list / Taking Forward to Short-List	Indicative Cost
	the region of the car park in the middle of the barrier. The recycled material would then be redistributed by natural processes. Loading at the north end could be facilitated by an overhead hopper, and unloading could be by done by using self unloading trucks, with the shingle being carried out to the edge of the sea by means of a conveyor belt at each of the two drop off locations. As for the economics of such a scheme, building costs would be low as most of it would simply be laid on top of the existing shingle, while profits from the passenger service would likely cover the cost of carrying shingle, the shingle operation probably only requiring two people to run it, thereby keeping costs to a minimum.	than the road already is without major investment in appropriate defences along the length of the frontage. Considered to be a significant 'show stopper'.	
26	Build-up (recharge) sherries bank with similar material/plastic (to reduce the wave energy approaching the shoreline)	This option is discounted on environmental grounds, in that it will not be acceptable, and that it will not provide sufficient protection to the north. Considered to be a significant 'show stopper'.	Option not costed due to uncertainty

2.6 Short-list Options

2.6.1 Short-list Options

The following options were forward to the short-list; this includes short-listed options road realignment options, which were considered under various Change Scenarios.

Option Number	Option Description	Summary of Rationale for Discounting from Long-List / Taking Forward to Short-List	Indicative Cost (20 year discounted Present Value whole life cost)
10	Seawall (maintain and upgrade existing seawall at Torcross)	This option provides sufficient protection against erosion and flooding at the southern end of the BMP frontage. Since the wall is already in place and is compliant with the current SMP2 policy, it will need to be considered alongside all other options going forward.	£376,244
15	Rock revetment (strategically placed at specific locations)	This option reduces overtopping and risk of cut-back, but there is a risk of potential for cutback and outflanking between each section of rock revetment, which would leave isolated hard-points. Costs are reduced when considered against a full-length revetment. The alignment to the SMP2 Managed Realignment Policy is questioned.	£6,155,904 to £14,452,992
16	Timber groynes (along length of beach between Torcross and Strete)	This option would provide sufficient protection for 20 years. The timber groynes would act to reduce the alongshore movement of material, which is a key contributor to the erosion of this coastline.	£15,954,244
17	Timber groynes (strategically placed at specific locations)	This option would provide sufficient protection for 20 years. The timber groynes would act to reduce the alongshore movement of material, which is a key contributor to the erosion of this coastline. There is a risk of cutback and outflanking around the strategically placed structures, which would require further construction and costs to rectify - the placement and number of groynes would need to be considered very carefully, and may even need to be considered alongside a beach recycling option.	£2,991,421 to £6,847,030
18	Rock groynes (along the length of the barrier)	This option would provide sufficient protection for 20 years. The rock groynes would act to reduce the alongshore movement of material, which is a key contributor to the erosion of this coastline.	£12,559,955
19	Rock groynes (strategically placed at specific locations)	This option would provide sufficient protection for 20 years. The rock groynes would act to reduce the alongshore movement of material, which is a key contributor to the erosion of this coastline. There is a risk of cutback and outflanking around the strategically placed structures, which would require further construction and costs to rectify - the placement and number of groynes would need to be considered very carefully, and may even need to be considered alongside a beach recycling option.	£2,374,348 to £5,677,788

Option Number	Option Description	Summary of Rationale for Discounting from Long-List / Taking Forward to Short-List	Indicative Cost (20 year discounted Present Value whole life cost)
20	Terminal groyne at Pilchard Cove (to prevent northerly transport of material north towards Black Pool Sands)	A groyne at this location would prevent the loss of material from the Slapton Sands frontage, however, alone it doesn't allow for the movement back of material to the south. This option will only be successful if considered in conjunction with beach recycling.	£2,218,383
21	Beach recycling (move material along the beach from area of accretion in the north to area of erosion in the south)	Beach recycling is an agreeable option when considering costs, impacts on coastal processes and the environment. It is relatively low cost, however, movement is strongly linked to weather patterns and the ability for the material to move to the right place at the right time. This option would work better with beach control structures to help reduce the uncertainty.	£1,278,200
22	Beach recycling (strategic movement of material along the coast, in support of beach retaining structures such as wooden groynes)	This option would provide sufficient protection for 20 years. Beach recycling is an agreeable option when considering costs, impacts on coastal processes and the environment. It is relatively low cost, however, movement is strongly linked to weather patterns and the ability for the material to move to the right place at the right time. The use of a control structure would help to retain the material where paced, but does come with its own pros and cons.	£1,278,200
25	Beach nourishment/recharge	This option could provide sufficient protection for 20 years. The success of this option will ultimately depend on the ability to source appropriate material and achieve associated licensing approval.	£8,947,399
27	Reactive realignment of the road, with all planning requirements in place (emergency works)	This option could help to maintain the road link over the next 20 years, however, it will be focused on an isolated area of the coastline and does not therefore protect the length of Slapton Sands from flooding and erosion risks. It should be considered alongside other beach management options that aim to reduce the risk of flooding and erosion, and subsequently road loss.	£892,875
28	Pro-active realignment of the road at locations identified as 'erosion hotspots' (similar to Option 29)	This option could help to maintain the road link over the next 20 years, however, it would only be successful if that particular section of coastline is at risk. Similar to reactive realignment, it will be focused on an isolated area of the coastline and does not therefore protect the length of Slapton Sands from flooding and erosion risks. It should be considered alongside other beach management options that aim to reduce the risk of flooding and erosion, and subsequently road loss.	£1,434,233
29	Realignment of the A379 road, either side of the previous realignment	This option could help to maintain the road link over the next 20 years, however, it would only be successful if that particular section of coastline is at risk. Similar to reactive realignment, it will be focused on an isolated area of the coastline and does not therefore protect the length of Slapton Sands from flooding and erosion risks. It should be considered alongside other beach management options that aim to reduce the risk of flooding and erosion, and subsequently road loss.	£1,590,128

2.6.2 Options That Do Not Directly Reduce Flooding or Erosion but Considered Under Change Scenario

The following '**adaptive'** options will be carried forward to the short-list under the relevant Change Scenario.

				Change Scenario					
				Storm - breaches road in part	Storm - breaches road in full	Funding - is an issue	Funding - <£2 million	Funding - £2 - 5 million	Funding - £5-15 million
Option Number	**Option Description**	**Summary of Rationale for Discounting from Long-List / Taking Forward to Short-List**	**Take Forward to Short-List Appraisal (Y/N)**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**
30	Relocate car parks landward	This option does not directly reduce flooding or erosion and for that reason will not achieve FCERM-GiA funding. It will not therefore be continued through the BMP short-list appraisal, but will be considered within the BMP going forward as an alternative option when considering the Change Scenario of 'Funding - Is An Issue'.	N	N	N	Y	N	N	N
31	Gravel road (cease maintenance of the tarmac road, but allow the top of the barrier to be used as a carriageway)	This option does not directly reduce flooding or erosion and for that reason will not achieve FCERM-GiA funding. It will not therefore be continued through the BMP short-list appraisal, but will be considered within the BMP going forward as an alternative option when considering the Change Scenario of 'Funding - Is An Issue'.	N	N	N	Y	N	N	N
32	Land/road bridge connecting Torcross with Strete	This option does not directly reduce flooding or erosion and for that reason will not achieve FCERM-GiA funding. It will not therefore be continued through the BMP short-list appraisal, but will be considered	N	N	Y	Y	N	N	N

				Change Scenario					
				Storm - breaches road in part	Storm - breaches road in full	Funding - is an issue	Funding - <£2 million	Funding - £2 - 5 million	Funding - £5-15 million
Option Number	**Option Description**	**Summary of Rationale for Discounting from Long-List / Taking Forward to Short-List**	**Take Forward to Short-List Appraisal (Y/N)**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**
		within the BMP going forward as an alternative option when considering the Change Scenarios; (i) 'Full Breach of the Road'; and (ii) 'Funding - Is An Issue'.							
33	Upgrade inland routes	This option does not directly reduce flooding or erosion and for that reason will not achieve FCERM-GiA funding. It will not therefore be continued through the BMP short-list appraisal, but will be considered within the BMP going forward as an alternative option when considering the Change Scenarios; (i) 'Full Breach of the Road'; and (ii) 'Funding - Is An Issue'.	N	N	Y	Y	N	N	N
34	New road (inland)	This option does not directly reduce flooding or erosion and for that reason will not achieve FCERM-GiA funding. It will not therefore be continued through the BMP short-list appraisal, but will be considered within the BMP going forward as an alternative option when considering the Change Scenarios; (i) 'Full Breach of the Road'; and (ii) 'Funding - Is An Issue'.	N	N	Y	Y	N	N	N
35	Road toll (to fund management of the road)	This option does not directly reduce flooding or erosion and for that reason will not achieve FCERM-GiA funding. It will not	N	N	N	Y	N	N	N

				Change Scenario					
				Storm - breaches road in part	Storm - breaches road in full	Funding - is an issue	Funding - <£2 million	Funding - £2 - 5 million	Funding - £5-15 million
Option Number	**Option Description**	**Summary of Rationale for Discounting from Long-List / Taking Forward to Short-List**	**Take Forward to Short-List Appraisal (Y/N)**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**
		therefore be continued through the BMP short-list appraisal, but will be considered within the BMP going forward as an alternative option when considering the Change Scenario of 'Funding - Is An Issue'.							
36	Car ferry (allowing the existing defences and road to fail)	This option does not directly reduce flooding or erosion and for that reason will not achieve FCERM-GiA funding. It will not therefore be continued through the BMP short-list appraisal, but will be considered within the BMP going forward as an alternative option when considering the Change Scenarios; (i) 'Full Breach of the Road'; and (ii) 'Funding - Is An Issue'.	N	N	Y	Y	N	N	N
37	Develop adaptation plan with adaptation phases	This option does not directly reduce flooding or erosion and for that reason will not achieve FCERM-GiA funding. It will not therefore be continued through the BMP short-list appraisal, but will be considered within the BMP going forward as an alternative option when considering the Change Scenario of 'Funding - Is An Issue'.	N	N	N	Y	N	N	N
38	Define Slapton as a CCMA and devise adaptation plan	This option does not directly reduce flooding or erosion and for that reason will not achieve FCERM-GiA funding. It will not	N	N	N	Y	N	N	N

				Change Scenario					
				Storm - breaches road in part	Storm - breaches road in full	Funding - is an issue	Funding - <£2 million	Funding - £2 - 5 million	Funding - £5-15 million
Option Number	**Option Description**	**Summary of Rationale for Discounting from Long-List / Taking Forward to Short-List**	**Take Forward to Short-List Appraisal (Y/N)**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**	**Back in: y / n?**
		therefore be continued through the BMP short-list appraisal, but will be considered within the BMP going forward as an alternative option when considering the Change Scenario of 'Funding - Is An Issue'.							

SECTION 3

Short-List Options Appraisal

3.1 Derivation of the Short-List

The purpose of the short-list appraisal was to assess the viability of the short-listed options in more detail, which required a more vigorous assessment of their technical suitability (considering coastal processes and build-ability), potential economic viability, and the impact that it may have on the environment, as described below. As with the long-list appraisal, the short-list appraisal draws from the four baseline reports already completed for the BMP (including the coastal processes, environmental, defence, economics baselines), to provide an assessment of the advantages and disadvantages of each short-listed option.

The full short-list appraisal table is presented in Appendix F.

3.1.1 Technical Suitability

The options have been assessed against the impact (be it positive and negative) that it could have on coastal processes and shoreline interaction, and what the option would entail in terms of construction, maintenance and life-span of the relevant structure.

- For the short-list appraisal, consideration has been given to alternative layouts within an option (i.e. sub-options). This included defining a series of assumptions, such as the length of coastline over which the structure would extend, the number of groynes/length of groynes, and m^3 of beach recycling required. The short-list options layouts are presented in Appendix G of this note.

3.1.2 Environmental Impacts

Each option has been considered against a standard suite of environmental aspects in order to identify key potential impacts. For the short-list appraisal, this also included:

- A range of other impacts might be introduced by construction or modification of new and existing coastal defence structures. Many parts of the BMP frontage are currently popular tourism resources and provide amenity use for residents throughout the year. Changes to coastal defences in these locations will influence the amenity use of the areas and may also create a visual impact to residents and the wider area.
- Some options introduce additional Health and Safety concerns by including concealed structures or allowing members of the public to access structures that may pose trip hazards and wider Health and Safety concerns.
- Such impacts are identified where appropriate in the options appraisal.

PLEASE NOTE: The assessment of environmental impacts presents the case for social and natural considerations, and it is not so easy to draw a clear-cut conclusion on whether an option is acceptable. For example, an option may result in the coastline behaving 'naturally' but this could result in impacting on socio-economics, which may not be considered as a positive outcome'. This has been flagged accordingly in the accompanying spreadsheet, but it could be worth consulting on this with representatives of Natural England/Devon County Council/South Hams etc. to firm up the overall thought on the options from an 'environmental perspective'.

3.1.3 Economic Implications

The economic implications are based on a high-level understanding of the likely cost for the various options, and initial indications of Flood Defence Grant-in-Aid (FCERM-GiA) funding. For the short-list appraisal, this included:

- An assessment of option costs (based on typical unit rates). This utilised Government guidance, best practices and previous scheme examples, and included optimism bias of 60% (also in line with current costing guidance).
- The costs estimated have been used alongside the monetary damages/benefits estimated to determine indicative benefit:cost ratios that can be fully carried by FCERM-GiA funding (and those that would require partnership funding.
    - The amount of FCERM-GiA estimated to be available for works at Slapton between Torcross and Strete Gate is £1,778,000 (full details are provided in the Economics Baseline).
        - *Note: this is on the basis of providing protection to the 48 properties at risk of flooding at Torcross and protecting the damage to the A379 road and thereby preventing its closure.*
    - On this basis, the amount of partnership funding required for each short-listed option was also calculated.
        - *Note: The amount of FCERM-GiA is wholly dependent on existing damages; it does not change if more third-party contributions become available.*
    - A key source of third-party funding for road management is Devon County Council (Highways). Responsibility to safeguard the A379 road falls to Devon County Council (DCC) (Highways); they currently maintain the road and have contributed to the previous road realignment.

3.1.4 Short-List Stakeholder Workshop – 13th October 2017

A presentation on the long¬-list and short-list of options was given to the SLP and stakeholders at a workshop on the 13th October 2017. The workshop provided an opportunity for a discussion to be held around the pros and cons of various options and what the preferred options may be. Comments made during the workshop were taken onboard and used to inform the appraisal process.

It was flagged during the workshop that FCERM-GiA funding has not been used previously to fund road realignment projects and a strong case for it would need to put forward to the Environment Agency Projects Assurance Board (NPAS). Following this, enquiries were made and discussions held with the Environment Agency to determine what would be required for a road realignment such as those proposed for Slapton Line to achieve FCERM-GiA funding. The outcomes are presented in Section 3.2.

3.2 Notes on FCERM-GiA Funding

During the course of developing the short-list, the Environment Agency (Martin Davies, *Pers. Comms.*, 2017) confirmed that FCERM-GiA funding must be used to provide measures that protect against flood and erosion damages and realise the 'benefits'. Any business case submitted to NPAS must demonstrate 'confidently' that the problem of flooding/erosion would be 'solved' and not need further protecting for the duration of the 'benefits' claimed. This 'confidence' may be provided through scientific evidence/modelling outputs. Further to this, FCERM-GiA funding must allow for the associated costs of production and provision of the supporting materials, including the likes of modelling, ground investigations and business case.

3.2.1 Criteria for Proactive Realignment to Achieve FCERM-GiA Funding

For a proactive realignment project to achieve FCERM-GiA funding, the Environment Agency have confirmed that the following assurances would be required:

- Confidence that any proactive realignment would 'solve the problem' (i.e. road wouldn't need further realigning and properties not need further protecting) for the duration of benefits of the

scheme (i.e. 20 years). As described above, confidence may be achieved scientific evidence/modelling outputs.

- A strong benefit to risk case would be required, with compelling evidence that the risk of erosion to the road will be reduced along a majority of its length. Informing this:
    - How do the costs of reactive and proactive realignment compare? There may be efficiency/value to proactive realignment as it is likely to be cheaper than reactive realignment on the basis that it is better planned and not 'last-minute'.
    - The majority of vulnerable sections would need to be realigned; any part of the road that is not realigned could still be vulnerable to damage post-scheme. Should this be the case then proactive realignment is unlikely to be approved for FCERM-GiA funding.

3.2.2 Conclusions

Proactive realignment is very unlikely (if at all) to be eligible for FCERM-GiA funding on the basis that it would not be possible to confidently demonstrate that proactive realignment of parts of the A379 would provide sufficient protection along a majority of the length of the A379 road over the next 20 years (i.e. realigned sections may be protected, but investment in these areas may be compromised in the future by an increase in vulnerability/loss of un-realigned sections within the 20 year benefits period).

FCERM-GiA funding would be more likely to be available to fund reactive realignment of the A379 road (with contributions from others, e.g. DCC (Highways), on the basis that with this solution, the road would continue to function and thereby economics damages/losses are avoided.

SECTION 4

Preferred Option Selection

4.1 Preferred Options – With Current FCERM-GiA Funding

The findings of the short-list appraisal were drawn-together to determine which of the options would be suitable to carry forward as a preferred option. Details of the preferred options are presented in Table 4-1; in summary, the preferred options include:

- Option 10 - Seawall (maintain and upgrade existing seawall at Torcross). ***Note Option 10 has been extended to include maintenance, upgrade and improvement of the existing defences adjacent to the Torcross seawall (including the concrete wall, sheet pile wall and the rock revetment) to address the risk of flood and coastal erosion to the north of the seawall caused by outflanking.***
- Option 27 - Reactive realignment of the road, with all planning requirements in place (emergency works) (location will be dependent on where the road fails).
- Option 29A - Reactive realignment of the A379 road, location refers to either side of the previous realignment (as per existing planning application).

4.1.1 Option 10 - Seawall (maintain, improve and upgrade existing seawalls at Torcross)

The purpose of this option would be to provide a robust defence for the properties at Torcross against flooding via wave overtopping and protection of the road behind from erosion.

4.1.1.1 Maintain the Existing Seawall at Torcross

The purpose of this activity is to ensure that the existing seawall at Torcross continues to provide a robust defence for the properties at Torcross against flooding via wave overtopping and protection of the A379 road behind from erosion. It is not anticipated that the seawall is upgraded and made higher due to landscape issues.

During the Stakeholder Workshop held on the 13th October (see Section 3.1.4), the Environment Agency confirmed that maintenance of the existing seawall would be covered by the Environment Agency as part of their asset maintenance programme. It is not anticipated that the seawall is upgraded and made higher due to landscape issues.

4.1.1.2 Existing Defences Adjacent to Torcross Seawall

In developing the short-list/preferred list of options, it was recognised that the maintenance of the Torcross seawall alone does not fully address flood and coastal erosion risk at this location, and further, the wall could also be at risk from outflanking in the future. Therefore, Option 10 has been extended to include protection of the coastline adjacent to the Torcross seawall, as a means to prevent erosion of the road behind and outflanking of the existing seawall. Under current guidance, FCERM-GiA can be used for to extend the useful life of an asset beyond its original design. Therefore, funding would be sought via FCERM-GiA, as well as SHDC/DCC (Highways), to make improvements to the defences adjacent to the Torcross seawall, including:

- Maintain 23m of concrete seawall along landward edge of slipway (reference 'Concrete Seawall 3' in the Defence Baseline Report) to address signs of cracking and loss of structural concrete at the crest and raise to the same standard as the adjacent sheet pile wall to the north. Refer to images in Figure 4-1.
- Maintain existing 60m Sheet Pile Wall at Torcross (replaced approximately one year ago in 2016 to a cost in the region of £180,000).

- Upgrade and improve existing 60m concrete seawall at Torcross (reference 'Concrete Seawall 4' in the Defence Baseline Report) to the same standard as the adjacent sheet pile wall to the south. Refer to images in Figure 4-2. The estimated costs to undertake these works could be in the region of £250k (Dan Field, *Pers. Comms.*, 2018).
- Upgrade and improve 700m of rock revetment at Torcross, to address issues of displaced along the barrier, including recovery and re-profiling of the rock, in line with the SMP2 Policy. The estimated costs to undertake these works could be in the region of £500k (Dan Field, *Pers. Comms.*, 2018).

Figure 4-1 Concrete seawall; Left - location of works indicated by yellow line and Right – photograph of the seawall
Source: Left - (© 2015 Google Earth) and Right – photograph taken during condition assessment on 27th April 2017, looking north-east

Figure 4-2 Concrete seawall; Left - location of works indicated by yellow line and Right – photograph of the seawall
Source: Left - (© 2015 Google Earth) and Right – photograph taken during condition assessment on 27th April 2017, looking north-east

4.1.2 Option 27 – Reactive Realignment

The purpose of this option would be to re-instate the A379 road in the event that it is damaged during storm activity, as and when/where the road fails.

Reactive realignment as an emergency measure, should form part of the strategy to manage the A379 going forward.

Reactive realignment of the road should take place when in response to failure of the road as and when it occurs. It is suggested that where possible any necessary preliminary studies, consents and planning works are undertaken so emergency works can be undertaken as quickly and smoothly as possible.

Should storm damage result in failure of the road to a state that is repairable within budgets available at the time, it is anticipated that funding will be made available through FCERM-GiA and funds provided by DCC (Highways).

4.1.3 Option 29A – Reactive Realignment

The purpose of this option would be to re-instate the A379 road in the event that it is damaged during storm activity to the north of the BMP frontage, as per the existing planning application (location as shown in Figure 4-3).

Reactive realignment as an emergency measure, should form part of the strategy to manage the A379 going forward.

An existing planning application has been submitted to realign the road to the north of the junction of the A379 and the road to Slapton village; the current status of the planning application will need to be confirmed in due course. The ground work to implement the realignment is therefore all in place and this realignment could be implemented as and when damage occurs.

Should storm damage result in failure of the road to a state that is repairable within budgets available at the time, it is anticipated that funding will be made available through FCERM-GiA and DCC (Highways).

Figure 4-3 Approximate location of proposed realignment to north of Slapton
Image Source: © 2015 Google Earth

4.2 Preferred Options – 'Change in Circumstances' Scenario

The estimate of available funding via FCERM-GiA is based on present-day conditions, which as calculated for the Economics Baseline, is limited. However, it may be that in the future more funds become available to invest in coastal protection measures at Slapton Sands through the likes of third-parties, lobbying or increased funding pots etc. Considering this potential eventuality, a sensitivity test was completed as part of the options appraisal processes to determine if there may be options, previously discounted from the appraisal process, that could be reconsidered within the short-list should more money become available.

The sensitivity test, considered a situation or 'Change in Circumstances Scenario', whereby there would be an availability of 'unlimited funds'. However, the impacts that the option could have technically and environmentally still required consideration, and for this reason, the pros and cons on coastal processes, shoreline interaction, the buildability of the option, and the impacts that it could have on the environment still determine the appropriateness of the option

4.2.1 Change in Circumstances Scenario Options

Following the test, six options were considered to be appropriate for the Slapton Sands BMP study area under a scenario of 'unlimited funds', and of those, there was one clear option that would also be suitable technically and environmentally. Details of those options are presented in Table 4-2.

- Option 16 - Timber groynes (along length of beach between Torcross and Strete) (indicative cost £15,954,244).
- Option 18 - Rock groynes (along the length of the barrier between Torcross and Strete) (indicative cost = £12,559,955).
- Option 22 - Beach recycling (strategic movement of material along the coast, in support of beach retaining structures such as wooden groynes, rock groynes or terminal groyne at Pilchard Cove) (indicative cost = £1,278,200).
- Option 25 - Beach nourishment/recharge (could be anywhere along the frontage and will depend on volumes required, where placed, beach level required and how frequently recharge is required) (indicative cost = £8,947,399).
- Option 28 - Proactive realignment of the road at locations identified as 'erosion hotspots' (between P0 - P3 and P8 - P11 (as per CP Baseline) (indicative cost = £1,434,233).
- Option 29B - Proactive realignment of the A379 road, either side of the previous realignment (as per existing planning application) (indicative cost = £1,590,128).

To Note: as noted above in Section 3.1.2, these options would need to be consulted on going forward, as they may not be acceptable when considering the impacts on the environment and the views of Natural England.

4.2.2 Most Favourable 'Change in Circumstances' Scenario Options

Of the six options under a 'Change in Circumstances Scenario', the most favourable options would be 22, 28 and 29:

- Option 22 - Beach recycling would involve the movement of material from areas of accretion to areas of erosion.
    - Beach recycling has been undertaken in the past along The Line.
    - Movement of material to the southern erosion hot spot could help to raise beach levels to a healthier level, thereby providing some buffer to wave energy.
    - However, in the absence of control structures this material could be removed in one storm. Therein, it is appreciated that there are many uncertainties and risks associated with this option (as noted by the BMP options appraisal), including the volumes required, frequency of movement, the likelihood that the beach material will stay in place and provide a sufficient level of protection. Any planned movement would therefore need to take consideration of observed weather patterns and their influence on beach erosion/accretion and the latest beach monitoring data to inform this action. Such uncertainty could also be further reduced by undertaking modelling of the beach under various weather conditions.
- Option 28 - Proactive realignment of the road at locations identified as 'erosion hotspots' (between P0 - P3 and P8 - P11 (as per CP Baseline).

  - Funding for this option would not be sourced from FCERM-GiA and is wholly dependent on the availability of third-party funds.

- Option 29B - Proactive realignment of the A379 road, either side of the previous realignment (as per existing planning application) (only in combination with/in replace of northern hotspot in Option 28).
  - Funding for this option would not be sourced from FCERM-GiA and is wholly dependent on the availability of third-party funds.

4.2.3 Preferred 'Change in Circumstances' Scenario Option

Of the three most favourable 'Change in Circumstances Scenario' options, the preferred is Option 22 - Beach recycling. The key reasons for this are:

1. Improves the height and width of the beach, thereby helping to protect the A379 from erosion by providing a buffer to storm activity.
2. Works most favourably with coastal processes and recycled material can be taken from areas of beach accretion and re-placed at specific locations where beach levels are low.
3. Does not leave a legacy for future generations.
4. Relatively affordable.

4.3 Recommendations for Flood and Coastal and Erosion Risk Management.

The overall strategy going forward is to recognise that reactive work should be done, but only to patch and mend the defences and road as required over the next 20 years. This is in line with the technical and environmental feasibility of the works and the funding available via FCERM-GiA. Further options do exist but their implementation is wholly dependent on the availability of third-party funds. Preparations should be made for the next 50 years, and not to leave a legacy of unmanageable and unaffordable solutions to future generations.

4.3.1 Concrete Seawall Maintenance, Upgrade and Improvements (Option 10) - Funding Source: FCERM-GiA (Environment Agency)

Maintain the existing seawall at Torcross to continue provision of a robust defence for the properties at Torcross against flooding via wave overtopping and protection of the A379 road behind from erosion. It is not anticipated that the seawall is upgraded and made higher due to landscape issues.

Following emergency works in 2016, the sheet pile wall should be maintained. Future maintenance will be undertaken by SHDC as part of their asset maintenance programme.

Works to improve the existing condition and level of protection of the concrete seawall adjacent to the Torcross seawall should be undertaken to protect the seawall from outflanking and in turn protect the road from erosion. Funding for these works should be sort from the Environment Agency FCERM-GiA.

Note: This option assumes the ongoing maintenance of the seawall at Torcross and seeks to maximise its performance.

4.3.2 Rock revetment Repairs (Option 10) – Funding Source: SHDC/FCERM-GiA (Environment Agency)

Although a scheme may not be possible, there are works that can be done to address the state of the existing defences, including repairs to the existing rock revetment. Presently, there is approximately 700m of rock revetment that has become displaced along the barrier. At present,

some of this rock is providing some degree of protection to the barrier from wave attack. Recovering and re-profiling of the rock in conjunction with concrete seawall improvements (as described above) may attract some FCERM-GiA contribution. However, if undertaken in isolation it is less likely to achieve FCERM-GiA funding. Therefore, in order for this option to be implemented, it recommended that funds are identified via SHDC to support any FCERM-GiA that may be available.

Note: This option assumes the ongoing maintenance of the seawall at Torcross and seeks to maximise its performance.

4.3.3 Beach Recycling (Option 22) – Funding Source: Environment Agency/SHDC/DCC (Highways)

Beach recycling would not provide protection to the full length of the eroding frontage, rather used to bolster areas along the beach where levels are low. This would provide a temporary protection measure, but the is not guarantee the material will stay in place. Beach control structures would need to be used and, as the appraisal process has identified, there are pros and cons to implementing such structures.

Note: This option assumes the ongoing maintenance of the seawall at Torcross and seeks to maximise its performance.

Beach recycling may attract some FCERM-GiA contribution if supporting measures to address outflanking of the Torcross seawall. However, if undertaken to protect the road, it is less likely to achieve FCERM-GiA funding. Therefore, in order for this option to be implemented, it recommended that funds are identified via SHDC and/or DCC (Highways) to support any FCERM-GiA that may be available.

4.3.4 Emergency Reactive Realignment (Options 27 and 29A) – Funding Source: FCERM-GiA (Environment Agency)/DCC (Highways)

Reactive realignment would achieve funding from both FCERM-GiA and DCC (Highways) and should be used to fund emergency works as and when they are needed. Any further works required to implement the northern realignment should be undertaken as per the existing planning application, and as much preparatory work relating to consents, planning and funding should be undertaken from the remainder of the A379 along The Line to facilitate a prompt realignment should the need arise.

4.3.5 Coastal Change Management and Adaption

It is evident from undertaking the Slapton Sands BMP that funding for the management of flood and coastal erosion risk at Slapton Sands is limited and that there is little that can be done to combat the effects of ongoing coastal change. Over time, the road may become irreparable and even breach. It is therefore important to formally recognise this in the immediate future and define 'The Line' as a 'Coastal Change Management Area' in order to drive future coastal change adaptation efforts in the area.

Recommendations to address coastal change adaptation include:

- Update the Plymouth and South West Local Plan (PSWLP) to include the BMP study area and the associated areas at risk from flooding and erosion within the CCMA (*as defined by Policy Dev38 and shown on SUB3 Policies Map: Thriving Towns and Villages Policy Area (South Hams), plymouth.gov.uk*). The should be completed in accordance with the Coastal Change Planning Guidance (CH2M, 2015) and will need to be mapped as a 'zone', for which specific planning policies will need to be defined.
- Build on the work completed for the Coastal Change Pathfinder Project, including:
    - High quality education and engagement – communicate with the public about the changing processes and landscape and the realities of this.

    - Wider use of local land charges registers for getting this information out there.

- Prepare for eventuality of road failure including any required pre-existing planning and EIA work.
- Preparing for the eventually of a breach and the need for a new road link – identify a suitable inland road network and make movements to improving it. To assist with the BMP project, work is being undertaken by DCC (Highways) to estimate costs associated with improving and upgrading inland routes.
- Work with the SHDC planning department and develop the Local Plan. Investigate adaptive solutions and make provisions to 'roll back' properties and assets at risk, including defining a plan for compensation, changes to planning restrictions, relocation etc.

SECTION 4

Table 4-1 Preferred options

					Summary Suitable Preferred Management Option (Y/N) (numbered notes provided in adjacent column)					
Theme	**Option Number**	**Option Description**	**PV Cost (20 year PV whole life cost)**	**Third Party Funding Required**	**Coastal Processes**	**Defences**	**Economics**	**Environment**	**Numbered Notes on Summary Selection**	**Carry Forward as Preferred Management Option**
Shoreline Structure	10	Seawall (maintain and upgrade existing seawall at Torcross)	£376,244	£376,244	Y (1)	Y (2)	Y (3)	Difficult to define as so many variables (social, environment etc). Refer to note above in Section 2.2.3.	(1+2+3) This option affords protection to the properties at risk from flooding, on which the economic damages/benefits are based	**Y**
Road Realignment	27	Reactive realignment of the road, with all planning requirements in place (emergency works) (location will be dependent on where the road fails)	£892,875	£0	Y	N (1)	Y	*See comment in Option 10*	(1) Reactive realignment of the road doesn't address the issue of flood and erosion risk before event occurs; however, the option is more likely to achieve FCERM-GiA than proactive realignment.	**Y**
Road Realignment	29A	Re-active realignment of the A379 road, either side of the previous realignment (as per existing planning application)	£1,590,128	£0	Y	N (1)	Y	*See comment in Option 10*	(1) Reactive realignment of the road doesn't address the issue of flood and erosion risk before event occurs; however, the option is more likely to achieve FCERM-GiA than proactive realignment.	**Y**

Table 4-2 Preferred options – unlimited funding

					Summary Suitable Preferred Management Option (Y/N) (numbered notes provided in adjacent column)						
Theme	**Option Number**	**Option Description**	**PV Cost (20 year PV whole life cost)**	**Third Party Funding Required**	**Coastal Processes**	**Defences**	**Economics**	**Environment**	**Numbered Notes on Summary Selection**	**Carry Forward as Preferred Management Option**	**Change Scenario - Carry Forward with Unlimited Funding**
Beach Control Structure	16	Timber groynes (along length of beach between Torcross and Strete)	£15,954,244	£14,176,645	Y (1)	Y (2)	N	Difficult to define as so many variables (social, environment etc). Refer to note above in Section 2.2.3.	(1) However, timber groynes along the length of the barrier could affect material reaching Beesands and Hallsands (2) This option should be adapted, if possible/required, to consider cross-shore transport of material	N	Y
Beach Control Structure	18	Rock groynes (along the length of the barrier)	£12,559,955	£10,782,357	Y (1)	Y (2)	N	As above	(1) However, rock groynes along the length of the barrier could affect material reaching Beesands and Hallsands (2) This option	N	Y

					Summary Suitable Preferred Management Option (Y/N) (numbered notes provided in adjacent column)						
Theme	**Option Number**	**Option Description**	**PV Cost (20 year PV whole life cost)**	**Third Party Funding Required**	**Coastal Processes**	**Defences**	**Economics**	**Environment**	**Numbered Notes on Summary Selection**	**Carry Forward as Preferred Management Option**	**Change Scenario - Carry Forward with Unlimited Funding**
									should be adapted, if possible/required, to consider cross-shore transport of material		
Recycling / Recharge	22	Beach recycling (strategic movement of material along the coast, in support of beach retaining structures such as wooden groynes, rock groynes or terminal groyne at Pilchard Cove)	£1,278,200	£0	Y (1)	Y (1)	Y (1)	As above	(1) This option would only be selected in support of a beach control structure option	N	Y (if considered alongside full-length beach control structures, i.e. in combination with Option 16 and Option 18)
Recycling / Recharge	25	Beach nourishment/recharge (could be anywhere along the frontage and will depend on volumes required, where placed, beach level required and how frequently recharge is required)	£8,947,399	£7,169,800	Y	Y (1)	N	As above	(1) Assuming that a suitable grading of nourishment/recharge material can be sourced	N	Y

					Summary Suitable Preferred Management Option (Y/N) (numbered notes provided in adjacent column)						
Theme	**Option Number**	**Option Description**	**PV Cost (20 year PV whole life cost)**	**Third Party Funding Required**	**Coastal Processes**	**Defences**	**Economics**	**Environment**	**Numbered Notes on Summary Selection**	**Carry Forward as Preferred Management Option**	**Change Scenario - Carry Forward with Unlimited Funding**
Road Realign ment	28	Pro-active realignment of the road at locations identified as 'erosion hotspots' (between P0 - P3 and P8 - P11 (as per CP Baseline)	£1,434,233	£0	Y	Y (1)	N (2)	*See comment in Option 10*	(1) This option may entail partial loss of car park at Torcross (2) This option is very unlikely to achieve FCERM-GiA funding.	N	Y
Road Realign ment	29B	Pro-active realignment of the A379 road, either side of the previous realignment (as per existing planning application)	£1,590,128	£0	Y	Y (1)	N (2)	*See comment in Option 10*	(1) This option needs to be considered in combination with/worked into Option 28 to provide protection to the southern part of the road to address the erosion risk there (2) This option is very unlikely to achieve FCERM-GiA funding.	N	Y

SECTION 5

References

CH2M, 2015. Coastal Change Adaptation Planning Guidance. Report produced by CH2M for East Riding of Yorkshire Council, August 2015. Viewed online 25-01-2018 at https://coastalsig.files.wordpress.com/2013/02/ccapg-august-2015.pdf.

CIRIA, 2010. Beach Management Manual (second addition). A CIRIA Report C685 RP787 © CIRIA 2010 ISBN: 978-0-86017-682-4-3. Published by CIRIA, Classic House, 174–180 Old Street, London, EC1V 9BP.

Defra, 2011a. Partnership Pays: An introduction to the future funding and management of flood and coastal erosion management projects for Local Authorities and Internal Drainage Boards.

Defra, 2011b. Flood and Coastal Resilience Partnership Funding: Defra policy statement on an outcome-focused, partnership approach to funding flood and coastal erosion risk management. May 2011.

Environment Agency, 2017. Capital Expenditure Guidance. Operational instruction 492_09. Issued 01/09/2017.

Environment Agency, 2012. Principles for implementing flood and coastal resilience funding partnerships.

Halcrow, 2011. Durlston Head to Rame Head Shoreline Management Plan Review (SMP2). South Devon & Dorset Coastal Advisory Group, June 2011.

McNally, C., Johns, D. and Pygott, K., 2012. Partnership Funding for Flood Risk Management. Environment Agency Toolbox Talk, 19th January 2012.

Appendix A – Coastal Processes Baseline Report

Appendix B – Environmental Baseline Report

Appendix C – Defence Baseline Report

Appendix D – Economics Baseline Report

Appendix E – Long-List Appraisal Table

Appendix E – Long-List Appraisal Table is provided on the accompanying CD

Appendix F – Short-List Appraisal Table

Appendix F – Short-List Appraisal Table is provided on the accompanying CD.

Appendix G – Short-List Option Layouts